Doing-Being Creative

Empirical Studies of Interaction in Design Work

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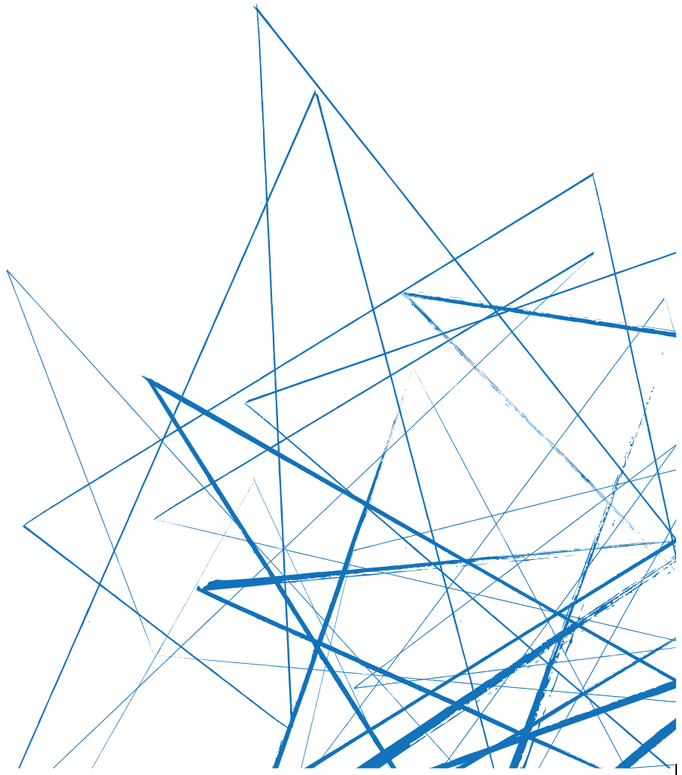

DOING-BEING CREATIVE: EMPIRICAL STUDIES OF INTERACTION IN DESIGN WORK

PhD Series 17.2022

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Summary

This dissertation addresses how the conversational, embodied, and material aspects of design work may be studied from a practice-based perspective. From this perspective, design work is understood as eclectic and complex interactions that occur as an interplay among multiple actors, stakeholders, artifacts, and resources that are embedded in a social, cultural, and material world. By exploring design work as it happens in practice, this dissertation focuses on what designers say and do when engaged in various types of design work. The dissertation presents five distinct articles concerned with multiple situated design activities whereby design work is accomplished. The articles consider how talk and the use of various visual objects and technologies are structured and organized among the participants in various design projects and in different design tasks. Conducting the studies involved collecting audiovisual recordings of designers engaged in their daily work in different institutional contexts. The audiovisual recordings enabled the consideration of the variety of communicative and interactional resources used by the participants. In addition to talk, gestures, and bodily orientation, the tools for communication included the use of objects as design materials, and digital technologies such as sticky notes, whiteboards, computers, tablets, smartphones, and online resources.

Studying design work from a practice-based perspective entails looking beyond the linear processes of design in steps or phases; instead, design practice should be understood as social and material choreography in the complex and "messy" interconnection of people, things, and discourses. Moreover, studying design practices poses a challenge to the standard research methods used in the field of design research. Details of the interactions, such as work that is co-located in various parts of a design project using digital and analog tools, searching for visual inspiration online, or moving sticky notes on a board, calls for methodological flexibility. Conceptual creativity is needed to capture these interactional details and to analyze the data thereafter.

To overcome this research challenge, this dissertation presents a diverse, interdisciplinary, and mixed-method approach to the study of design practices. The five articles represent various analytical approaches to the study of design practices in which theoretical perspectives and methods adopted from ethnomethodology (EM), conversation analysis (CA), and cognitive and social psychology are combined. The combination of theories and methods varies across the five studies, and each article demonstrates a distinct way of collecting and analyzing design work, with

audiovisual data as the core of the empirical fundament. With reference to the five articles, this dissertation demonstrates the broad scope of the possible methods for video analysis that are relevant to design research and organization and management studies in general. To illustrate:

- Article one, "The Oscillation Between Individual and Social Designing in Co-Located Student Teams," shows how a video-based analysis of the oscillating nature of individual and social activities in design teams challenges the current mainstream theoretical assumption of co-designing and creativity as solely social activities. The article examines team interactions across different episodes (for example, individual or social) and sub-activities (such as problem definitions, planning, and concept development) in a co-located design project. Various perspectives from cognitive and social psychology are integrated with a micro-level analysis of the details in the recorded interactions. The study draws on the sociological traditions of EM and CA to focus on details of the team members' interactions (such as the use of digital and analog communicative resources to attract and establish joint attention). The quantitative analysis reveals how various phases and activities in the design project involved extended and more frequent social episodes; that is, activities such as idea generation and problem definition entail longer episodes of social activity. More frequent (but shorter) types of social activities were related to concept development and project planning. In addition, the EM/CA-inspired micro-level analysis of the shift from working individually to working collectively shows how the team members applied different strategies to attract the team's attention during activities such as concept development and decision making. Furthermore, the analysis revealed how digital and analog communicative recourses were used to mediate joint attention. The results contribute to a procedural understanding of collaborative design practices by honing in on oscillations between individual activity and joint attention in co-located teams.

- Article two, "How Task Constraints Affect Inspiration Search Strategies," employs a quantitative approach to the analysis of screen recordings of online image searches as a different type of audiovisual data. The study illustrates three different inspiration search strategies in an experimental setup with three predefined task formulations with distinct levels of constraints (from one to 13 main keywords). The results show that a high number of available search terms in the design task with a high level of constrainedness allowed for *flexible* search behavior (such as quick and numerous searches) and *broad* searches (for

example, random search terms). A design task with an intermediate level of constrainedness showed diligent and slow *in-depth* search behavior, with search queries consisting entirely of search terms drawn directly from the keywords in the design task. A design task with a low level of constrainedness showed quick and *divergent* search behavior, in which few searches made use of the search terms in the design task. The article's main contribution is an empirical study using audiovisual data, which offers new insights into how varying levels of constrainedness in creative tasks affect inspiration search strategies.

- Article three, "Kinds of 'Moving' in Designing with Sticky Notes," explains how a moment-to-moment analysis of moves and gestures when designing with sticky notes provided critical insights into the embodied and material aspects of a collaborating team's shared understanding and progress in a design project. The article deploys a multimodal methodological approach to analyze sticky note moves as a type of design activity via video recordings of naturally occurring interactions in design teams as the empirical basis. The study was informed by EM and CA combined with perspectives from cognitive psychology to analyze the moment-to-moment moves of the sticky notes and their sequential order in the design activity. The article drew on the visuospatial layout and content on the whiteboard (where the movement occurred) in the analysis. Moreover, the situated and embodied interactions of the design team were assessed to understand the structure and types of sticky note moves. The analysis suggests that the sticky note structure (that is, how the sticky notes were placed) on the whiteboard and the accompanying gestures when referring to, moving, placing, or touching a note, as opposed to only the verbalizations, often became communicative resources in the members' co-construction of how to move a sticky note and where exactly to place it. Moreover, the study revealed that the movement of individual sticky notes had a relatively stable sequential order containing interactional strategies for directing and maintaining shared attention. Furthermore, three types of sticky note movements pertaining to the formation of *associations*, *categories*, and *partial solution structures* were found. By exploring how and why designers move sticky notes, the study points toward new directions for research on visual support in design work.

- Article four, "'What do you think?'": Managing reflection during group supervision," takes a qualitative approach to the study of reflective practice and "doing reflecting" in team supervision sessions. The study's analytical approach draws upon EM and CA to unravel the

overall structural organization of the supervision sessions and to analyze the sequential structure of the unfolding reflection in the student teams. Through a set of empirical examples drawn from a 16+h video-based dataset, the article uncovers novel aspects of the organization of reflective practice, which had not been identified previously. The analysis reveals how the institutional "rules" of social order in the classroom may disrupt the ideal of reflective practice as "thinking about your own work." Four ways of "doing reflecting" were observed in the data: (1) Reflection as advice-giving, (2) reflection as challenge-forecasting, (3) reflection as a comparison, and (4) reflection as evaluative praise. As few studies have considered reflection in higher education as an interactional phenomenon, this paper contributes by providing insights into how students and teachers construct and enact reflective practice in situ. By providing empirical knowledge about the process of team supervision and reflection in groups, the paper also highlights the role of facilitation and supervision when teaching and learning reflective practice. These findings offer insights that are useful for developing methods for teaching and learning reflection in institutional and organizational contexts.

- Article five, "Video-Based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions," addresses the key issues that researchers should consider when collecting video data to share with other researchers. In organizational studies, video data are particularly promising for data sharing due to the unique qualities of permanence and density, as these qualities allow for a range of quantitative and qualitative forms of analyses. These data-sharing advantages offer possibilities for "video collaboratories" in organizational research projects in which teams of international researchers have the opportunity to investigate a single yet massively rich dataset in innumerable ways and from multiple perspectives. The article argues that this vision provides the possibility of increasing access to the organizational settings and of stimulating dialogue across the organizational sciences. The article presents the case of an interdisciplinary conference at which a video-based dataset was collected, shared, and analyzed by 28 international research teams with diverse ontological stances to demonstrate the approaches to and challenges of collecting video-based data for data sharing and secondary analyses. Finally, the article provides a set of methodological reflections and recommendations regarding the advantages of the video collaboratory for organizational research and discusses the most significant data collection and data management issues to be considered in supporting its success.

Resumé / Summary (Danish)

Denne afhandling omhandler, hvordan de verbale, kropslige og materielle aspekter af designarbejde kan studeres ud fra et praksisbaseret perspektiv. Fra dette perspektiv forstås design som eklektiske og komplekse interaktioner, der opstår i et samspil mellem flere aktører, interessenter, artefakter og ressourcer, der er indlejret i en social, kulturel og materiel verden. I denne afhandling studeres design som et arbejde, der udfoldes i praksis med et fokus på hvad designere siger og gør, når de er involveret i forskellige former for designarbejde. Afhandlingen præsenterer fem forskellige artikler, der vedrører forskellige situerede designaktiviteter, hvor designarbejde udføres. Artiklerne behandler, hvordan tale og brug af forskellige visuelle objekter og teknologier er struktureret og organiseret blandt deltagerne i forskellige designprojekter og i forskellige designopgaver. Gennemførelsen af studierne involverede indsamling af audiovisuelle optagelser af designere i deres daglige arbejde i forskellige institutionelle kontekster. De audiovisuelle optagelser gjorde det muligt at analysere de mange kommunikative og interaktionelle ressourcer som deltagerne brugte. Ud over tale, bevægelser og kropslig orientering inkluderede de kommunikative ressourcer brug af genstande som designmaterialer og digitale teknologier såsom sticky notes, whiteboards, computere, tablets, smartphones og online ressourcer.

At studere designarbejde ud fra et praksisbaseret perspektiv indebærer at se design som mere end en lineær proces bestående af trin eller faser; i stedet forstås design som en social og materiel koreografi i den komplekse og "rodede" sammenkobling af mennesker, ting og diskurser. Studier af designpraksis udgør en udfordring for de typiske forskningsmetoder, der anvendes inden for designforskning. Det kræver metodisk fleksibilitet at få adgang til specifikke detaljer i interaktionerne, såsom hvordan digitale og analoge værktøjer indgår i forskellige dele af et designprojekt, hvordan online inspirationssøgning folder sig ud i praksis, eller hvordan sticky notes flyttes på et whiteboard. Derudover er konceptuel kreativitet nødvendig for at indfange detaljer i interaktionen og analysere dem efterfølgende.

For at overvinde denne udfordring præsenterer denne afhandling en heterogen, tværfaglig og mixed- method tilgang til studiet af designarbejde og designpraksis. De fem artikler repræsenterer forskellige analytiske tilgange, hvor teoretiske perspektiver og metoder hentet fra etnometodologi (EM), samtaleanalyse (CA), kognitiv psykologi og socialpsykologi kombineres. Kombinationen af teorier og metoder varierer på tværs af de fem studier, og hver artikel demonstrerer en særskilt

måde at indsamle og analysere audiovisuelle data af designarbejde på. Med henvisning til de fem artikler demonstrerer denne afhandling det brede omfang af mulige metoder til videoanalyse, der både er relevante for designforskning samt organisations- og ledelsesstudier mere generelt. For at illustrere:

- Artikel et, "The Oscillation Between Individual and Social Designing in Co-Located Student Teams", viser, hvordan en videobaseret analyse af designarbejdets skiftende individuelle og sociale aktiviteter i designteams udfordrer den nuværende almindelige teoretiske antagelse om co-design og kreativitet som værende udelukkende sociale eller individuelle aktiviteter. Artiklen undersøger teaminteraktioner på tværs af forskellige episoder (for eksempel individuelle eller sociale aktiviteter) og sub-aktiviteter (såsom problemdefinition, planlægning og konceptudvikling) i forskellige designprojekter. Forskellige perspektiver fra kognitiv psykologi er integreret med en mikro-analyse af detaljerne i de observerede interaktioner. Undersøgelsen trækker på de sociologiske traditioner fra EM/CA for at fokusere på detaljer i teammedlemmernes interaktioner (såsom brugen af digitale og analoge kommunikative ressourcer til at tiltrække og etablere fælles opmærksomhed). Den kvantitative analyse viser, hvordan forskellige faser og aktiviteter i designprojektet involverede længere og hyppigere sociale episoder; aktiviteter som idégenerering og problemdefinition medfører længere episoder af social aktivitet. Hyppigere (men kortere) typer af sociale aktiviteter var relateret til konceptudvikling og projektplanlægning. Derudover viser den kvalitative EM/CA-inspirerede analyse af skift fra at arbejde individuelt til at arbejde sammen, hvordan teammedlemmerne anvendte forskellige interaktionelle strategier for at tiltrække de andre medlemmers opmærksomhed under aktiviteter såsom konceptudvikling og beslutningstagning. Desuden afslørede analysen, hvordan digitale og analoge kommunikative ressourcer blev brugt til at formidle og etablere fælles opmærksomhed i samarbejdet.

- Artikel to, "How Task Constraints Affect Inspiration Search Strategies", anvender en kvantitativ tilgang til at analysere skærmoptagelser af online billedsøgninger som en type audiovisuelle data. Undersøgelsen illustrerer tre forskellige inspirationssøgningsstrategier i et eksperimentelt setup med tre foruddefinerede opgaveformuleringer med forskellige begrænsninger (fra et til 13 søgeord). Resultaterne viste, at et stort antal tilgængelige søgeord i designopgaven med et højt niveau af begrænsning muliggør en fleksibel søgeadfærd (såsom hurtige og talrige søgninger) og brede søgninger (for eksempel med tilfældige søgeudtryk).

En designopgave med et mellemliggende niveau af begrænsning viste energisk og dybdegående søgeadfærd med søgninger, der udelukkende består af søgeudtryk hentet direkte fra nøgleordene i designopgaven. En designopgave med et lavt niveau af begrænsning (få søgeord) viste en hurtig og divergerende søgeadfærd, hvor få søgninger brugte søgeudtryk genter fra designopgaven. Artiklens hovedbidrag er den empiriske undersøgelse baseret på audiovisuelle data, som giver ny indsigt i, hvordan forskellige niveauer af begrænsning i kreative opgaver påvirker strategier til inspirationssøgning.

- Artikel tre, "Kinds of 'moving' in designing with sticky notes", præsenterer en detaljeret analyse af bevægelser og gestus, når man anvender sticky notes i en designproces. Artiklen giver indsigt i de kropslige og materielle aspekter af designteams' fælles forståelser og fremskridt i et designprojekt. Via videooptagelser af naturligt forekommende interaktioner i designteams som datagrundlag, anvendes en multimodal metodologisk tilgang til at analysere sticky note-flytninger som en specifik type designaktivitet. Undersøgelsen kombinerer en EM/CA tilgang med perspektiver fra kognitiv psykologi for at analysere de momentvise flytninger af sticky notes og deres sekventielle rækkefølge i designaktiviteten. Her inkluderes det visuelle og spatiale layout og indhold på tavlen (hvor flytningerne finder sted) også i analysen. Desuden inddrages de situerede og kropslige interaktioner i designteamet for bedre at forstå strukturen i flytningerne af de enkelte sticky notes. Analysen viser, at sticky note strukturen (hvordan de enkelte sticky notes er placeret) på tavlen og de medfølgende gestus, når der henvises til, flyttes, placeres eller røres ved en sticky note, i modsætning til kun verbaliseringerne, oftest blev de centrale kommunikative ressourcer i medlemmernes konstruktion af, hvordan man flytter en sticky note - og hvor den nøjagtigt skal placeres. Desuden afslørede studiet, at flytningen af individuelle sticky notes havde en relativt stabil sekventiel rækkefølge, der indeholdt interaktionsstrategier til at tiltrække og etablere fælles opmærksomhed. Derudover blev der fundet tre typer af flytninger vedrørende associationer, kategorier og delvise løsninger i relation til designprojektet. Studiets fokus på, hvordan og hvorfor designere flytter sticky notes, peger mod nye retninger for designforskning omkring, hvilken rolle visuelle materialer har i designaktiviteter.

- Artikel fire, "'What do you think?': Managing reflection during group supervision", tager en kvalitativ tilgang til studiet af refleksion og reflekterende praksis i grupper, der superviseres

sammen. Undersøgelsens analytiske tilgang trækker på EM/CA for at undersøge den overordnede strukturelle organisering af gruppesupervision. Analysen fokuserer på, hvordan refleksion udfoldes sekventielt i grupper af studerende, der deltager i supervision sammen. Gennem et sæt empiriske eksempler hentet fra et 16+ timers videobaseret datasæt afdækker artiklen nye aspekter af refleksiv praksis, som ikke tidligere har været identificeret. Analysen afslører, hvordan de institutionelle "regler" for den sociale orden i klasseværelset kan forstyrre idealet om reflekterende praksis som "at tænke over sit eget arbejde". Fire måder at reflektere på blev observeret i dataene: (1) Refleksion som rådgivning, (2) refleksion som udfordringsprognoser, (3) refleksion som sammenligning og (4) refleksion som evaluering. Da få studier har betragtet refleksion på videregående uddannelser som et interaktionelt fænomen, bidrager denne artikel ved at give indsigt i, hvordan studerende og undervisere sammen konstruerer og fremfører reflekterende praksis in situ. Ved at bidrage med empirisk viden om gruppesupervision og refleksion i grupper fremhæver artiklen også rollen som facilitator, når man underviser og lærer reflekterende praksis. Disse fund giver ny viden, der er brugbar i udviklingen af metoder til undervisning i reflekterende praksis i institutionelle og organisatoriske sammenhænge.

- Artikel fem, "Video-Based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions", handler om de mest centrale spørgsmål, som forskere bør overveje, når de indsamler videodata, der skal deles med andre forskere. I organisatoriske undersøgelser er videodata særligt lovende til datadeling på grund af de unikke kvaliteter ved video såsom dataenes permanens og detaljegrad, da disse kvaliteter giver mulighed for en række kvantitative og kvalitative former for analyser. Disse fordele ved datadeling muliggør video collaboratories i organisatoriske forskningsprojekter, hvor teams af internationale forskere har mulighed for at undersøge et enkelt, men alligevel rigt datasæt på utallige måder og fra flere perspektiver. Artiklen argumenterer for, at denne samarbejde-vision giver mulighed for at øge adgangen til organisatoriske miljøer og stimulere dialogen på tværs af organisations- og ledelsesstudier. Artiklen præsenterer casen om en tværfaglig konference, hvor et videobaseret datasæt blev indsamlet, delt og analyseret af 28 internationale forskerhold med forskellige ontologiske standpunkter. Casen demonstrerer tilgangen til og udfordringerne ved at indsamle videobaserede data til datadeling og sekundær analyse. Afslutningsvis giver artiklen et sæt metodiske refleksioner og anbefalinger vedrørende fordelene ved

videosamarbejde til organisatorisk forskning og diskuterer de mest vigtige dataindsamlings- og datahåndteringsproblemer, der skal overvejes for at understøtte samarbejdets succes.

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List of tables and figures

Acknowledgments

Completing this Ph.D. project has been both challenging and tremendously rewarding. Throughout this journey, I met many inspiring people and learned more than I ever expected. Special thanks are extended to Bo T. Christensen for guiding me through this project, for sharing my excitement about video methods and sticky notes, and for supporting my choices and projects. I would not have been able to come this far without your brilliant supervision and constant encouragement. I would also like to thank my secondary supervisor, Daniel Hjorth, the staff at the Department of Marketing, and my fellow Ph.D. students at Copenhagen Business School for their support and inspiration. In addition, I am extremely grateful to Ursula Plesner for giving me the opportunity to teach the Digitalization and Organization course at the BSc in Business Economics and Psychology at Copenhagen Business School, which was a rewarding and inspiring teaching experience from which I benefitted immensely.

I would also like to thank all the people who agreed to participate in my studies and allowed me to record them while they were working on their creative projects. This dissertation would not have come to fruition if you had not allowed me to follow you closely, with all my camera equipment, for days, weeks, and even months. Thank you for being so open-minded and for trusting me.

A huge thank you is extended to the Creativity in Blended Interaction Spaces (CIBIS) and the Designerly Ways of Teaching for Entrepreneurship in Higher Education (DEED) projects for allowing me to be part of these research groups and to participate in numerous exciting field studies, experiments, conferences, travels, and publications. These interdisciplinary collaborations expanded my academic horizons and provided me with many opportunities to challenge and develop my methodological and theoretical toolbox. Thanks are also due to the Independent Research Fund Denmark for funding the CIBIS and DEED projects, thus making this Ph.D. project a reality.

I am also grateful to Jon Hindmarsh and the members of the Work, Interaction & Technology Research Group at King's College London for welcoming me so warmly and for the interest you expressed in my project and data during various data sessions and meetings. The support and advice I received during this stay were of tremendous assistance in helping me to find a path through many hours of data analysis and gave me a more focused direction for my project. In this regard, I would like to thank the ReNEW mobility grant for funding my research stay in London.

Lastly, to Christian, my family, and my friends, thank you for supporting and believing in me all the way.

Sille Julie J. Abildgaard

Rye, July 2021

Preface

The dissertation contains five articles. The first two articles have been published, the third article has been accepted for publication in 2021, and the last two are on their final path to submission. I present the status and authorship of each of the five articles below.[1]

Article one, "The Oscillation between Individual and Social Designing in Co-Located Student Teams," was co-authored with my primary supervisor, Bo T. Christensen, and was published in *CoDesign – International Journal of CoCreation and Design in the Arts*. The article was available online on 20 December 2018 under the reference Christensen, B. T., & Abildgaard, S. J. J. (2018). The oscillation between Individual and Social Designing in Co-Located Student Teams. *CoDesign*, 1–21. https://doi.org/10.1080/15710882.2018.1557695. An earlier version of the article was presented at the Design Research Society conference in June 2018 in Limerick, Ireland.

Article two, "How Task Constraints Affect Inspiration Search Strategies," was co-authored with a group of researchers from Aarhus University and Bo T. Christensen as part of a research collaboration. The article was published online on 8 February 2019 in the *International Journal of Technology and Design Education* under the reference Biskjaer, M. M., Christensen, B. T., Friis-Olivarius, M., Abildgaard, S. J. J., Lundqvist, C., & Halskov, K. (2020). How task constraints affect inspiration search strategies. *International Journal of Technology and Design Education*, 30, 101–125. https://doi.org/10.1007/s10798-019-09496-7.

Article three, "Kinds of 'Moving' in Designing with Sticky Notes," was co-authored with Bo T. Christensen. The article has been accepted to be published in a special issue of *Design Studies—The Interdisciplinary Journal of Design Research,* and will be published in fall 2021. The article builds on a valued research interest and is part of a dataset from another published article in *Design Studies* entitled "Grouping Notes through Nodes: The Functions of Post-it Notes in Design Team Cognition," which was co-authored with the previously mentioned group of researchers; I was the second author. The previous article was published in July 2018, three months into my Ph.D. studies, and was written during my employment as a research assistant at Copenhagen Business School. Thus, it has not been included in this dissertation. However, the article "Grouping Notes through Nodes" influenced my research interest in collaborative design and design materials, particularly the use of sticky notes, and shaped my methodological approach to my research. It is

[1] I refer to the co-author statements in Appendix B for specific details about my contributions to each of the five articles.

referenced as Dove, G., Abildgaard, S. J. J., Biskjaer, M. M., Hansen, N. B., Christensen, B. T., & Halskov, K. (2018). Grouping Notes through Nodes: The Functions of Post-it Notes in Design Team Cognition. *Design Studies*, 57, 112–134. https://doi.org/10.1016/j.destud.2018.03.008.

Article four, "'What do you think? '": Managing reflection during group supervision," is my single-author article that was written for publication in *Studies of Higher Education*. The article was submitted to the *Studies of Higher Education* journal in the summer of 2021.

Article five was co-authored with Bo T. Christensen and Jon Hindmarsh; I was the first author. The article, "Video-Based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions", has been in progress since the early stages of my Ph.D. studies. The study is of great importance with regard to my views on and approach to video methods and their significant potential in interdisciplinary research collaborations and secondary analysis. The article is currently under formal review with *Organizational Research Methods*.

1 Introduction

This dissertation explores design as it happens in practice by focusing on what designers say and do when engaged in various types of design work. The five articles presented here focus on design practices in educational and professional contexts to explore specific details concerning the ways in which design work is conducted in collaboration with others using the various analog and digital tools that are available. A growing body of work across the field of design research is concerned with the relationships among design materials, collaboration, and the progress of design projects (Ball & Christensen, 2018; Luck, 2012a; Matthews & Heinemann, 2012; McDonnell & Lloyd, 2009b; Oak, 2003). However, there is still relatively little understanding of how participants engaged in design work use, characterize, and discriminate objects as design materials in the course of design activities such as searching for inspiration, brainstorming, categorization, and concept development.

I argue that a combination of theoretical perspectives and methodological approaches is useful and necessary to reveal these embodied and material aspects of design practice. These views allow for the study of details in situated interactions while maintaining a wider perspective of the design process. Specifically, the articles presented here combine perspectives from ethnomethodology (EM) and conversation analysis (CA) with views from cognitive and social psychology within design research to examine design practices. Consequently, the articles presented in this dissertation suggest that there might be a bridge to build between the fields of cognition, EM, and CA. This multidisciplinary approach allows for a better understanding of how designers in various situated practices orient toward cognition and understanding in interactions, construct shared understandings and establish progress in a design project together (Deppermann, 2012; Luck, 2012a; Oak, 2011).

The purpose of this dissertation is twofold. First, the dissertation advances our understanding of how talk and the use of various visual objects and technologies are ordered and organized among participants in different design projects in educational and professional settings. It is essential to examine the ways in which visual objects and technologies are part of everyday design processes are important because these objects and their use are intertwined in the ways in which design work is practiced, facilitated, conducted, and communicated. Moreover, visual objects and technologies typically represent a tangible part of the final design outcome, thus enabling participants to include

visual referents in the conversation (Luck, 2012a). These visual referents also tell us something about how initial ideas evolve into finished designs (Christensen & Friis-Olivarius, 2020).

Second, this dissertation explores and illustrates approaches to the study of situated design practices in which theoretical and methodological approaches from sociological, linguistic, and psychological traditions are combined in different research designs. This interdisciplinary approach is important because it allows for the various analyses that consider larger structures or phases in design work while also focusing on specific details in the interactions of the participants, the materials or technologies at hand, and the rich semiotic environment in which the design activities unfold. In this regard, audiovisual data provide a unique opportunity to include visual objects, technology, and the immediate environment in the analysis (Heath et al., 2010).

Video data have unique qualities such as permanence, density, and the ability to capture a version of a specific situation as it occurred naturally in a given context (Hindmarsh & Llewellyn, 2018). The rich and dense records of social interaction provide a new kind of data for the social sciences and organization studies (Christianson, 2018; LeBaron et al., 2018). Moreover, video enables researchers to capture social interaction in an unprecedented mimetic, less manipulated, and, in terms of details, far denser manner than other qualitative data allow. Ultimately, video data allows for otherwise inaccessible aspects of social practices, behaviors, and organizational phenomena to be studied, such as the use of technology, the organization of teamwork, and the nature of routine, skills, and expertise (Best & Hindmarsh, 2019; Hindmarsh & Heath, 2007; Llewellyn & Whittle, 2019; Nicolini, 2009; vom Lehn & Heath, 2016; Yamauchi & Hiramoto, 2016). This accessibility makes video data well suited to a range of analytic and theoretical considerations of both a qualitative and a quantitative nature (Christianson, 2018; Heath et al., 2010), as well as complementing other forms of research (LeBaron et al., 2018). This dissertation addresses the potential and tradeoffs involved when working with video in both qualitative and quantitative research projects.

The dissertation delves into the field of design research to achieve this twofold purpose and presents five articles pertaining to various situated design activities whereby design work is practiced, performed, and accomplished. The outset is a practice-based perspective in which design work is understood as a series of eclectic and complex interactions that take place as an interplay of multiple actors, stakeholders, artifacts, and resources that are embedded in a social, cultural, and material world (Ball & Christensen, 2018).

In recent decades, the field of design research has begun to focus on design as it is actually practiced in various everyday settings. However, practice-based naturalistic studies remain in the minority among empirical studies within design research (Matthews & Heinemann, 2012). Moreover, studies of practice require observation methods and interpretation frameworks that allow for "zooming in and out" of the different features of practice (Nicolini, 2009). As I argue in this dissertation, a methodological pluralism whereby quantitative methods are sometimes combined with qualitative approaches to study interactions is thus necessary (Kendrick, 2017; Stivers, 2015). I approach the study of design practices through five distinct datasets with audiovisual recordings as the primary data sources. The five datasets serve as empirical entry points for the five articles in the dissertation. The articles illustrate various analytical approaches to studying design practices in which theoretical lenses and analytical tools from EM, CA, cognitive and social psychology, and design research are combined.

Article one, "The Oscillation Between Individual and Social Designing in Co-Located Student Teams" (Christensen & Abildgaard, 2018), examines shifts between individual activity and social activity in design work and how joint attention may be mediated by analog and digital communicative resources. The study's empirical entry point is a co-located individual and social design activity conducted by teams of high school students. The aim of the study was to refine the understanding of how students in creative teams move from seemingly individual tasks to more explicit collaborative activities in their design projects. In addition, the research adds empirical evidence of the oscillating nature of design practices in teams to challenge the descriptive models of design team processes in which design is conceptualized as an individual activity or as a social endeavor (Christensen & Abildgaard, 2018).

Article two, "How Task Constraints Affect Inspiration Search Strategies" (Biskjaer et al., 2020), studies high school students' strategies for seeking inspiration using Google Images. The study provides empirical insights into how varying levels of task constraints influence individual search strategies. The findings suggest that neither too little nor too much available information conceived of as constraints would be conducive to creativity; that is, the person engaged in the search activity will balance the use of keywords from the creative task in the inspiration search in order to establish a "sweet spot" of constrainedness (Biskjaer et al., 2020).

Article three, "Kinds of 'Moving' in Designing with Sticky Notes,"(Christensen & Abildgaard, in press) examines how designers use and move sticky notes when engaged in design work. By

using video data of two different design projects, the article examines how designers display their understanding of objects as design materials, specifically sticky notes. The modalities of the sticky notes and the semiotic environment play a vital role in the design activity and how participants, even if only temporarily, accomplish a shared understanding of the features and moves of the sticky notes with their co-participants. This shared understanding is central to determining why the participants moved the sticky notes and how this created progress and direction in the design project.

Article four, "'What do you think? '": Managing reflection during group supervision," describes reflective practice in design pedagogy. I approach reflective practice through the empirical analysis of 24 cluster supervision sessions in an experimental business and design course at the MA level. The article reveals aspects of the organization of reflective practice, which had not been studied previously, and identifies four ways of reflecting in the data: (1) Reflection as advice-giving, (2) reflection as challenge-forecasting, (3) reflection as a comparison, and (4) reflection as evaluative praise. As few studies have considered reflection as an interactional phenomenon, this paper contributes by providing insights into how students and teachers construct and perform reflective practice in situ.

Article five, "Video-Based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions," focuses on the consequences and impact of the use of video data for sharing across disciplines; this area has been underexplored thus far. The article addresses means of creating new ways of sharing video-based datasets and discusses questions such as: What does video data require (as a minimum) to be used by a variety of disciplines? Which analytical opportunities and limitations does a sharable video dataset afford? How can video data be collected without a field-specific research purpose? How "open" can video data be without losing its value? The article provides a set of reflections and insights regarding how to share video data, plan for and address the issues that arise when collecting data with the aim of sharing, and how to prepare and subject a video-based dataset to multiple analyses.

1.1 Working with video data in interdisciplinary research projects

The five articles in this dissertation do not only illustrate distinctive ways in which video data may be used in various research designs and with different research interests in mind, as the articles also represent my academic journey over the last few years, including my involvement in various research groups and finding my own path in terms of stance, method, and analytical

processes. Thus, this dissertation encompasses a collection of interdisciplinary mixed-method studies, which inevitably constitute a series of compromises of a theoretical, methodological, and analytical nature. However, the collection of articles also serves to illustrate how combining theoretical lenses and mixing methods may be immensely productive, and allows for new insights in terms of the breadth and detail of the phenomena of interest.

A large portion of the data for this work was collected as part of an interdisciplinary research project, Creativity in Blended Interaction Spaces (CIBIS). The CIBIS project consisted of an interdisciplinary group that included researchers from the computer sciences, human-computer interaction (HCI), interaction design, creativity research, and the cognitive sciences. We found common research interests such as co-design activities, design strategies, and design materials. The project allowed me to integrate my interest in how the use of materials and turns of talk are coordinated in everyday activities and how video data allow for the detailed and multimodal analyses of such activities from an EM/CA-inspired perspective. These commonalities led to several projects, including in Articles one (oscillation between individual and social design) and two (inspiration search strategies) (and partly Articles three (moving sticky notes) and five (video-based data sharing) in which datasets were used for the secondary analysis), in which audiovisual data were the core of the empirical basis.

During the CIBIS project, I was involved in or worked independently on other projects with video data as the focal point, including a study of design teams building models with LEGOs in the same physical space and the dynamic process of close physical encounters and potential micro-conflicts (Abildgaard & Christensen, 2017b). In addition, I conducted a collaborative case analysis of how a professional design team may provide a new variant of case studies for design research (Abildgaard & Christensen, 2017a). I also researched how sticky notes were used to externalize thoughts and ideas in collaborative design activities (Dove et al., 2018), and conducted a study of verbal displays of idea ownership during collaborative brainstorming sessions (Abildgaard, 2020). In each of these projects, EM/CA-like practices such as detailed analyses of selected episodes of interactions were conducted within frameworks guided by "wider" concerns, including those of design cognition, creativity research, and HCI.

In the CIBIS research setup, video recordings of the work and the interactions in various design settings, often augmented by fieldwork and interviews (as in Articles one and two, and partly in Article five), enabled us to address a range of details concerning the ways in which design work

is carried out in collaboration with others using various analog and digital tools. Given the interdisciplinary nature of the CIBIS research group concerning theoretical stances and analytical approaches, my engagement in the project demanded flexibility, compromises, and creativity in the research design and analytical approach in regard to my training in EM/CA and video ethnography. For example, Article one (oscillation between individual and social design) was based on "naturally occurring data;" that is, data from situations that would likely have occurred in a similar manner regardless of the presence of the data collector. This approach contrasts with Article two (inspiration search strategies), which relied on what may be labeled "researcher-provoked data" (Silverman, 2006; ten Have, 2007) because the workshop and inspiration searches, which constituted the empirical setting, were only conducted due to the CIBIS project. Similarly, the facilitated brainstorming sessions, which partly constituted the empirical setting in Article three (moving sticky notes), were also conducted in relation to the CIBIS project.

Thus, from the beginning of my academic journey, I was involved in various research projects driven by diverse research interests and analytical approaches in which audiovisual data were the main input for the subsequent quantitative and qualitative analyses. Participation in the CIBIS project showed me the wide range of applications of video-based research and how amenable video data may be subjected to both quantitative and qualitative analytical approaches (Hindmarsh, 2017). The sequence of the five articles herein is a chronological illustration of my academic journey through different research settings and collaborations and indicates how my methodological approach has developed over the years. Articles one (oscillation between individual and social design) and two (inspiration search strategies) were some of my first endeavors using a mixed-method approach in which audiovisual data played a central role. Article three (moving sticky notes) was written at a later point in my Ph.D. studies when my co-author and I chose to combine two video-based datasets from the CIBIS project and selected specific parts of these datasets to develop the study and focus solely on social interactions involving sticky notes. This approach was only possible because we were familiar with the datasets from previous projects, and had a thorough knowledge of the contents and contexts of the datasets.

During my Ph.D. studies, I joined the project on which this dissertation is based, namely "Designerly Ways of Teaching for Entrepreneurship in Higher Education" (DEED). The overall aim of DEED is to investigate how design pedagogy, particularly studio-based learning, may help to develop a student's entrepreneurial mindset. DEED comprises two Ph.D. projects, this project

and another project that has an entirely quantitative methodology. This Ph.D. project is thus influenced by the DEED agenda, which has framed part of the focus of my studies.

In the DEED context, this dissertation explores design work through a video-based methodology. This Ph.D. project focuses on understanding interactional details in design practice (and design pedagogies), which may provide information about how design activities, such as reflection or idea generation, are conceptualized and measured. The other Ph.D. project in DEED used experimental methods and register data to measure the effects and long-term impact of design pedagogies (such as studio-based learning) on students' post-graduation career choices and entrepreneurial activities such as enterprise start-ups, as well as the survival and growth of these start-ups.

As part of the DEED project, I conducted a longitudinal video-based fieldwork in an interdisciplinary MA course for business and design students. The project allowed me to use my skills and pursue some of my research interests independently, which resulted in the study presented in Article four (reflection in supervision) concerning reflective practice in an educational business and design context. This study was part of a larger research agenda in DEED, where teacher-student reflection and student co-design activities in studio-based learning are studied to understand whether these pedagogical approaches make a critical difference in developing students' entrepreneurial mindsets and, if so, how. Of course, this is not the primary purpose of this dissertation or of Article four, ""What do you think?": Managing reflection during group supervision," nevertheless, this study is related to the DEED agenda and is inevitably framed by it. The aim of Article four was to contribute to a better and more detailed understanding of how reflection takes place (as reflective talk) in a studio environment.

Article five (video-based data sharing) is placed at the end of the sequence of articles in the dissertation to form a synthesis of my methodological approach and stance after working with video-based research for many years and in various project constellations. The article is based on the case of the 11th Design Thinking Research Symposium (DTRS 11), at which an ethnographic video dataset was collected, shared, and analyzed by 28 international research teams as part of the CIBIS project.

1.2 Structure of the dissertation

In the following chapter, I present the main research question of this dissertation together with the five distinct research questions relating to each of the articles included in the dissertation. In

Chapter 3, I outline the overall contribution of the dissertation and the contributions of each of the individual studies. In Chapter 4, I expand the main theoretical fundament in the dissertation, while the analytical approaches in the five articles are presented in Chapter 5. In the methodological section of the dissertation, Chapter 6, I provide a detailed description of the empirical settings and methods of data collection in the five articles. The limitations of the five studies are discussed in Chapter 7, while suggestions for future studies are described in Chapter 8. The conclusion is presented in Chapter 9, and a brief summary of the five articles and their publication status is presented in Chapter 10. The five articles are included at the end of the dissertation in Chapters 11–15.[2]

[2] The articles are presented in the same form as the manuscripts submitted or accepted for publication. All references have been moved to the end of the dissertation to ensure that the formatting of the five articles matches the rest of the dissertation.

2 Research question

Providing an overarching research question for this dissertation was somewhat challenging since the dissertation is composed of five articles, each of which had distinct research questions. However, before I present the five distinct research questions related to the five articles, I present a central research question to provide the reader with an idea of the overall framing and theme in the dissertation that may aid in creating coherence across the five studies.

Adopting a practice-based perspective on design activities, I ask:

> How do designers mobilize visual objects and technology to construct shared understanding in design work?

Some comments on this research question are in order. The term "mobilize" could also be read as "use" or "work with", and is used to describe how objects may or may not be used in the practice of interest. Using objects through practice in meaningful ways animates the work, knowledge, and discourse of specific communities, and reveals important aspects of what is required to be a competent member of that community (Goodwin, 2013). In design, this could be studying how moving sticky notes a few inches on a whiteboard tells us something about how the sticky notes are discriminated by the participants as a specific design material, and how the mobilization thereof is important for the participants to build action collaboratively and to make the further development of the design possible (as investigated in Article three). It could also pertain to how tablets and personal laptops may hinder an attempt by a co-participant to attract the attention of the participant working on the device (as investigated in Article one).

By using the terms "visual objects" and "technology," I wish to include any object that may feature in the design practices and to include items of either an analog or a digital nature. Studying the sequential organization of how designers produce and coordinate their actions also implies studying the variety of resources they mobilize, whether these resources are talk, gestures, bodily orientation, objects, or technology (Comi et al., 2019; Luff & Heath, 2019; Whyte et al., 2007). As the qualitative analyses presented in the articles are partly informed by EM/CA perspectives, the term "construct" should be understood as "produced," "created," or "brought into being" (Rawls, 2002). The term "shared understanding" refers to how participants externalize their understanding in interactions and in conversation. In this sense, the participants actively shape their shared understanding in specific situations, and, in turn, the shared understanding shapes the participants' sayings and doings (Thompson & Fine, 1999). One participant can invite others to

participate in the activity via explicit formulations or more implicit actions, such as bodily conduct or the use of objects or gestures. The other participants may then join the activity through their display of explicit formulations or implicit actions (Due, 2018; Luck, 2007). The term "design work" is used to cover any type of activity or task framed as "designing" or "creativity" by the participants in the studies, such as teachers, students, or professional designers, as well as to indicate the link to a body of research within the EM/CA community and organization studies, also known as workplace studies. Workplace studies are concerned with studying work in complex, organizational, and institutional environments, and focus on the social and interactional production of organizational activities (Button & Sharrock, 2000; Llewellyn & Hindmarsh, 2010; Luff et al., 2000; Luff & Heath, 2019).

The main research question was investigated via the analyses of interactional audiovisual data from five datasets that feature different design activities and design practices. The five articles that underpin this dissertation present selected perspectives on the main research question. Taken together, the four first articles touch upon various aspects of design practices and ways of doing-being creative when working individually or collaborating in teams. In this context, "doing-being" refers to how participants constitute themselves as creative or "designerly" during their interactions in various design-related work activities (Sacks, 1984).

Articles one, two, and three analyze how different visual objects and technologies featured in the design activities and how a shared understanding was constructed in the process of designing. In Article four, I analyzed how reflective practice in design team projects was carried out as reflective talk. Thus, the article focuses on the construction of shared understandings through reflection; however, the topic was mainly studied through talk and gestures (not interaction with visual objects or technology). Article five differs from the other articles because it is an entirely methodological article that argues for the use of video-based data for data sharing and secondary analyses across disciplinary boundaries and methodological stances. Thus, Article five covers the methodological aspects of the main research question, namely how one may conduct video-based research and design interdisciplinary, mixed-method research projects in such a way that it is reasonable to expect that the research question posed can be answered. I present the specific research questions in the articles in this dissertation below.

The distinct research questions in the five articles are:

Article one: "The Oscillation between Individual and Social Designing in Co-Located Student Teams"

> How does joint attention fluctuate across design sub-activity types during the course of designing? How do contextual factors and communicative resources influence whether attempts to attract joint attention actually succeed?

Article two: "How Task Constraints Affect Inspiration Search Strategies"

> How do dissimilar levels of task constraints affect inspiration search strategies?

Article three: "Kinds of 'Moving' in Designing with Sticky Notes"

> How and why do designers move sticky notes in collaborative design work?

Article four: "'What do you think?': Managing reflection during group supervision"

> How do students and teachers organize group reflection sessions? How is reflective talk structured and co-constructed in the classroom setting?

Article five: "Video-Based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions"

> How can a video-based data collection with the purpose of sharing data be designed and conducted?

These research questions were investigated through quantitative and qualitative analyses of interactional audiovisual data collected at various Danish educational institutions at the secondary and higher levels, and by recording a professional design team working at an international company.

3 Contribution

First, this dissertation contributes to the field of design research, particularly to the area that studies design using an ethnographic approach through in situ observations and audiovisual recordings (Ball & Christensen, 2018; Button, 2002; Lloyd, 2019; Luck, 2012b; Matthews & Heinemann, 2012). This dissertation contributes empirical evidence to challenge existing understandings and theoretical models of design processes and collaborative design practices. This is done by empirically demonstrating the *situated* design practices of collaborative design activities with visual objects and technologies in complex, real-world design contexts. Design practice is explored as a social activity through ethnomethodological questions of how design team members construct situated joint attention and shared understandings, and accomplish design work via the use of various materials.

Second, this work provides examples of how video data may be used to support the analysis of everyday social activities in institutional and organizational contexts. Moreover, the dissertation contributes to video-based research by demonstrating the broad scope of possible methods for video analysis that are relevant not only to design research but also to organization and management studies in general (Christianson, 2018; Hindmarsh, 2017; LeBaron et al., 2018). The combination of theory and methodology varies across the five studies, and each article presents a way of collecting and analyzing data pertaining to design work by using audiovisual data as the basis. Thus, the dissertation also contributes to the field of inter- and cross-disciplinary research more broadly by illustrating how mixed-method approaches allow researchers to provide both individual and collective, local and processual descriptions of design work, thus offering more complex and nuanced findings (DeCuir-Gunby et al., 2012).

Each of the five articles makes distinct contributions. Article one (oscillation between individual and social design) contributes by providing insights into the theoretical understanding of collaborative design practice by empirically illustrating how the currently held general conception of team designing as being entirely social in nature is overly simplistic (Christensen & Abildgaard, 2018). Based on a close examination of the activities in the design teams, the empirical evidence suggested that the activities in the co-located design teams oscillated between individual activity and joint attention depending on the phases and activities involved in the design work. Moreover, the findings showed how analog and digital media were used as communicative resources to mediate individual attempts to attract attention and to establish joint attention in the teams, in

which some communicative resources were more effective than others. These findings offer valuable insights for the teaching and facilitating of collaborative design activities.

The main contribution of Article two (inspiration search strategies) is the empirical findings, which provide insights into how varying levels of constrainedness in creative tasks affected inspiration search strategies (Biskjaer et al., 2020). The study revealed that inspiration search processes were initiated in response to the information stated in a creative task, and thus to the level of constrainedness. The findings showed that neither too little nor too much available information conceived of as constraints would be beneficial to creativity. The findings are relevant to the field of design research concerning inspiration searching as an important design activity, and to design practitioners and design educators who solve or formulate creative design tasks for which finding sources of inspiration is essential.

Article three (moving sticky notes) contributes empirical evidence showing how the movement of sticky notes supported conceptual design in design teams. The empirical findings contribute to the conclusion that the main reason that the movement of sticky notes supports conceptual design appears to be the changing visuospatial proximity between the notes across time in terms of gesture and note placement (Christensen & Abildgaard, in press). The study of how specific forms of representations or materials support design work is important for design researchers in order to advance the understanding of design practice and cognition (Cash & Maier, 2021; Dove et al., 2018). These findings may point toward new directions for research on design moves by exploring how and why designers move sticky notes.

Article four (reflection in supervision) on reflective practice in design pedagogy contributes empirical knowledge to the educational practice of team supervision and group reflection from a practice-based perspective. The empirical findings revealed aspects of the organization of reflective learning and "doing reflecting" (Arano, 2020) that had not been identified previously. Moreover, the article highlights the role of facilitation and supervision when teaching and learning reflective practice. These findings offer insights that are useful for developing methods for the teaching and learning of reflective practices in higher education.

The articles that study design in an educational context (Articles one to four) contribute by providing empirical knowledge regarding how students learn and practice design work, which offers useful insights for current teaching methods within the areas of design and creativity, and

may inspire the development of new methods for teaching and learning design and creative practices in secondary and higher education.

Article five (video-based data sharing) contributes to and expands on the line of research that is mainly based on in-field collected video data (e.g., Harris 2016; Heath et al. 2010; Knoblauch, Tuma, and Schnettler 2014; Pink 2007; Shrum and Scott 2018). The article assesses how video-based data collection is conducted with the purpose of data sharing and the central editorial and cinematic decisions involved. Video data do not offer infinite flexibility in terms of the analytical approaches afforded but can facilitate the comprehension and discussion of results that would be outside of the ordinary theoretical lens of the individual researcher. Shared video-based datasets remain scarce within the humanities, social sciences, and technical sciences. Nevertheless, global trends toward Big Data and Open Science indicate that sharing video data has substantial research potential for inter- and cross-disciplinary collaborations and for novel ways of organizing research projects (Corti et al., 2014; Corti & Thompson, 2011; Hindmarsh, 2008). Furthermore, of current concern, the article covers how to collect video data for sharing, which holds the promise of allowing for collaborative video analysis even at a time when video-based data collection remains highly challenged by Covid-19 restrictions internationally. An example is illustrated by the "first-mover" case of the DTSR 11 described in the article. The eclectic nature of the field of design research makes it a good candidate for illustrating the potential of sharing one video-based dataset with many different researchers who have varying ontological assumptions and methodological approaches to analysis.

4 Theoretical background

I worked within two intersecting research fields as the foundation for the five articles in the dissertation. The first was design research, specifically the area of design research that is concerned with studying design practice in situ in institutional and organizational settings. This practice-based perspective on design also implies studying design as a social activity that is embedded in the material world (Ball & Christensen, 2018; Comi et al., 2019; Matthews & Heinemann, 2012). The second was the combined fields of ethnomethodology (EM) (Garfinkel, 1967; Rawls, 2008) and conversation analysis (CA) (Atkinson & Heritage, 1984; Goodwin et al., 2017) because these perspectives offer appropriate methods and tools for investigating and understanding the micro-foundations of social interaction.

4.1 The field of design research

Design has evolved from being a distinctive and specialized discipline pertaining to the design of products and the establishment of scientific design processes to being a field characterized by multiple disciplinary perspectives that has been incorporated into a variety of areas such as business, economics, computing, anthropology, psychology, and others (Bremner & Rodgers, 2013; Cross, 2007). As a result, design research and design practice are evolving constantly. New hybrid forms of design have come into existence due to this disciplinary mutability (Bremner & Rodgers, 2013). This dissertation illustrates the varying and expanding terrain of design and designing beyond product design by focusing on how the act of designing unfolds in institutional contexts in which students are engaged in various design projects, and among professional designers working with "soft deliveries," such as strategic design and service design (Abildgaard & Christensen, 2017a).

With regard to the history of design research, one may characterize the field as being fundamentally multidisciplinary, as several disciplinary lenses have been used to study design and designing (Christensen & Ball, 2019). Design research evolved from being a field of systematic and scientific practice in the early stages (Cross, 2007; Matthews & Heinemann, 2012) to an area in which most of the empirical studies of design were staged experiments (Cross et al., 1996). The field of design research has evolved further into a more diverse field of inquiry with what has been called an empirical turn, whereby design practice has become an independent topic of investigation (Matthews & Heinemann, 2012), and a social turn, whereby design is considered to be much more than dialogical processes (Button, 2002; Lloyd, 2019). Most research within the

design field has either focused on design as something that designers "do" (as a "unique" type of activity) (Button, 2002; Luck, 2012a, 2012b), or on design as a certain way of thinking and knowing (for example, creative thinking, problem-solving, and logic) (Cross, 2006, 2011).

Studies within the field of design research have increasingly embraced design work as a set of actions and interactions rather than as a type of logic or thinking. This practice-based perspective considers design work to consist of eclectic and complex interactions that take place as an interplay among multiple actors, stakeholders, artifacts, and resources that are embedded in a social, cultural, and material world (Ball & Christensen, 2018; Button, 2002; Button & Sharrock, 2000). Studying design work from a practice-based perspective entails looking beyond the linear process of design as being composed of steps or phases, and understanding design practice as the social and material choreography in the complex and "messy" interconnections of people, things, and discourses (Nicolini, 2007). Thus, the study of design practice is also an examination of the contexts and relationships among people, environments, objects, technologies, and other matters over time (Campbell, 2019).

Researchers who are interested in design practice have begun to study how design is accomplished in naturally occurring settings instead of in experimental environments (Comi et al., 2019). In these studies, design work is understood as an embodied and situated activity in which a wide range of multimodal resources are mobilized (such as gestures, bodily orientation, gaze, use of objects, and the like) within complex and specific patterns of interaction (Luck, 2012b).

Several design researchers use methods informed by EM /CA to study design practices (Matthews & Heinemann, 2012) by drawing our attention to how artifacts are used to mediate the understanding of design and construction processes (Luck, 2007). EM/CA methods have also been employed to analyze how the conversational aspects of collaborative design may reveal how design objects are understood and assessed (Oak, 2011), and how participants in a design interaction move from fragmented to shared understandings and professional visions by engaging with visual objects (Comi et al., 2019). By analyzing design practice based on ethnographic video data of naturally occurring interactions, this dissertation builds on previous studies of "designing in the wild" (Ball & Christensen, 2018) and "doing designing" (Luck, 2012b). These works focused on how design team members constructed situated joint attention, shared understandings, and accomplished design work using various objects and technologies in institutional and

organizational contexts. In the next section, I provide a brief review of the essentials of EM/CA as the second field of research underpinning this dissertation.

4.2 The field of ethnomethodology and conversation analysis

CA developed from the sociological traditions of EM, a theoretical perspective that is essentially concerned with how interactions are organized (Garfinkel, 1967, 1997; Heritage, 1984; Rawls, 2008). EM is the study of how people accomplish things; that is, the (ethno) methods used by groups and their members' knowledge. In other words, what people need to know to accomplish things, and how that knowledge features in the organization of their work (Button, 2002; Garfinkel, 1967). As Lloyd stated, "ethnomethodology looks at particular practices of how particular things are achieved, and that includes designing" (Lloyd, 2019, p. 173). CA is the study of the order of interactions and how people produce accountable actions through talk, with a focus on what an action (such as talk) accomplishes in relation to the previous action and what it projects in terms of the subsequent action (Heritage & Clayman, 2010). As a rigorous and inductive approach to studying social interaction, EM/CA considers the sequential production and structure of actions and how interaction is accomplished on a turn-by-turn basis, whereby participants orient toward actions as being context producing and context renewing (Atkinson & Heritage, 1984; Goodwin et al., 2017). Objects and the use of material structures in the environment are particularly relevant and are considered to be organized reflexively in and through social interaction (Hindmarsh & Heath, 2000).

EM/CA offers a functional and advanced analytical toolkit for investigating practice. Through the sequential production of action and the detailed attention to overlapping, latched, interrupted utterances and gestures, EM/CA offers tools (such as transcription) to report how an action is produced in an interaction (Jefferson, 2014). However, EM/CA only considers actions that are observable to the participants in the situation. Within EM/CA, no assumptions are made in terms of interpreting what is occurring in the participants' minds, such as their motivations or the intentions behind their actions. From this perspective, it is essential to note that phenomena such as power relations, institutions, culture, and social structures are only considered in the analysis if they are observably manifested in the social practices of the participants (Llewellyn, 2008; Nicolini, 2009).

Although studies employ EM/CA methods in various ways, the two main areas within CA can be identified as "pure/basic" CA or "applied/institutional" CA (Kasper & Wagner, 2014).

Researchers engaged in pure CA focus mainly on the mechanisms of talk in interaction, as the aim is the systematic and detailed study of sequence organization, turn design, repairs, and so on (ten Have, 2007). Within the field of pure CA, an analysis is no longer considered to be genuine CA if the analysis of the data is guided by predetermined theoretical assumptions or hypotheses (Mori & Zuengler, 2008).

Applied CA refers to the application of the basic CA principles, methods, and findings when studying social domains and situated local practices (Kasper & Wagner, 2014; ten Have, 2007). Applied CA focuses on institutional talk and the ways in which interactions in local settings such as a doctor's clinic, classrooms, interviews, meetings, and so on are conducted (Antaki, 2011). What is interesting about institutional interaction is how "these places are roped off from casual life not only by physical barriers and by the presence of certain furniture and props, but by different rules of, and entitlements to, talk" (Antaki, 2011, p. 6). From this perspective, one may argue that the contexts for studying design practices in this dissertation—classrooms, studios, offices, and other types of working environments—fall under the category of institutional interaction (or applied CA).

There are ongoing controversies regarding the potential that CA has for contributing to a broader audience of researchers and practitioners. In particular, "unmotivated looking" (ten Have, 2007, p. 121) and the use of video recordings as the primary data source have received criticism from outside research fields, which have claimed that it is essential to include details such as sociodemographic data or the institutional context, which do not appear in the recordings or the analysis (Mori & Zuengler, 2008). With regard to CA studies of classroom interactions, a frequent criticism is the lack of addressing learning and learning outputs, which is at the heart of a substantial proportion of educational research. Other controversies stem from CA's purely structural descriptions of minute details, as critics have questioned how one may draw theoretical and practical implications on this basis (Mori & Zuengler, 2008). This focus has led to reflections on the data collection procedures and analytical approach promoted by CA and the possibilities of the combination and synthesis of CA and other methodological and theoretical frameworks for the purpose of institutional and interdisciplinary research (de Ruiter & Albert, 2017; Mori & Zuengler, 2008; Stivers, 2015).

The following section describes the primary analytical strategy applied across the studies in this dissertation, and how this strategy allows for the combination of theoretical lenses from EM/CA, psychology, and the cognitive sciences when studying design practices.

4.3 Combining theoretical lenses to study practices

Studies of practices draw on a long theoretical history with a wide range of methods and have recently been developed across a variety of fields beyond design research, such as organizational and management studies (Miettinen et al., 2009). This "re-turn" to practice and a focus on "what humans actually 'do' when managing, making decisions, strategizing, organizing and so on" also challenges researchers "to bridge different levels of analysis, and to do so in different ways" (Miettinen et al., 2009, p. 1309). In this regard, theories about practice foreground the importance of the bodily and material aspects of all social affairs, in which practice may be described "as routine bodily activities made possible by the active contribution of an array of material resources" (Nicolini, 2012, p. 4).

The concept of practice, and how it may best be studied, arguably requires moving away from the language and idea of social science, in which a phenomenon is divided into three levels: a micro-level (sayings and doings), a meso-level (routines and rituals), and a macro-level (institutions; (D. Boden, 1994; Miettinen et al., 2009). Instead, research must develop vocabularies and approaches that transcend these constructed levels and allow for the study of practice simultaneously locally and globally, in the here and now as situated practicing, and elsewhere and then in connection with other practices (Miettinen et al., 2009; Nicolini, 2009).

The main analytical strategy in the study of design practices in this dissertation can be described as taking inspiration from the metaphorical movement of "zooming in" and "zooming out" of practice, as termed by Nicolini (2009). The metaphor illustrates how switching theoretical lenses when studying practice may foreground certain aspects of the practice while placing others in the background (2009). Studying real-time practice poses a challenge to the researcher because practices occur in the background of everyday life in the details of the sayings and doings. Thus, in order to study practices, they "need to be drawn to the fore, made visible and turned into an epistemic object" (Nicolini, 2009, p. 1392). Therefore, the provisional framework presented by Nicolini (2009) suggests that the "zooming in" movement is an essential first step in understanding and re-presenting practice. "Zooming in" requires conceptual tools and perspectives, which help to accomplish a detailed study of the material, and the discursive and

interactional aspects of practice. The second movement, "zooming out," calls for an approach that allows for the exploration and analysis of connections between the details of a particular situated practice and the broader aspects of everyday organizational practices (Nicolini, 2009, p. 1392). In line with Nicolini (2009), I do not provide an ultimate definition of practice in this dissertation; instead, I aim to show how specific "units of analysis" in each of the five articles are representative of local practices, and how they are defined is internal to each of the theoretical frameworks, which makes it impossible to choose one definition without "reducing the richness provided by the different approaches" (p. 9).

Several theoretical traditions may be echoed in the metaphorical movement of zooming in and out. Nicolini (2009) drew on four, namely the Wittgensteinian and Heideggerian views of social affairs and the practices of everyday life, EM/CA, cultural and historical activity theory, and actor-network theory. The zooming in and out of practices by switching or combining theoretical lenses helps to foreground different details when studying practices, which may also enhance how practice is re-presented in research. Ultimately, the argument is that this eclectic approach to studying, analyzing, and re-presenting practice offers a "toolkit logic," which may be more appropriate for capturing some of the complexity of practice compared to a single theoretical approach (Nicolini, 2009, p. 1413).

4.4 Social interaction, psychology, and cognition

The articles presented in this dissertation all used audiovisual recordings of naturally occurring data to study social interaction. Tools from EM/CA were used in combination with quantitative analysis and theoretical and conceptual frameworks from psychology and cognition to unravel the complexities of the situated design practices in the data. Thus, the articles represent a combination of theoretical positions within cognition and psychology in combination with EM/CA. Based on the provisional and open-ended framework summarized in a table by Nicolini (2009, p. 1412), Table 1 summarizes the frameworks and focal points across the articles.

Table 1

Summary of the Frameworks in the Five Articles.

Zooming in	
Focus on the:	Sayings and doings of designing The active role of analog and digital materials and the use thereof Local methods and micro-strategies Body choreography Discrimination of objects as design materials Embodied design activities […]
Zooming out	
Focus on the:	Design team processes Design phases and design episodes Team activity and transitions Design thinking and knowing Patterns of associations and connections Design progression […]

The "zooming in" in the articles mainly explores the focus points listed in Table 1: The sayings and doings are explored in Articles one (oscillation between individual and social design), three (moving sticky notes), and four (reflection in supervision) (and partly in Article two that focuses on individual inspiration searches online). The active role of analog and digital materials and the use thereof are explored in relation to attracting and establishing joint attention (Article one) and in relation to visually supporting the design process and the shared understanding thereof. The local methods and micro-strategies, together with the bodily choreographies, are explored in Articles one, two, three, and four via different units of analysis (for example, individual or social activity, the use of communicative resources, the movement of sticky notes, and ways of reflecting).

The "zooming out" in the articles articulates the role of the processes, phases, and patterns listed in Table 1. For example, Article one (oscillation between individual and social design) provides an analysis of design sub-processes and knowing from a cognitive perspective. This approach is

complemented by a fine-grained EM/CA analysis of the embodied interaction of design and how digital and analog materials are featured in the process of designing. Another example is Article three (moving sticky notes), which provides an analysis of how visual representations and the moment-to-moment movement thereof in collaborative design activities provide external support for design cognition and facilitate the design process and the design progression.

In the following section, I provide a brief summary of some of the main similarities and differences between CA and psychology to build an argument for combining the methods from the two fields.

One of the main differences between psychology and CA is how psychologists formulate new theories or hypotheses through predicted effects, such as a difference in aggregated values; (de Ruiter & Albert, 2017). This approach differs fundamentally from CA, in which the idea of invoking theoretical assumptions or concepts that are not grounded firmly in natural observation is considered heretical (de Ruiter & Albert, 2017; Stivers, 2015). Within the field of psychology, data are collected via experimental setups or from existing data sources. This process contrasts with the CA approach, which is the collection of data from naturally occurring human interaction or the use of existing records that were recorded "naturally" as part of routine procedures such as telephone calls (ten Have, 2007) or surveillance and CCTV systems (Luff & Heath, 2019; Whiting et al., 2018). The use of descriptive statistics such as means and medians within psychology contrasts with the methods used in CA, arguing that human interaction does not lend itself to be reduced to aggregate values and variables. Moreover, one may risk overlooking hidden variables or concealing important variables when using this method, which paradoxically may reverse the direction of the relationship between two variables (de Ruiter & Albert, 2017).

One area in which the field of psychology could benefit from CA is the approach to and the use of data when studying social interaction. Instead of relying on data from experiments or existing data corpora that are "generated by or filtered through the pre-empirical introspection and intuitions of the researcher" (de Ruiter & Albert, 2017, p. 98). One could use the data collected during naturally occurring, everyday interaction (Heritage, 1984). This method could assist psychologists to remain conceptually closer to studying actual social behavior "in the wild" (de Ruiter & Albert, 2017, p. 97). The method also adds nuances to the study of interaction, in which behaviors are not only perceived as symptoms of a cognitive process but are also understood as actions that are designed for a recipient (de Ruiter & Albert, 2017; ten Have, 2007).

With regard to the study of practices, pure CA is limited by its strict focus on the verbal machinery of interactions, which may not fully capture how practices are constituted through many layers of interactions (Nicolini, 2012). However, a focus on multimodal interactions (such as bodily conduct in verbal and nonverbal interaction) has been on the rise in CA studies based on video data (Deppermann, 2013). While EM/CA provides an excellent toolkit for studying practice as it occurs, as mentioned previously, it does not take cognitive phenomena such as motivations and intentions into account, nor does it consider "macro" phenomena such as social structures, power, and culture to be relevant to the analysis unless they are made visible by the participants in the local situation (Nicolini, 2009). In addition, CA's exclusive focus on language cannot capture the interactional complexities that are present in the specific contexts in which practice is studied (Campbell, 2019). The relationship between social interaction and cognition, specifically the relationships of practice and cognitive categories such as thinking, knowing, understanding, and discovering, which are central topics within design research (and the studies presented here), may best be explored "through fine-grained studies of embodied interaction in ethnomethodological and conversation analysis" (Luck, 2012b, p. 524). EM/CA studies provide a method for "zooming in" on certain aspects of practice, and can be supported by other perspectives, such as from the field of psychology, to provide a "zoomed out" perspective on practice (Nicolini, 2009) to overcome the limitations of EM/CA.

The argument in this dissertation is in line with de Ruiter and Albert's (2017) view that social action can be studied from an interdisciplinary position in which methods adopted from cognition, psychology, and EM/CA are combined in a fruitful way that preserves "the empirical rigor of CA and the methodological flexibility of psychology*"* (de Ruiter & Albert, 2017, p. 102). In the next chapter, I describe the analytical processes in the five articles in detail. Via the combined perspectives in the five articles, I aim to demonstrate that designing is not a unitary thing, but is "a collection and pattern of many things" (Lloyd et al., 1995, p. 259) that is best studied through the combination of different methods, analytical approaches, and theoretical stances.

5 Analytical approaches

This dissertation presents five articles that approach the study of design work and situated design practices from an interdisciplinary perspective by drawing on EM/CA, social psychology, and cognitive psychology, and combines the analytical tools and theoretical concepts of these disciplines.

The first three articles in this dissertation are examples of mixed-method studies. Each article illustrates different analytical approaches in which analytical tools from EM/CA are combined with methods from social and cognitive psychology. Article four (reflection in supervision) is an EM/CA study. Article five (video-based data sharing) differs from the first four articles because it is a methodological article that argues for the use of video data in qualitative and quantitative analyses with various approaches to research.

The quantitative analyses in Articles one (oscillation between individual and social design) and two (inspiration search strategies) were performed by my co-authors because descriptive statistics are outside of my area of expertise. However, I worked on the coding and analysis of the data to make the recorded data (video recordings in Article one and screen recordings in Article two) available for the quantitative analysis. In Table 2, I present a methodological overview of the five articles and describe the type and size of the data used in each article.

Table 2

Methodological Overview of the Five Articles.

	Research approach	**Phenomenon of interest**	**Data**	**Size of dataset**	**Analytical approach**
Article one: "The Oscillation Between Individual and Social Designing in Co-Located Student Teams"	Inductive and abductive	Shifts between individual activity and social activity in design work	Video recordings, observation notes, and documents	34 h 55 min. of video recordings	Coding and multimodal CA
Article two: "How Task Constraints Affect Inspiration Search Strategies"	Deductive	Inspiration search strategies	Screen recordings, interviews, and observation notes	9 h 44 min. of screen recordings, three interviews	Coding and complementa-ry qualitative analysis
Article three: "Kinds of 'Moving' in Designing with Sticky Notes"	Inductive and abductive	Using and moving sticky notes in design work	Video recordings and pictures	15 h + 4 h of video recordings from two datasets	Multimodal CA
Article four: "'What do you think?'": Managing reflection during group supervision	Inductive	Reflective practice in design pedagogy	Video recordings, observation notes, and documents	16h 39 min. of video recordings	CA
Article five: "Video-Based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions"	Mixed	Collaborative designing and creative practices in a design project	Video recordings, interviews, observation notes, documents, and pictures	15 h of video recordings selected from a raw 150-h dataset	Mixed

5.1 Coding social interaction

Before providing a detailed examination of the analytical approaches in the five articles, I will briefly discuss coding because two of the articles in this study, Articles one (oscillation between

individual and social design) and two (inspiration search strategies), were based on the coding of social interaction in audiovisual recordings. In addition, Article one (oscillation between individual and social design) combined coding and a qualitative analysis using methods from EM/CA, motivated by the desire to understand the details in the situated design activities of a single design team, while also looking more broadly at the design processes across several design teams simultaneously.

The formal coding of social interaction is generally used in top-down, theory-driven, quantitative studies, in which the broad patterns of interaction are of interest, together with the goals of quantifying certain aspects of the interactions and reducing the complex nature of human interactions to categories. Qualitative-oriented CA researchers may consider this method to be a broad and flat approach to the study of social interaction (Stivers, 2015), given that formal coding is perceived as being antithetical to CA's sensitivity to turn design, sequential positions, and the moment-by-moment details in the unfolding interaction (Atkinson & Heritage, 1984). Nevertheless, despite CA's robust qualitative agenda and sensitivity to the details of ordered social interaction (Hazel et al., 2014), CA may be considered to be the most quantitative of the qualitative methods in the social sciences due to the way in which CA studies categorize and count interactional phenomena, and focus on the shared properties in the target phenomena (Stivers, 2015).

More recently, several studies have shown that the formal coding of social interaction is possible. In these and other studies, it is evident how behavior and conversation are observed (and reduced to) as categories that allow for further examination, such as frequency, association, or effects with other variables. These variables include smiling and laughing during conversations (Mehu & Dunbar, 2008), gaze behavior in different contexts (Kidwell, 2005), sticky note use in design team interactions (Dove et al., 2018), applause during political speeches or at conferences (Heritage & Greatbatch, 1986), turn-taking structures in doctor-patient dialogues (Roter et al., 2008), and the like.

It has been argued that CA should enter the field of experimental and laboratory studies of interaction and should embrace methodological pluralism (Kendrick, 2017) driven by the motivation to assess associations among social interaction and external variables such as sociodemographic factors, factors measured through surveys or interviews, outcome variables such as grades in education, or personality traits (Stivers, 2015). CA may also contribute to the

experimental and laboratory studies related to the fields of psychology, cognitive science, social neuroscience, or psycholinguistics (Kendrick, 2017). Psychology and the cognitive sciences, and the fields coded, counted, and summarized representations of human interaction, may benefit from the way in which CA adheres "closely to the phenomena" through detailed renderings of situated practices and interactional activities, and the detailed transcriptions thereof (ten Have, 2007, p. 9). Thus, CA may allow for the analysis of important details pertaining to social interaction that would otherwise be inaccessible and may help to reveal further essential contextual moderators and mediating variables in quantitative analyses.

5.2 Analytical processes in the five articles

As described in Table 2, the analytical processes in the five articles varied. However, the analytical approach in Articles one (oscillation between individual and social design) and three (moving sticky notes) had some similarities. The intent in both studies was not to test theories or to revise them; instead, we first approached the data inductively, whereby the empirical phenomena emerged through the review and transcription of the video records. We observed shifts in individual and social activities in Article one and the movement of sticky notes in various design processes in Article three; we then employed micro-analyses to examine these empirical phenomena in a theoretical context. We applied theoretical lenses from psychology and design cognition to consider the observed phenomena, which paved the way for a discussion of the existing theoretical assumptions within the field of design research. This approach may be described as abductive, which refers to an inferential process in which the researcher moves from a puzzling fact observed in the data to some hypotheses that may explain it (Svennevig, 2001). In Article one, this approach enabled a discussion of the theories examining creative work as an individual activity (Cross, 2011; Fischer et al., 2005; Sawyer, 2007) or as a social activity (Cross & Clayburn Cross, 1995; Kleinsmann et al., 2007). The results were compared to our empirical findings. In Article three, our observations and the analysis of how designers moved sticky notes allowed for discussions of the role of design materials in collaborative design activities and gestalt psychology (Hegarty, 2011; Kosslyn, 2006).

Article one entailed a protocol-inspired analytical strategy in which visual behavior was coded based on the naturally occurring interactions visible in the video recordings (Christensen & Abildgaard, 2018). This approach differed from the traditional protocol analysis used within design research, which relies on a constructed design task in a laboratory environment, in which the participant (working in isolation) is asked to think aloud while completing an assigned task

(Ericsson & Simon, 1999; Lloyd et al., 1995). The think-aloud task was then transcribed and coded. The theory behind the traditional protocol analysis is that the think-aloud task allows for direct access to the participants' thoughts. This contrasts with real-world designing, in which the setting is typically social or team based, and the design activity takes place in the daily working environment of the designer (Christensen & Ball, 2014). By coding the shifts in activity (from an individual activity to joint attention) through the naturally occurring interactions that are visible on the video recordings, the approach in Article one resembles *in vivo* methodology in which "messy" real-world data (including verbalizations and observations of behavior and gestures) are used to study cognitive processes (Christensen & Ball, 2014; Dunbar, 1995).

The video analyses in Articles one and three included a multimodal EM/CA-inspired analysis of the designers' interactions with different design materials. In Article one, the qualitative EM/CA-inspired analysis that followed the quantitative analysis was used to reveal the interactional details in the co-located team and to determine how the visual and analog recourses were mobilized to attract joint attention.

The difference between Articles one and three is that Article one contains a combined analytical approach that includes a quantitative analysis and a protocol-inspired analysis (Christensen & Ball, 2014), which involved coding the entire video corpus. Article three does not contain a quantitative analysis. In Article three, we used a combination of still images from the video recordings, visual illustrations of the movement of the sticky notes, and animated images (GIFs) to support the visual presentation of the analysis[3] and to "re-present" (Nicolini, 2009, p. 1392) the design practice of moving sticky notes.

Article two (inspiration search strategies) included a descriptive statistical analysis together with qualitative interviews; quantitative measures and qualitative data were combined once again. However, this article differs from the others because it does not contain an EM/CA-inspired analysis. Since the first part of the study was focused on individual inspiration searches, the screen recordings of the searches for inspirational images did not entail verbalization. Instead, each search entry and image selection was transcribed and coded. The second part of the study focused

[3] As the print version of this dissertation cannot display animated images (GIFs), the print version of Article three (moving sticky notes) contains images to illustrate the moves and gestures instead of GIF animations (which will be available in the version published online).

on group selection and ideation, in which the ideas were collected and counted for coding. The qualitative interviews supported the findings, as the students expressed their strategies, frustrations, and approaches to the search for inspiration via online image searches.

The inductive approach applied in Article four (reflection in supervision) predominates in EM/CA studies (de Ruiter & Albert, 2017; Svennevig, 2001). The analytical process involved reviewing the video data from the three cluster supervision by examining the recordings and taking notes about the general teaching format, deviations from it (such as breaking the rules for participation, which the teacher had defined), and the number of participants (students and teachers) in the sessions, since the attendance varied during the course. The next step was to transcribe the cluster supervision sessions. I first worked with a rough transcription; when the selected data were transcribed, I selected various sequences to be subjected to a more detailed transcription and analysis. The selection of sequences for the detailed analysis was guided by an interest in how the students displayed their understanding of the format of cluster supervision, and how they approached the teacher's requests to reflect on someone else's work. I attended data sessions with other EM/CA research groups at Copenhagen Business School and King's College London. Data sessions are collaborative explorations of data in which data sequences are viewed and listened to repeatedly in informal meetings with researchers with the aim to learn the craft of CA analysis and develop preliminary observations into analytical claims (ten Have, 2007). In 2019, I attended several data sessions to which I brought different sequences from the cluster supervision data to qualify my analysis and findings. Following numerous viewings of the sequences of data, I began to narrow my focus to episodes of reflective practice in which the teacher asked the students to reflect on what had just been presented and the students' replies. I observed four variations of "doing reflecting," which is how the students formatted their replies to the teacher's request to reflect. For the article, I selected examples from the data that best illustrated the ways of "doing reflecting" among the students and teachers. Finally, I tested the observed four variations in reflective practice by applying the four variations as codes in the entire corpus of transcribed data. This informal counting of particular linguistic phenomena is not an unusual practice within CA (de Ruiter & Albert, 2017). This process allowed me to understand the frequency of the four variations of reflection across the cluster supervision sessions and which ways of "doing reflecting" were most or least prominent.

Article five (video-based data sharing) is a methodological article that does not contain an analysis of a specific phenomenon, unlike the other four articles. Instead, we analyzed and reflected on our

approach to data collection and data management in this article. The article is based on the DTRS11 case with a shared video-based dataset. The DTRS11 case concerned a symposium event including 28 symposium papers, and resulted in special issues of *Design Studies* and *CoDesign* (Ball & Christensen, 2018; Halskov & Christensen, 2018) and an edited book with thirty chapters (Christensen et al., 2017b). In the article, we analyzed the different publication outcomes in terms of how the DTRS11 research teams approached the shared video-based dataset, the types of analyses they produced, and how they used qualitative, qualitative, deductive, and inductive approaches to investigate the data, as well as which parts and how much of the dataset they used for their respective studies. Finally, we analyzed our approach to the data collection with sharing in mind and discussed the choices we made in terms of cinematic decisions during the data collection and the editorial decisions pertaining to data management. This analysis of our key learnings resulted in a list of recommendations when collecting video data that are relevant to be shared in organizational research projects and, more broadly, in interdisciplinary research.

In this dissertation, I aim to illustrate that the fields of social and cognitive psychology and EM/CA may benefit from combining their analytical approaches and that combining these theoretical lenses and methods may provide new insights in terms of the details and breadth of the phenomena of interest. In addition, these mixed-method approaches would allow studies to reach a broader and more applied audience than would otherwise be possible (DeCuir-Gunby et al., 2012; Stivers, 2015).

6 Methodology

6.1 Video-based ethnography

Video data are beneficial when conducting empirical studies to understand interactions in more detail. Video data provide unique access to details of interaction that are not visible when using only audio recordings and observations, such as facial expressions, gazes, gestures, and the use of materials as interactional resources. Moreover, video recordings enable new analytical approaches to the phenomenon of interest for both qualitative- and quantitative-oriented researchers (Heath et al., 2010).

All five articles in this dissertation use audiovisual recordings as the primary data. In Article two (inspiration search strategies), screen recordings are the primary data. Despite being an audiovisual representation of online search for inspiration, this type of recording obviously has specific affordances that constrain and frame how the phenomenon of searches for inspiration online is available for analysis. However, one may argue that any type of audiovisual methodology does more than simply record what occurs in a specific situation, but also has a "performative effect" on the phenomenon being studied (Mengis et al., 2018, p. 289).

Visual data have a long history of use in the social sciences, having roots in anthropology and, to a lesser extent, in sociology and organizational studies (Hindmarsh, 2008). A recurring debate in the use of video methods has been the extent to which video may capture reality through pure observation rather than being a subjective construct. In the 1940s of anthropological research, it was claimed that data collection using visual methods was subjective and lacked scientific rigor (Pink, 2007). In contrast to this view, several ethnographers, including Margaret Mead (1995), defended the objective nature of film under certain conditions. However, such scientific–realist approaches have been subject to criticism. For example, researchers have argued that:

(1) It is impossible to video record a situation without disturbing it (Heath et al., 2010),

(2) the camera cannot catch everything from the beginning to the end of a situation (Laurier & Philo, 2006),

(3) recording practices and the choice of camera angle produce specific understandings of the phenomenon of interest (Mengis et al., 2018), and

(4) video ethnographic knowledge does not necessarily exist as observable fact but is produced in negotiation between informant and researcher (Pink, 2007).

Discussions of video as a means of data collection have often focused on matters of validity and knowledge production, and on how the researchers' subjectivity affected the knowledge produced (Pink, 2003). Emphasis has often been placed on the choice of epistemology, research design, analysis, and dissemination (Harris, 2016), as well as on the post-production processes, such as analyzing videos and developing preliminary observations (Heath et al., 2010), or on the reflective practices associated with personal experiences, visual and technical skills, and culture (Pink, 2007). While all these factors are relevant and must be considered when working with video, current works on video methods agree that researchers must also be aware of the choice of technology and camera setup prior to the data collection (Harris, 2016; Heath et al., 2010; Knoblauch et al., 2014; Laurier & Philo, 2006; Mengis et al., 2018; Pink, 2007). However efficient video may be in terms of capturing human behavior and enabling a wide range of analyses, video data do not give us unmediated, untransformed access to the world as it is (Knoblauch et al., 2014; Mengis et al., 2018). Therefore, the camera should not be treated as a simple or neutral recording device (Toraldo et al., 2018).

Research projects using video data have many more complexities than one may anticipate at first, including the recording itself (the number of cameras, the choice of angle, the cuts, and the focus), and data management (editing, selection, and retrieval). The extraordinary level of detail and density accompanying the video data format enables a variety of analytical opportunities (Knoblauch et al., 2006; Luff & Heath, 2012). At present, video data may even be constructed by the people of interest themselves (for example, YouTube videos, mobile short-form videos, video diaries, and wedding videos; (Knoblauch et al., 2006; Shrum & Scott, 2018; Wang, 2020; Zundel et al., 2018). Videos may also be available from other sources, such as surveillance videos or CCTV systems (Luff & Heath, 2019; Whiting et al., 2018).

Of particular ethical concern when conducting video-based research is gaining access, establishing trust and securing participant consent, managing who has access to the data, and ensuring appropriate levels of anonymization and confidentiality. When negotiating access, it is necessary to address and explain the proposed research project while sensitively discussing any concerns. Here it is central to establish a trusting relationship in order to negotiate access and confidentiality in the research project to obtain written consent from participants and organization representatives. Moreover, it is essential to clarify and agree upon anonymization and the treatment of any sensitive information in publications resulting from the project. All participants

in the five studies signed Informed Consent before recording. See Appendix C for the documents containing information about the participants' consent.

Note that, when referring to video ethnography (Heath et al., 2010) in this dissertation, the term "ethnography" relates to a field of practice or methodology that is not owned by one discipline (Pink, 2007), despite the term's historical association with anthropology and sociology. As a practice and method, ethnography has been shaped and formed by the disciplinary theories and priorities that informed the work undertaken. For example, widely differing methodological emphases and traditions have been used in organizational studies (Best & Hindmarsh, 2019; Christianson, 2018; Hindmarsh & Llewellyn, 2018; Hindmarsh & Pilnick, 2007; Toraldo et al., 2018), workplace studies (Balogun et al., 2015; Button, 2002; Heath & Luff, 2018; Hindmarsh & Heath, 2007), cognitive ethnography (Ball & Ormerod, 2000; Nemeth et al., 2006), user studies (Due, 2015; Isaacs & Szymanski, 2013), and visual ethnography (Pink, 2007).

6.1.1 Using video to study practice

The emergence of EM/CA, as well as the pioneering studies by Sacks (1992), Garfinkel (1967), and Goffman (1959), enabled the methodological development of a body of sociological research that uses video recordings to study interactions in the everyday working lives of organizations and institutions (Hindmarsh & Heath, 2007). Analytical attention has been devoted to the study of talk in interaction and the ways in which social activities were accomplished in situ by the participants and these methodological developments have placed practice at the center of the agenda of video ethnography (Hindmarsh & Heath, 2007). At present, video recordings are perceived as being particularly well suited to the study of situated practices and social interaction due to their useful features such as permanence, density, and the detailed recording of events (Christianson, 2018).

A fixed wide-angle camera was used in the five studies. This type of recording is generally preferred within the EM/CA community because it allows for a consistent view of what occurs in a given setting and facilitates the analysis of the sequential unfolding of events from the beginning of the recording to the end (Laurier & Philo, 2006; Luff & Heath, 2012; Mengis et al., 2018). The fixed camera setup also minimized the intrusiveness of the recording because it was possible to leave the scene once the recording was running. The fixed camera setup with a wide-angle lens provided a stable long shot, which was suitable for analyzing all the action in the scene. However, the wide-angle panoramic view may have limited the analysis of specific details of the interactions due to the "fish-eye view" which potentially can make certain analyses extremely difficult, e.g.,

eye gaze or facial expressions. In some studies, several fixed cameras were used to record the interactions, which I described in each of the articles below in the section entitled "Research settings." Some cameras were placed in a long-shot position to capture the overall action in the scene, while other cameras were placed in a medium or close-up position to capture parts of the activity in greater detail (Mengis et al., 2018). The use of several fixed cameras in long, medium, and close-up positions allowed for the analyses of certain details in the interactions, such as moving sticky notes a few inches on a board or showing certain details on a personal laptop to another team member.

Obviously, video recordings are secondary to real-life activities, but they are necessary for the systematic study of talk in interaction, particularly within EM/CA studies. Transcripts are also secondary to video recordings but are an essential tool for researchers to identify a given phenomenon of interest in the data being studied (Wagner, 2020). Transcription is thus a valuable tool for analyzing video recordings and for presenting the temporal production of utterances and nonverbal conduct in the episodes of interest in the publications (Hindmarsh & Llewellyn, 2018). The process of transcribing selected episodes of video recordings forces the researcher to pay attention to the details in an episode and to watch it repeatedly. Jefferson (1984) developed the transcription system for talk and other verbal conduct that is used within the CA community. The system was developed for audio recordings but, due to the increasing use of video recordings, methodological questions about multimodal transcriptions have arisen (Bezemer & Mavers, 2011; Mondada, 2016).

At present, there are multiple practices for the transcription of verbal and non-verbal conduct visible on video recordings, as the studies in this dissertation also demonstrate. Transcription practices vary across the studies due to differences in research interests and analytical approaches, but the transcriptions are essential for the analyses in all cases regardless of whether the approach is inductive or deductive, begins with coding, or "unmotivated looking" (Kasper & Wagner, 2014; Mori & Zuengler, 2008). In each study presented here, I considered the video recordings to be my data, and the transcriptions of entire datasets or selected episodes to be translations (or partial representations) of the video data. Thus, the transcriptions enable the data management and support the analytical work, while also serving as practical assistance in presenting the findings to the reader. See Appendix A for a summary of the transcription conventions used in the five articles.

6.2 Research settings

The data for the five articles in this dissertation were collected from 2015 to 2019 at various Danish educational institutions and at a Scandinavian car manufacturer. I was involved in all the processes concerning the design, collection, management, and analysis of the data in all five articles.

The data used in Articles one, two, three, and five were collected in relation to the CIBIS project and the DTRS11 interdisciplinary international conference hosted at the Copenhagen Business School in November 2017 (Christensen & Abildgaard, 2017). The data used in Article four were collected in relation to the DEED project.

In the following section, I describe the empirical setting for each of the five articles. The following section regarding the analytical approaches in the five articles describes how specific parts of the datasets were selected for the analytical focus of the subsequent analytical procedures.

6.2.1 Article one: Empirical setting

The data used in Article one, "The Oscillation Between Individual and Social Designing in Co-Located Student Teams,"(Christensen & Abildgaard, 2018) were collected at one of Denmark's leading IT- and media-focused high schools. We gained access to the site via a research collaboration established through the CIBIS project. Article two also entailed data collected at this particular high school, albeit with different students.

We followed a second-year class of 25 students aged 15 to 18 during an interdisciplinary project week focused on English and visual arts. The project aimed at teaching the students skills regarding topics of creativity, innovation, and communication. The students were given the assignment to design an innovative multimedia solution regarding how to brand Danish contemporary art for a foreign audience. During the week, the students followed four design phases: "prepare", "understand", "shape", and "finish", and their schedule was divided accordingly. By the end of the week, the student groups presented their solutions and displayed their visual products as sketches, prototypes, or other forms of visualization.

The data collection was planned without a predefined research interest or hypothesis to test. Instead, our approach was shaped by a desire to observe, cover, and record as much of the activity and variety in the groups as possible during the week-long project. Thus, we designed the data

collection according to the students' schedule in order to observe the various activities taking place and to document the different stages of the projects.

Although we approached the data collection inductively with no hypothesis to test or instructions for the students to follow, we had a research interest in the architecture of creative activity in teamwork based on the overall aim of the CIBIS project. Moreover, in this particular project, we had a specific interest in understanding how individual and social activity within creative teamwork was constructed and de-constructed in the changing phases and activities as the design project proceeded. The focus of our research thus required video recordings of the student teams' interactions in various stages of their school project. In addition, our analytical focus required high-quality recordings of facial expressions, gestures, gazes, and details of the surrounding environment, such as laptop screens and posters. Given the interest in the interactions among the participants and their orientations toward each other, as well as the "communicative resources" in the article (Christensen & Abildgaard, 2018, p. 4), we needed to ensure the coverage of all the group members, the design materials, and their interactions in the recordings.

Figure 1

Camera View of a Student Team

Note: The team is working with three laptops and one tablet. A second camera is placed on top of the board to the left.

We aimed to capture the naturally occurring interactions among the student teams without influencing the students' activities or instructing them to behave in specific ways. The students self-organized in groups in an open-office-like setting, and we followed them to their chosen

location to set up our cameras (see Note: The team is working with three laptops and one tablet. A second camera is placed on top of the board to the left. for an example of a team working). It would have been difficult to pre-position cameras before the interaction because students self-organized their work and did not have a fixed and designated work area. Instead, we used GoPro cameras with additional power banks to make the mounting and setup as easy as possible while avoiding cords and the need for power sockets. We used two cameras for each team and placed them when the student teams initiated their teamwork where surfaces such as tables or laptops could be used for easy and quick mounting (see Figure 1). Wide-angle settings were used for the cameras, which inevitably distorted the perspective but allowed for as much of the activity as possible to be captured.

The students were aware of our presence and were thus influenced by the fact that recordings took place to some extent. A student would occasionally reposition a camera if the group moved around or would call us if the power went off to request help with the recordings. With more than 10 years of experience in video observations, particularly in educational contexts, it is my general opinion that the participants tend to forget about the presence of video cameras quickly, possibly because video devices such as smartphones and webcams have become a natural part of our daily interactions.

The final dataset consisted of 34 hours and 55 minutes of video recordings. In addition to the video recordings, the dataset included group journals (daily journals written by the students describing their work in progress), different mandatory materials produced by the groups such as mind maps, mood boards, and personas, and a final written report about the project for each of the groups.

6.2.2 Article two: Empirical setting

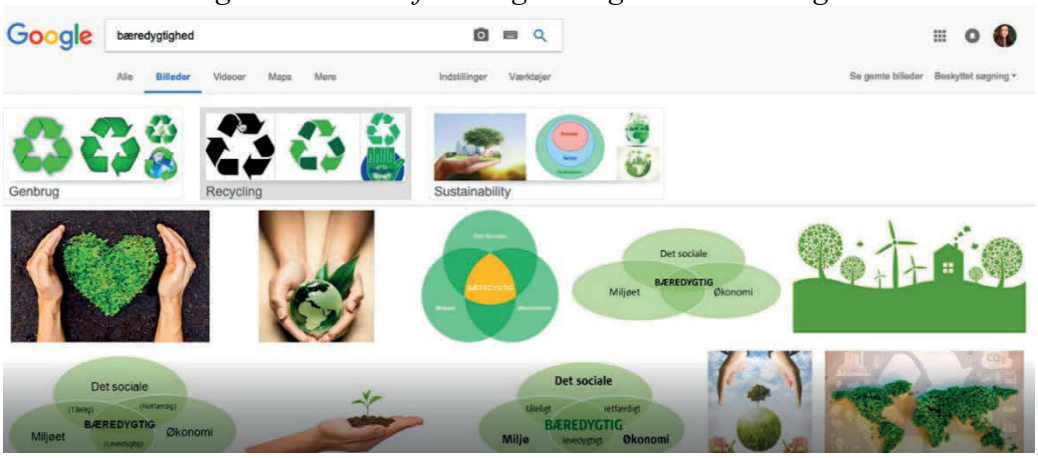
A more experimental video-based study was also conducted separately from the aforementioned research project on creativity (CIBIS). For Article two, "How Task Constraints Affect Inspiration Search Strategies," (Biskjaer et al., 2020) we also observed Danish high school students who were engaged in creative activities. In contrast to Article one, this empirical setting involved a semi-experimental setup in which we used individual computer screen recordings of online activity as opposed to video recordings of interactions. In this study, our interest was the students' search strategies for inspiration and the influence of varying levels of design task constraints. We followed a week-long interdisciplinary project in the mandatory courses of Business Economics

and Social Studies, in which two classes of students took part in a design case competition to design the best (fictional) business idea. We entered the project in the initial phase of the inspiration search and collected the data during the first day of the project week.

The experimental setup was divided into two parts, namely an individual image search task and an image selection task, and a group selection and ideation task. Thirty-nine students participated in the first part of the study, in which each participant received a design task written on a piece of paper. The students were divided randomly into three conditions, and the wording of the design task varied with regard to how detailed the design task was; for example, the design task may have had low constraints, intermediate constraints, or high constraints. We installed screen recording software (Open Broadcaster Software) on all the individual laptops and instructed the students on how to turn it on at the beginning of the task. Each student was asked to search individually for inspiration for his or her assigned task using Google Image search for 10 minutes (see Figure 2 for an example). The students were then asked to save the relevant pictures (to save the images in a folder on their desktop) and to select five pictures that were most inspiring. When the time was up, each student should have saved the pictures on his or her computer.

Figure 2

Screen Recording Screenshots of a Google Image Search during Part 1



Following the first task, we selected three students to participate in a short interview in which they were asked individually to reflect on their choice of the five images and to explain their strategies. The three students were asked to explain which five images they found, how they searched for the images, which words they used, and why they chose the images.

The interview guide consisted of the following questions:

- Which inspiring pictures did you find?

When the student presented the five pictures, the interviewer asked these questions about each of the five pictures:

- How did you search for the image?
- What exactly did you write?
- Did you complete several searches before you found the image?
- How did you decide that this specific picture was inspirational?

The interviews were recorded and transcribed.

Forty-two students participated in the second part of the study. The students were divided into groups of three, each consisting of students assigned one low, one intermediate, and one highly constrained task. The groups were first required to complete a selection task for 15 minutes. The groups were then presented with 15 images selected by another group (3 × 5 pictures) via Google Slides (an online presentation program with an easy-share function) and were asked to select the five images they found to be the most inspiring sources for their own business ideas. For each selected picture, the group was asked to write a short statement about why the photo was chosen. The groups were asked to write the short statement below the pictures in Google Slides, which were shared with us. Again, we recorded the screens during the group task.

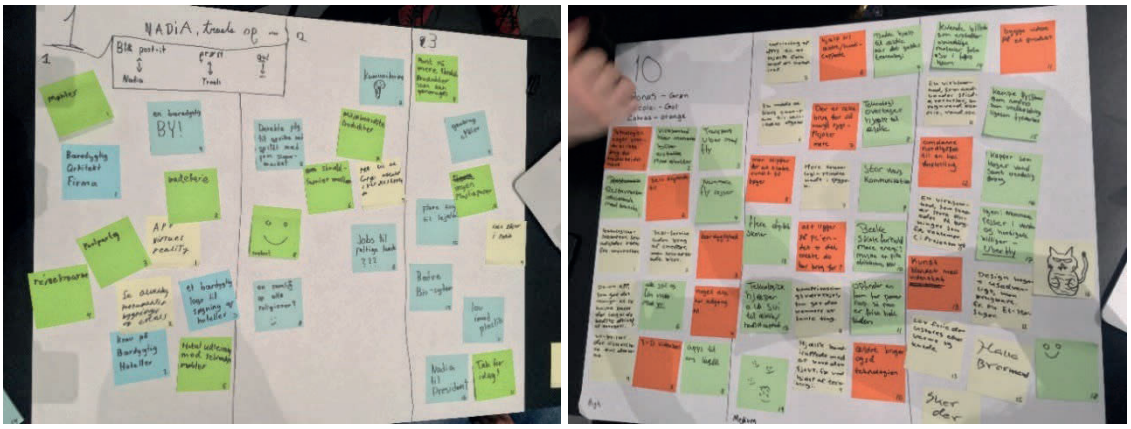
Following the selection task, the students were provided with a short introduction to the rules of brainstorming, including Osborn's principles of brainstorming with a focus on generating as many ideas as possible without criticizing or evaluating the ideas during the brainstorming phase (Osborn, 1957).

The groups were then asked to engage in three brainstorming sessions with five images in each session. The five images were chosen from either the low, intermediate, or high constrained tasks, and counterbalanced in each of the three sessions. The five pictures for each of the three sessions were available as Google Slide files that the students could access on one computer. The groups were asked to keep the images open on the computer screen and to brainstorm ideas for their own businesses based on the five pictures in each category. The groups were blind to the image condition (low, intermediate, high) and the order of the categories was counterbalanced across the groups. The brainstorming resulted in posters with sticky notes from the brainstorming sessions

(see Figure 3). High-quality photos of each poster were taken to enable the count and transcription of all the ideas for subsequent analysis.

Figure 3

Two Posters with Sticky Notes from the Group Brainstorming Exercise



6.2.3 Article three: Empirical setting

We used two datasets for Article three, "Kinds of 'Moving' in Designing with Sticky Notes," (Christensen & Abildgaard, in press) which we had used previously for other studies and publications. One dataset was drawn from the DTRS11 data, which was also the central focus of the methodological Article five in this dissertation. The DTRS11 dataset was previously used to study the functions of sticky notes in design team interactions, which resulted in the publication "Grouping Notes through Nodes: The Functions of Post-it Notes in Design Team Cognition" (Dove et al., 2018). The second dataset used in the article was used previously in a qualitative study of the verbal display of idea ownership in brainstorming sessions (Abildgaard, 2020), which was published as a book chapter in the anthology "Sticky Creativity: Post-it Note Cognition, Computers, and Design"(Christensen et al., 2020). Both datasets were useful in this study because they entailed recordings of novice and expert designers using sticky notes in various design activities.

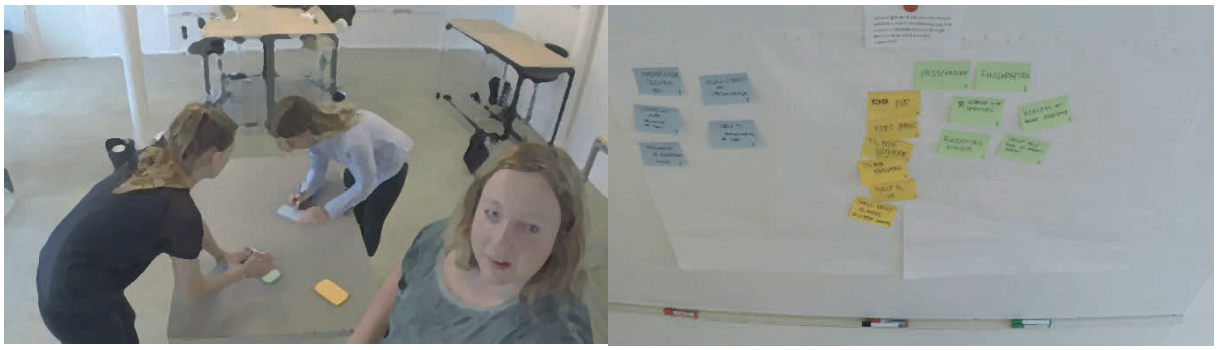
The empirical setting for the DTRS11 dataset is described in detail in Article five and in the section "Article five: Empirical setting" below. For this particular study, we chose only the recordings in which sticky note activity was visible, which were four of the 20 video-recorded sessions that comprise the final DTRS11 dataset (Christensen & Abildgaard, 2017).

The other dataset, which was collected as part of the CIBIS project, consisted of four hours of video recordings of 10 brainstorming sessions that were conducted on the same day. In total, 38

university students (22 females and 16 males) participated in the study as part of the master's course on creativity and innovation at a Danish business school. The students were divided into 10 groups of two to six participants. As we had only three rooms available, we recorded three groups (each group in a separate room) simultaneously. A facilitator was present in each room during the 10 sessions. The study had a clear framework in which a team of students was asked to brainstorm about a given design task for 20 minutes.

Figure 4

Student Team during a Brainstorming Session using Two Camera Angles



The students were then asked individually to highlight five ideas from the brainstorming session. The highlighted ideas were separated from the pool of initial ideas and were placed on a new board. The students were given 10 minutes to categorize the highlighted ideas and to provide a selection of ideas with titles. The students then evaluated their work in terms of how they benefitted from the task and how they could continue to work with their ideas. We used two cameras to record each group (see Figure 4) and took high-quality pictures of the sticky notes in the individual parts of the brainstorming exercise, the highlighting exercise, and the categorization exercise (see Figure 5). The images enabled the correct transcription of all the written content on the sticky notes. We numbered each individual sticky note, and each participant was given a specific color for a sticky note, which enabled the accurate and reliable transcription of how the notes were placed and moved during the exercise.

Figure 5

Sticky Notes after the Brainstorming Exercise (Left) and the Categorization Exercise (Right)

6.2.4 Article four: Empirical setting

The data used in Article four, "'What do you think?': Managing reflection during group supervision?" were collected in 2019 during a four-month field study at a Danish visual and fine arts higher education institution where I followed an interdisciplinary MA course on strategic design with design, architecture, and business students (37 students and three teachers). Part of the course took place in studio environments. The motivation behind this longitudinal field study was to gain an understanding of the educational activities in the studios and the situated practices of the student designers and their teamwork. This required video observations rather than interviews and field notes because interviews would only provide access to subjective understandings and interpretations of what occurred in a retrospective manner. Moreover, field notes would not allow for the analysis of interactional detail in the design practices of the students, while video observations would provide access to the activities in the different educational settings used throughout the course and the everyday work practices in the student teams. Thus, I selected video observations as my primary data source and made as many recordings as possible during the course. I gained access to the course through close contact with the three teachers and was given permission to follow and record most of the course activities.

During the field study, I collected more than 80 hours of video recordings of the different activities in the course. For Article four, I chose to focus on the cluster supervision sessions. These sessions were an important part of the course activities because the students were given the opportunity to present and reflect on the progress of their design projects, and to listen to their peers' and

teachers' reflections on their progress. The selected video data consisted of 16 hours and 39 minutes of video recordings from three camera angles (see Figure 6). The empirical setting is described in detail in Article four.

Figure 6

Cluster Supervision Session Recorded using Three Cameras

6.2.5 Article five: Empirical setting

As a part of the DTRS11, we video-recorded a professional design team during their everyday activities over several months (Christensen & Abildgaard, 2017b, Abildgaard & Christensen, 2018b). The video data were collected by adopting an ethnographic approach to design research (Ball & Christensen, 2018). The intent was to share data among research teams in different fields of expertise, but with a mutual interest in design research and design thinking. Collecting the data entailed several challenges, the two most relevant challenges being how to collect video data of naturally occurring interaction, and how to collect video data that could be shared and provided multiple entry points for analysis to allow researchers with both quantitative and qualitative approaches to use the data.

We recorded the design team in their natural environment as opposed to in a controlled or semi-experimental setting. In this situation, we did not have complete knowledge about how the interactions would unfold; thus, it was impossible to decide on the camera setup in advance. Instead, we had a research assistant follow the design team over the course of the entire design project, which helped us to develop an understanding of the design team's working routines and

environments (Christensen & Abildgaard, 2017, p. 21). We used two to four GoPro cameras to record the design team during meetings, conversations, Skype meetings, workshops, and a 10-day field trip to China. Some meetings were planned, but others happened spontaneously and lasted for several hours, which required a flexible, easy, and cordless setup, with power banks for long recordings to avoid having to change the batteries frequently. Each of the video recordings was unique because the cameras were mounted on the go and placed where possible without interfering with the design team's working routine or interactions. This limitation had consequences for the video recordings, as not all the recorded situations were covered from all angles.

Once a large corpus of video data (>150 hours) had been collected, we evaluated all the material and discussed which fields of inquiry might be pursued and which analytical topics could become the focus of further research. We sampled sessions from various stages in the design process and compiled a dataset that was designed to provide multiple entry points for analysis to allow researchers a wide range of analytical options. The final dataset that was shared consisted of +15 hours of video and audio recordings, including complete transcriptions. As a result, the dataset allowed 28 research teams to analyze the design activities and design behavior according to themes ranging from team dynamics and conflicts to cultural aspects, cognitive aspects, user involvement, and the design process (Abildgaard & Christensen, 2017a; Christensen & Abildgaard, 2017). Several important points could be drawn from the exemplary case of data sharing in DTRS11, and Article five highlights issues related to analysis, collaboration, and methodology.

7 Limitations

By exploring new ways of collecting, managing, and analyzing data, this dissertation has highlighted ways of improving and challenging the typical methods used to study design work. Moreover, the five articles have shown how different constellations in research projects may shed light on the same phenomenon from multiple perspectives, thereby providing nuanced insights into design work and situated design practices. However, there are limitations in the studies regarding the analytical approaches, the methodological choices, and limitations of a more general character, which are addressed in the following section.

7.1 Analytical limitations

In Article one (oscillation between individual and social design), the study was limited by focusing solely on the shifts from individual to social activities, thus ignoring the opposite directionality (Christensen & Abildgaard, 2018). Furthermore, we experienced difficulty in coding the individual design activities because these activities were nonverbal. Thus, despite the applicability of the coding scheme inspired by Cross (1995) and Lawson (2006) for coding verbalizations during design sub-activities, the scheme was inadequate for coding nonverbal individual activities. Consequently, the quantitative analysis did not provide much information about how the joint attention in the teams was disrupted or how the participants resumed their individual co-located work on their part of the design project.

In Article two (inspiration search strategies), we chose to focus only on quantitative measurements of inspiration searches and the levels of constrainedness (for example, the keywords used, the search duration, the length of the search string, the search string entries, the number of clicks per search, and the number of ideas generated). Moreover, our study of individual inspiration searches was only studied in 15-minute intervals (Biskjaer et al., 2020). Thus, while the results revealed how different levels of task constraints affected inspiration search strategies, they did not shed light on the designers' everyday inspiration search practices or on how the designers used online search tools and images, individually and in groups, for this purpose.

The study in Article three (moving sticky notes) focused on exploring how and why designers moved sticky notes in collaborative design work. Based on selected examples from two datasets of design activities using sticky notes, we examined the activity of moving one (or two combined) sticky notes from one place to another. The EM/CA-inspired analysis showed that the participants displayed high sensitivity with regard to the precise placement of the notes in the visual structure

that had been created by the placement of other sticky notes on the whiteboard. We only analyzed incidents in which notes had already been arranged in specific formations on a whiteboard, and how specific notes were subsequently moved and placed in a "final position" that was negotiated during the moving activity (Christensen & Abildgaard, in press). Therefore, our study did not reveal how the sticky notes were initially placed on the whiteboard. Moreover, how the participants decided on the initial formation and the structural build-up of note placement on the whiteboard remains unknown. How the placement of the sticky notes related to the design activity and the shared understanding of how the design project (or a part thereof) was best externalized and visualized using the sticky notes as design materials is also unclear.

In Article four (reflection in supervision), I studied how reflection was articulated during cluster supervision sessions in a class of 38 students and two teachers. Cluster supervision was a mandatory part of the course and allowed the student teams to present the current status of their projects and to receive feedback from their teachers and peers. The sessions followed a facilitated framework in which the team presenting a project was considered a "team of consultants" and the peers were considered a "reflective team." The facilitated framework had an observable effect on the interaction and on how the reflective talk among the team in focus, the peers, and the teacher was organized. As I only examined facilitated supervision in teams and reflective talk, the study was restricted to the local practices of the students and the teachers when observing the four ways of "doing reflecting" in the data. The study provided an empirical basis for examining local practices of reflection during the supervision sessions and how reflection was accomplished in this specific setting. Nonetheless, other ways of "doing reflecting" may be observed in other settings with less or no facilitation in similar educational contexts.

In Article five (video-based data sharing), we addressed the key issues that researchers need to consider when collecting video data to share with other researchers. We collected 150 hours of video data; from which we selected 15 hours and 24 minutes for the final dataset that was shared. One research team from the DTRS11 event pointed out the constructed nature of the shared dataset, and commented that our editorial choices might have significantly imposed a narrative structure on the data (Christensen & Abildgaard, 2017; Lloyd & Oak, 2017), which was a limitation of the dataset. However, we needed to reduce the dataset before sharing it to make the shared data manageable for the research teams to meet the DTRS11 deadline. Moreover, we chose to include different types of design activities, such as stakeholder meetings, meetings with external consultants, core-team meetings, workshops, sprint sessions, brainstorming sessions,

spontaneous idea generation sessions, and briefing sessions (Christensen & Abildgaard, 2017). Confidential information was excluded from the data. The result was a reduced and sampled dataset for purposes of sharing. Thus, the shared dataset allowed for both realist- and constructivist-oriented analyses. However, it would have been useful to have included further reflections on and information about the editorial choices in the technical report provided to the research teams.

Each of the articles and their research designs invites reflection on topics that can be suggested for future studies, which I address in Chapter 8, "Future research." First, I discuss the limitations of a more methodological and technical character in terms of using video methods and conclude the chapter by discussing some general limitations.

7.2 Methodological limitations

The five articles illustrate how I used video recordings as a means of analyzing social interaction in different research projects and via diverse analytical approaches. Certain similarities are revealed when considering the five articles described above. First, I used GoPro action cameras, which are small and easy to use, in the studies involving video recordings. The cameras have a wide range of extra materials and features, thus making mounting them a relatively quick and easy process. The exterior features mean that the cameras can be used in almost any setting, ranging from controlled experiments to naturally occurring interaction. With regard to technical considerations, I mainly used fixed cameras with wide-angle settings to record as much of the interactions as possible from the best camera angle. However, the camera angle still hindered the visibility of certain relevant activities. The choice of camera angles as part of the recording practice involved in video ethnography has inherent limitations, which may contribute to framing the understanding of the setting and what took place, thus possibly orienting the analysis toward a specific direction and foregrounding some phenomena or types of interactions while inevitably masking others (Mengis et al., 2018).

The differences in the abovementioned articles were the number of cameras used, the need for additional sources of audio, and the analytical opportunities afforded by the video recordings. In Article one (oscillation between individual and social design), two cameras covered each of the student teams. However, we could not record all eight student teams simultaneously because the students were placed in a large, open area, and we only had six cameras available. This limited the analysis because we could not analyze all the activities of each of the student teams from start

to finish. However, one may argue that almost 35 hours of video recordings constituted sufficient data. In this case, the data were sufficient to perform the quantitative analysis and to explore illustrative examples for the qualitative analysis to support the findings and add a detailed layer to the analysis regarding whether joint attention was established in the student teams.

In Article two (inspiration search strategies), we only used screen recordings of the individual inspiration searches as the data source. As no cameras faced the participants during the image searches, we were unable to analyze how they were searching for and "reading" the images or acknowledging the finding of an inspiring image (such as gaze, gaze direction, or gaze duration). Moreover, the lack of video data of the interactions in part 2 of the study design hindered a potential qualitative analysis of the group selection task. Having video recordings of the group selection and ideation task would have enabled a detailed analysis of how the participants used the pictures as visual objects to construct a shared understanding of the design task.

In Article three (moving sticky notes), we used video data from two different datasets that were also used for other studies on sticky note use and interaction (e.g., Abildgaard, 2020; Dove et al., 2018). The two datasets had different research designs but were used to study the same phenomenon, which was how and why team members moved sticky notes within a design project. One dataset was collected for DTRS11 with sharing in mind and with a strong focus on capturing naturally occurring interaction in a professional design team. The other dataset was collected to study idea generation using sticky notes and had a strong focus on capturing many teams that were engaged in similar activities (facilitated brainstorming and clustering activities). In the second dataset, the visibility of the use of and interaction with sticky notes as design objects guided the positioning of the cameras. This research setup may be described as quasi-experimental (Heath & Luff, 2018) because the study took the form of a naturalistic experiment conducted in the participants' everyday organizational setting (a studio at a business school), in which the participants embarked on tasks and activities that are common to the setting (for example, a creative task relevant to the teaching). However, the research design, and thus the facilitated structure of the creative task, may have influenced the interactions in the student teams. Part of the creative task (such as brainstorming) may, as would a meeting or any other social encounter, create a certain framework for participation (Kangasharju, 1996). Prior to the brainstorming sessions, the participants were instructed to follow specific rules for brainstorming, which meant that they might avoid criticizing an idea, which may have influenced their interactions with the sticky notes (as representative of a participant's ideas) (Abildgaard, 2020). Moreover, the role of

the facilitator in the brainstorming sessions was not that of a neutral participant (Nielsen, 2012). In the study, a facilitator was present during the creative task, which may have steered the participation in a particular direction and encouraged certain participants to share their ideas. This was not the case in the data collection for DTRS11.

In Article four (reflection in supervision), the camera angles enabled the analysis of the overall interactions among the student teams and the teacher, but close-up views of facial expressions and gaze directions were sometimes unclear in the video recordings. The lack of available cameras was also a limitation on some occasions during the data collection for DTRS11 (the case in Article five). It was important for us to avoid interruptions and not to intrude on the interactions among the people we recorded, even though we occasionally lost sight of the participants when they positioned themselves outside of the range of the camera. Ultimately, each cinematic and editorial choice in the studies was entwined with the planned analytical approach in each project, regardless of whether the aim was to understand social interaction as a whole or in specific detail.

7.3 General limitations

As the data used in all five articles were collected in a Scandinavian cultural context, it is difficult to estimate the extent to which the observed activities and behaviors might apply to other cultural contexts. The role of culture and the institutional setting may influence the particular character of words and gestures, and members of different cultures may use and respond to words differently (Jefferson, 2002). The participants in Articles one, two, and four, and in part of Article three, were all students (high school or university students) enrolled in different courses at various levels, which also made it difficult to draw parallels to professional designers and professional design contexts. The participants in the studies were acquainted with each other, as classmates, friends, or colleagues, which may have influenced the collaboration and verbalization in the teams. Because conversational partners who know each other well may be less explicit in their conversations, it may be difficult for an outside observer to follow the conversations and interactions.

Finally, each video-based dataset, being rich in interactional details, provided many analytical entry points and examples of situated design practices. Designing often involves a wide range of tools and materials, with some designers following certain methods and frameworks, and users and stakeholders often being involved in the design process. Moreover, designing often occurs in designated environments and spaces. Some of these factors surrounding design work have been

captured on record in the five studies, but it is beyond the scope of this dissertation to include the wide range of objects and settings available for analysis in each dataset. While I consider each of the studies and their focus to be particularly interesting and important aspects of design work, I am also aware that they represent only a single factor or sequence in a wider interactional ecology.

8 Future research

In Article one (oscillation between individual and social design), the analysis focused on shifts from individual design work to joint attention and social design activity. We did not study how the social design activity was interrupted or shifted back to individual work, which was potentially caused by analog or digital media, which invites further study. The EM/CA analysis showed an example of a failed attempt to attract joint attention, which illustrated how digital media (such as a personal laptop) had a "shielding effect" during collaborative activities, thus making it difficult for the other team members to attract the attention of the person who was working individually on the laptop (Christensen & Abildgaard, 2018, p. 17). It may be that individualized digital media, such as personal laptops or smartphones, may disturb or disrupt the social activity in the team and draw the attention of one (or more) members because the information on the screen is not displayed socially. However, participants may also show their co-participants what is visible on the screen, thus making the object of interest knowable (Due, 2015). This situation suggests future research in which both collaborative and personal device use in creative work may be explored in order to understand the facilitating and potentially disturbing effects that mobile devices may have on the interactional activities taking place.

In Article two (inspiration search strategies), we conducted the analysis based mainly on quantitative measures of inspiration search strategies. Moreover, part one of the study focused on individual search strategies. It would be interesting to study how people seek inspiration in teams or groups in design work using a video ethnographic approach. EM/CA studies of information searches using mobile phones (Brown et al., 2013; Laurier et al., 2016) or Google Glass (Due, 2015) have already begun to reveal some of the connections in the social, digital, and physical environments. How device use "responds and reshapes action" in the environments in which they are used has also been addressed (Brown et al., 2013; Laurier et al., 2016). A future EM/CA study of collaborative information searches in design work would generate new insights into how mobile devices feature in collaborative work (and inspiration searches). This research would also contribute to the field of mobility studies and device use in face-to-face interactional settings (Hindmarsh & Heath, 2007; Luff & Heath, 1998; Thorne et al., 2015).

In Article three (moving sticky notes), our findings suggested that proximity played a distinct role in the observed types of moving in design (Christensen & Abildgaard, in press). It would be interesting to investigate the role of team alignment (Kangasharju, 1996, 2002) in the meaning of

the sticky note movements to clarify whether alignment in the team in terms of the interpretation of the meaning of sticky note movements had an impact on design progression. Our study only examined brief episodes of sticky note movements. More research is needed to capture the structural build-up of notes and their movements over long stretches of time in the life of ideas (Gonçalves & Cash, 2021). Finally, our study only focused on sticky notes and how they were moved in a design activity. However, design often takes place in rich semiotic environments such as design studios that contain a multitude of objects and technologies. In future studies, it would be interesting to investigate visuospatial design moves beyond sticky notes and to examine how sticky notes may be used in conjunction with other design materials.

In Article four (reflection in supervision), I conducted the analysis of reflective practice in the context of three cluster supervision sessions to identify aspects of group reflection. The facilitated setup influenced the participation framework, which suggests future studies of situations with less or no facilitation. It would be interesting to study reflection in other contexts such as group work, not only in conversations between an individual design student and the studio master, but also in professional contexts involving expert design teams, stakeholders, and other involved parties. This analysis would aid the understanding of the dynamics and architecture of reflective practice in institutional and organizational life. Future studies of how reflection is manifested in real-world situations would also be of theoretical relevance, as it is difficult to assess reflection as a skill because it is often vaguely defined and measured (Ixer, 2016; Rodgers, 2002). A clear understanding of what reflection actually looks like is elusive, as is how reflection is practiced ("doing reflecting"; (Arano, 2020)) and constructed in interactions. This insight would provide some clarity regarding how reflection is conceptualized and would benefit research on the measurement, effects, and functions of reflection in institutional and organizational contexts (Ixer, 2016; Veen & de la Croix, 2016, 2017).

The ethical and epistemological aspects are covered well in the current seminal works concerning video-based methods (e.g., Harris, 2016; Heath et al., 2010; Knoblauch et al., 2014; Pink, 2007). In addition, video analysis is well researched, and there are abundant case studies that exemplify new opportunities for the use of video, particularly in social science research and organization and management studies (e.g.,Best & Hindmarsh, 2019; Christianson, 2018; Hindmarsh & Pilnick, 2007; LeBaron et al., 2018; Llewellyn, 2021; Llewellyn & Hindmarsh, 2008; Mengis et al., 2018). However, what appears to be missing is the next step of enhancing researchers' technical awareness and providing a transparent and appropriate overview of the current standard

that is expected (Jacobs et al., 2007). This technical awareness is essential because video-based methods are resource-demanding and data are irrevocable once recorded. For example, insufficient data do not permit the investigation of what was originally planned, thus restricting the area of opportunity as well as the credibility of the research. These potential technical limitations pose a challenge that can be addressed during pre-production, in which considerations of technical aspects are more relevant than ever due to open science and efforts to share and distribute data to researchers and even across domains, as every decision has the potential to impacts on other researchers' interests (Mengis et al., 2018). Within the EM/CA research community, no specific technical standards for data collection and recording equipment have been established as yet (Wagner, 2020). From this perspective, a future study could review the recording equipment that is currently available; it could review and compare current standards and the most popular recording equipment within the field, and discuss the tradeoffs entailed in the choice of equipment and the subsequent analyses.

9 Conclusion

The five articles that comprise this dissertation address key issues and challenges in the analysis of design work from an interdisciplinary perspective using audiovisual data as the core empirical basis. In these studies, I noted the importance and relevance of visual objects, technologies, and the immediate environment in different institutional settings, including project work in design teams, online searches for inspiration, idea development and brainstorming in studios, classrooms and office spaces, team reflection in supervision sessions, and various formal and spontaneous design activities in smaller and more open meeting rooms. Overall, I learned that studying and analyzing the various details of situated design work requires a methodological sensitivity to local practices, embodiments, and materiality. Moreover, zooming out is vital for observing the connections between the situated practices and the broader perspectives regarding that which constitutes design work as a way of doing, talking, being, and thinking. In this regard, audiovisual data provided a unique opportunity to include visual objects, technology, and the immediate environment in the analysis of interactions in design work. In addition, the five articles illustrate the wide range of applications of video-based research and how amenable video data is to both quantitative and qualitative analytical approaches.

I hope this dissertation's findings are timely and the five articles, with their combination of methods and theoretical perspectives, will interest and have an impact on a wide variety of researchers, inspiring them to embark on video-based research and interdisciplinary collaborations.

10 The five articles

The following five articles form the crux of this dissertation. As mentioned previously, the articles that have already been published or accepted for publication (Articles one, two, and three) are presented in their accepted manuscript versions, which are equivalent to the final draft in terms of content but which have not yet been set according to the specific journal's requirements, layout, or pagination. The last two articles are draft versions of the manuscripts that were submitted to the journals mentioned below. All references have been moved to the end of the dissertation.

Note that the five articles were written specifically for five different outlets. Thus, the articles are framed differently, which impacts the targeted discussions, theories, and concepts, as well as the engagement with different fields of research. The feedback and comments received from my supervisors, and during data sessions and presentations, have influenced the analytical process and the writing of the articles. Moreover, the published articles have been subjected to a peer-review process, and have been influenced by the comments and feedback received. These factors have inevitably contributed to the distinctiveness of the five articles.

Article one, "The Oscillation between Individual and Social Designing in Co-Located Student Teams," is the accepted manuscript of an article published by Taylor & Francis in *CoDesign* on 20 December 2018; it is available online at: https://doi.org/10.1080/15710882.2018.1557695

Article two, "How Task Constraints Affect Inspiration Search Strategies," is the accepted manuscript of an article published by Springer in the *International Journal of Technology and Design Education* on 8 February 2018; it is available online at: https://doi.org/10.1007/s10798-019-09496-7

Article three, "Kinds of 'Moving' in Designing with Sticky Notes," is the accepted manuscript of an article accepted for publication by Elsevier in *Design Studies*, planned for autumn 2021. See Appendix D for the confirmation of publication.

Article four, "Reflection, Roles, and Recipiency: The Architecture of Reflective Practice in Design Pedagogy," is the submitted draft of an article for *Studies in Higher Education,* which is published by Springer. The article is currently under formal review with *Studies in Higher Education*.

Article five, "Video-Based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions," is the submitted draft of an article for *Organizational*

Research Methods, which is published by SAGE. The article is currently under formal review with *Organizational Research Methods*.

11 Article one: The Oscillation Between Individual and Social Designing in Co-Located Student Teams

Abstract

Contemporary approaches to the study of design teams tend to assume that teamwork equates to social interactions, thereby failing to examine the extent to which design team processes involve the assumed joint attention and shared dialogue. Nowadays, mobile personal computing devices enable a situation where almost the entire design process can be carried out anywhere at any time. This also enables teams to work in co-located settings on joint and individual tasks, which allows for both individual and social creative processes during the organised teamwork. In this perspective, this article explores the oscillation between co-located individual and social design activity in student teams. To study the shift from individual to social activity within design teamwork, we surveyed 23 h of student teams' activity amongst 25 high-school students by coding and analysing captured video of their teamwork while working in a self-imposed manner on a design task. We found that different creative sub-processes, such as information search, problem defining, idea generation, decision-making, and feedback, foster varying degrees of joint attention, and that the joint attention may be established more successfully through analogue and shared digital communicative resources.

Introduction

Theoretical models of designing differ in whether they conceptualise design as an individual activity or a social endeavour. Early theoretical models of design and creativity processes tended to rely on conceptualizations of individual expert designers as creators working in isolation, i.e., the lone stoic thinker (Cross, 2011; Fischer et al., 2005; Sawyer, 2007). As design theory and practice have evolved into collaborative forms, such an individual conception was supplemented (some would say replaced) by the idea that design was primarily a social endeavour in a team (Cross & Clayburn Cross, 1995; Kleinsmann et al., 2007). The current theoretical mainstream on team designing and creativity, tend to fall into one of three distinct approaches. (1) Team efforts are compared to individual efforts in order to establish which is superior. For divergent production specifically, the creativity literature has debated whether individual vs. social production is more efficient, with some evidence that individual ideation (Diehl & Stroebe, 1987) or a hybrid of individual and social activity leads to more ideas (Korde & Paulus, 2017). (2) Team activity is viewed as a form of input-process-output model (Reiter-Palmon et al., 2012). (3) Team social

micro-processes are studied (Christensen et al., 2017b; Cross et al., 1996). These approaches tend to assume that teamwork equates social interactions, and hence fail to examine the extent to which team processes actually involve the assumed joint attention and dialogue based collaboration. While the third – process-based - approach to the study of designing is well suited to address fluctuating levels of joint attention and dialogue over time, in effect such studies typically involve only observations containing team-dialogue, thereby failing to explore flipside of the coin: individual team-related activity. Current design team research thus to a large part fails to appreciate the fact that much of collaborative design sub-activity is carried out by designers working individually (both inside and outside social meetings), albeit in some form of prior or concurrent coordination with the other team members. Our intention is not to re-establish the notion of the lone thinker (inside design teams). Rather, the present study attempts to address a research gap by offering the first analysis of oscillations between individual and social activity over time *within* team designing.

Coming from the field of cognitive and social psychology within design research, we take an integrated approach to examine real-life team interactions across different design episodes and sub-activities with both quantitative analysis of interaction patterns and types of design activity and qualitative microanalysis of team member interactions.

Specifically, this paper explores how individual and social dimensions of design team activity shifts across different sub-activities. The empirical study involves 25 high-school students and their teamwork, which entails sub-activities such as idea generation, information search or decision-making, where technology and physical materials feature in their ongoing work. This also makes it relevant to examine how the individual team members use digital and analogue communicative resources to attract and establish joint attention.

When the design research literature shifted from the study of individuals to teams, it may in part have been fuelled by shifting design practices into ever more open, complex, dynamic and networked forms of organising (Dorst, 2015). Similarly, the present paper also finds inspiration in ongoing changes in design team practices, in the form of increasing team co-located activity due to new ways of working, partly driven by new mobile technologies. Twenty years ago, digital tools for collaboration were complex stationary setups, tying them to specific locales, unsuitable for mobile collaboration (Luff & Heath, 1998). However, ubiquitous mobile digital design tools are changing the nature of organising for designing, allowing for the full range of design team

activities to be carried out on brought-along mobile devices. Consequently, design team members do no longer need to change the location back to their desk after a meeting in order to continue individual work, allowing for a co-located design process oscillating between individual work and social dialogue.

Theoretically, we seek to inform descriptive models of design team processes on the issue of self-selected oscillation between individual and social activity over time. While joint attention (Harvey, 2014), shared representations, and team mental models have been deemed important process characteristics for design (Kleinsmann et al., 2007), it is not clear how joint attention may fluctuate across design sub-activity types or over the course of designing. Further, while joint attention may be mediated through shared analogue media (co-sketching, collaborative prototyping) or gesturing, it is unclear whether and how joint attention may be established in the context of ubiquitous personal mobile computing. We sought to explore the effectiveness of the communicative resources deployed in attempts at establishing joint attention.

Design Team Processes

A team process is defined as 'members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioural activities directed toward organising task work to achieve collective goals' (Marks et al., 2001, p. 357). The state-of-the-art temporally based *recurring phase model* of team processes (ibid.) is based on the idea that teams perform in temporal cycles of goal-directed activity, called episodes (Bush et al., 2018). Episodes are sequenced distinguishable temporal units, which teams perform on their path to goal accomplishment. Centrally, they are iteratively structured by identifiable periods of action and transition periods between actions. Action phases are periods of time when teams are engaged in acts that contribute directly to goal accomplishment, while transition phases are periods of time when teams focus primarily on evaluation and/or planning activities (Marks et al., 2001).

The special nature of designing, devising courses of action aimed at changing existing situations into preferred ones (Simon, 1969), shifts much of team activity towards transition phases (involving, e.g. goal specification, problem definition and scoping, strategy formulation, and planning for design). In such transition phases, the team needs to reach a shared understanding of their goals and processes, before commencing with action phases. Fundamental to collaborative design activity is the sharing of representations (Cross, 2011, p. 114), which serve as the basis of subsequent sub-goaling, and individual design activity. Shared understanding may be defined as

a similarity in individual perception of actors about either how the design content is conceptualised or regarding team transitive memory (i.e. 'who knows what'; Kleinsmann et al., 2007). It is tricky for a team to reach a shared understanding in the context of creating novel designs (ibid.) and 'even when information is apparently shared, misunderstanding and misinterpretations are evident which means that common, shared understanding cannot always be assumed in teamwork' (Cross 2011, p. 104). Some studies show that analogising (Christensen & Schunn, 2007) and mental simulation (Casakin et al., 2015) in teams can play an important part in reaching shared team understanding and support team mental models.

Descriptive studies of design activity place centrally activities related to problem clarifying, planning, gathering and sharing information, and generating and adopting concepts (Cross, 2011; Cross & Clayburn Cross, 1995). The experimental setup in these studies involved short time-frames and depriving the participants of their usual tools and working environments. Such methodological conditions may have shielded the above studies from finding design activities stretching over longer durations, or involving activities crossing organisational or physical boundaries. To supplement with longitudinal perspectives, descriptive models from engineering design often entails a separation between conceptual design (early) and detailed design (later) (Cross, 2008). Further, the design sub-activities identified by Cross (2011) need not be thought of as constituting a normative linear progression, given the fundamental iterative nature of design, with problem and solution co-evolving (Dorst & Cross, 2001; Wiltschnig et al., 2013). Lawson (2006), in his descriptive model similarly referred to four types of design sub-activities: Assimilation, general study, development, and communication. When comparing individual design experts to student designers, it has been found that experts spend significantly longer on problem scoping and information gathering (Atman et al., 2007).

For the present purposes, of examining oscillations between individual and social activities, we studied episodes of transitions from individual to social activity in order to determinate the design sub-activity content. In principle, the opposite oscillation (from social to individual activity) is equally theoretically interesting, but it is not easy to analyse the design sub-activity in in-field ethnographic studies due to the lack of verbalizations, when social activity ends. Hence, we restrict our analysis to examine the oscillations from individual to social activity in teams. The individual activity is not understood as an isolated individual working in an interactional vacuum, but as a type of activity within what we understand as collaboration in the design process.

We hypothesised that design sub-processes would fall into the categories of either transitory or action phases, with differing needed levels of joint attention for their completion: sub-activities involving transitory phases (problem definition, planning, and concept development) should contain more and longer episodes of switching from individual activity to social activity. The action phases would more frequently involve individual sub-goaling, and information search should thus less frequently entail such social episodes. The action phase of detailed design should be constituted by a number of short team monitoring checks, with the purpose of quickly checking for whether individual work was on track with the shared understanding in the team (i.e. faster oscillations over time).

Communicative Resources and Joint Attention

A second research question regards the contextual factors and communicative resources influencing whether attempts at attaining social dialogue actually succeeds. A prerequisite for reaching a shared team understanding is to attain joint attention in the team to initiate a dialogue (Harvey, 2014). Joint attention may be defined as the participants' being mutually oriented to a common part of their visible environment, and are aware that their conversational partners are also looking at it (Whittaker & O'Conaiil, 1997; Zhang et al., 2017). In the context of communicative resources such as laptops, some team members may have the object in direct eyesight, whereas the object is occluded for others. For the present purposes, joint attention thus entails a mutual orientation towards a common part of their *immediate* environment, as well as an awareness that their conversational partners are also attending to it.

In a co-located setting, any diversion from individual work activity involves a team member intruding or interrupting the other member's individual attention. In a work context, interruptions are usually thought to be negative as they hamper individual productivity, but they may equally have beneficial effects (Jett & George, 2003) such as causing minor conflict, which can foster creativity (De Dreu, 2006). An individual being interrupted may feel counter-productive in the moment, but the presence of communicative resources establishing that the cause of the intrusion has a team benefit, may help make the attempt to attract joint attention successfully. Communicative resources can involve analogue (e.g. sketches) or digital (e.g. screen content) media, and visual or not currently visible referents to team generative materials, as well as gestures. Intruding work using analogue media may help communicate shared understandings, since the referent would usually have been pre-generated collaboratively, as when the sharing of sketches produced by the entire team may help to achieve consensus in decision-making

(Schembri et al., 2015) and reaching the common goal (Gül & Maher, 2009). Digital referents, however, change visual content rapidly, and hence needs further individual examinations before social meaning may be extracted in a new situation. A consistent issue in co-located teamwork, observed in our data, was how the screen of a laptop, tablet or smartphone was oftentimes shielding the individual from the others, making it difficult for all members to keep track of each other's work. Visibility of the actions of others has been argued to be of central importance in co-present collaboration (Cole & Stanton, 2003) as has the visibility of design representations (e.g. sketches), since they provide an external, common reference point which aids to organise the interaction on issues that need to be discussed and thus demands joint attention (McDonnell, 2009). Visual referents should be more effective at attaining joint attention, but in the case of referring analogue media (which carries a consistent visual meaning across situations), visible *yet* hidden (i.e., not currently visible) analogue media may be effective in attaining joint attention. For digital shielded content, intrusions might be less likely to lead to joint attention as the potential team benefit from the intrusion would be harder to assess.

Methodology

We apply a video ethnographic approach (Heath et al., 2010; Heath & Hindmarsh, 2002) to collect data of naturally occurring activity, recording the teams' design processes in situ.

Participants and Case Description

We recorded 25 Danish high-school students working in seven self-selected groups of three or four people. The students were aged between 15 and 18 years, with 15 female and 10 male participants. The school is one of Denmark's leading IT and media high schools. We followed a 2nd year class during a weeklong interdisciplinary project aiming to train creativity and innovation competencies. The students were assigned the task to design an innovative solution with multimedia to 'brand Danish contemporary art for a foreign audience'. The design brief focussed on a specific Danish artist who experiences difficulties reaching an American audience. The students were to make a mind map, a knowledge map, a mood board, personas, and a prototype, visualisation, or sketch of their final solution.

Video observation

We recorded 39 sessions of team activity, capturing each group with a two-GoPro dual-audio camera setup. This setup enabled the capture of all group members face-on along with their use of analogue and digital materials. Further, we collected materials produced in the groups (daily

journals, mood boards, mind maps, and personas). All groups were recorded in several iterations, and at each time point, 3 out of the 7 different groups would be recorded simultaneously in a counterbalanced collection design. Each group was recorded in 5-8 sessions throughout their design process. The dataset entails video from all groups the first two days and from five groups the third day. The students were not instructed to organise themselves in any particular way. We sought out the groups wherever they themselves chose to sit in the open class environment working on whatever they found relevant.

Analytical approach

We approach interaction analysis from a multimodal perspective, a broad interdisciplinary approach, which analyses communication as more than speech and text (e.g. Goffman, 1964; Heath et al., 2010; J. J. Streeck et al., 2011). When communicating, we use language, gestures, gaze, our bodily position in a particular environment, and materials in our surroundings, which are referred to as communicative resources. Communicative resources, like multimodal utterances (Goodwin, 2006), contains both verbal and non-verbal elements that we employ when communicating with each other when trying to make sense and establish a shared understanding of what is going on.

Since we have an interest the material and digital aspects of the social organisation of collaborative work, our focus is not just *which* materials and technologies are in use during group activity, but for which purpose and how they are activated. When applying a multimodal approach, communicative resources like pointing, gaze, and the material that the pointing is directed towards, becomes important features, as they are used 'to establish when a particular space becomes a shared focus for the organization of cognition and action' (Goodwin, 1994, 2003, p. 219).

The typical analytical strategy deployed in a multimodal analysis is a qualitative in-depth analysis of micro-events, where the sequential unfolding of human activity is transcribed in detail (Streeck et al., 2011, p. 8). In this study, we supplement this qualitative approach with a protocol-analysis (Ericsson & Simon, 1999) inspired approach. First, we code and count frequencies of specific occurrences in order to quantify and better understand general interactional patterns. The quantitate analysis is presented in the result section followed by a detailed analysis of illustrative micro-events to support the quantitative findings.

A typical protocol analysis approach would involve transcribing, segmenting, and coding verbal data, for example in the study of 'think aloud' protocols (ibid.) or naturalistic creative (Dunbar, 1995) or design team meetings (Christensen & Ball, 2014). However, for the present purposes of understanding shifts from individual to social activity, we diverged from transcribing and segmenting verbal data by dialogue turn-taking and instead segmented data by shifts in behaviour coded directly from the video.

Coding

To make data available for quantitative analysis, three independent coders assessed the videos. All transitions and time spend on social activity in each group were marked with timestamps.

Attention was coded in two categories: 1) *Individual activity* was coded in case the group members would focus their attention on distinct tools or objects (typically mobile devices) but did not interact verbally or non-verbally. 2) *Joint attention* was coded when two or more group members interact, maintaining a shared focus (e.g. on a prototype or a computer screen). The initiation of joint attention sometimes took the form of discernible attempts to attract attention. A subset of the episodes with joint attention was thus sub-categorised as containing attempts to attract attention when a member tried to draw attention from one or more group members to initiate social activity, either verbally (e.g. calling a name or asking a question) or non-verbally (e.g. gestures, movement or pointing). For the remaining joint attention episodes, no discernible attempts to attract attention could be identified, and joint attention would follow immediately from individual activity.

The activity is coded for the duration of the shared focus, leading to *episodes of joint attention*. An episode is started by a shift from individual activity to joint attention, often initiated by an attempt to attract attention, and ends when the group reverts to individual activity. Episodes of joint attention constituted our main unit of analysis.

Episode topic was coded as on- or off-task, where off-task was coded if the dialogue revolved around personal talk amongst the participants or in cases where the topic of the dialogue was unclear. For all episodes containing verbalisations, we utilised a coding scheme for design sub-activity drawing on the works of Cross (1995) and Lawson (2006), containing seven distinct categories: Problem definition, searching for information, planning (decision-making, delegation of tasks), concept development (idea generation, feedback), and detailing. Each episode could be classified as pertaining to several types of design sub-activity. We narrowed our analytical focus by concentrating on communicative resources as both verbal and non-verbal markers, which were

actively involved during the interaction. Episodes involving joint attention were coded for types of communicative resources in use. For the quantitative coding, the communicative resources could be digital (e.g. laptop), analogue (e.g. cut-outs, magazines, prototypes), and could be either 'visible' or 'not visible' to the intended receiver. Finally, it was noted whether a participant attempting to attract attention used gesturing (e.g. pointing, waving).

Inter-rater reliability

To establish inter-rater agreement, two independent coders coded 17.5 minutes of the video data for attempts to attract attention, and for joint attention. Reliability of episodes was calculated by segmenting according to each video second, for a total of 1046 segments. A Cohen's kappa coefficient of inter-coder reliability was calculated for each code. Attempt to attract attention Kappa= .65; Joint attention Kappa= .75. Further, two independent coders assessed on-task behaviour on 14% of the episode data, Kappa=.62. Finally, two independent coders coded two sessions for interrater reliability for communicative resources (Kappa=.67) and design sub-activity (Kappa=.63). In all cases, the reliability was deemed satisfactory.

Results

The dataset contained a total of 23:30 h of team activity, 10:41 h of which were coded as involving joint attention, and 12:49 h were spent in the teams in individual activity. We identified 758 unique joint attention episodes in the dataset. Of these, 122 episodes were removed due to containing only dialogue pertaining to off-task behaviour, leaving a total of 636 episodes. The length of the episodes ranged from 2 seconds and up to 13 minutes, with a mean length of 1:03 minutes, (standard deviation= 1:32 minutes). For 196 joint attention episodes, a distinct attempt to attract attention could be identified. Different communicative resources were used in the attempts to attract attention, with 52% of the episodes using digital and 23% using analogue references. Further, in 53% of the episodes communicative resources were visible, while in 24% of cases they were not visible (e.g. on an unshared personal screen), and in the remaining 23% of episodes, no clear referent could be coded. Additionally, 17% of the episodes contained gesturing by the team member attempting to attain dialogue.

Of the full set of episodes, 579 involved social dialogue. Based on the dialogue, the design sub-activity could be successfully coded in 505 cases, and of these 10% involved defining or framing the design problem; 14% involved searching for information; 48% involved concept development

(idea generation: 24%, or request for feedback: 28%); 40% pertained to planning (decision making: 30%, or delegation of tasks: 15%); and finally 38% involved detailing the design.

Exploring Joint Attention Episodes by Design Sub-activity

A repeated measured General Linear Model revealed that the prevalence of the seven distinct design sub-processes in episodes of joint attention differed significantly from each other $F(6,3024)=26.42$, $p<.001$ (See Table 1). The results revealed that from least to most prevalent design sub-activity: problem defining, searching for information, and delegation of tasks did not differ significantly from each other, but they were significantly less frequent than the remaining 4 sub activities. Idea generation did not differ from feedback, and decision-making, but was significantly less prevalent than detailing. Feedback also significantly differed from detailing (see Table 1).

Table 1. *Mean, standard deviation, and parameter estimates for the prevalence of design sub-activities across episodes of joint attention.*

				95% confidence interval	
Design sub-activity	Mean	Std. dev.	t	Lower bound	Upper bound
Problem definition	.10	.30	7.36	.07	.12
Information search	.13	.34	8.71	.10	.16
Delegation	.14	.35	9.20	.11	.17
Idea generation	.23	.42	12.33	.19	.27
Feedback	.28	.45	13.84	.24	.31
Decision making	.29	.45	14.39	.25	.33
Detailing	.36	.48	16.78	.32	.40

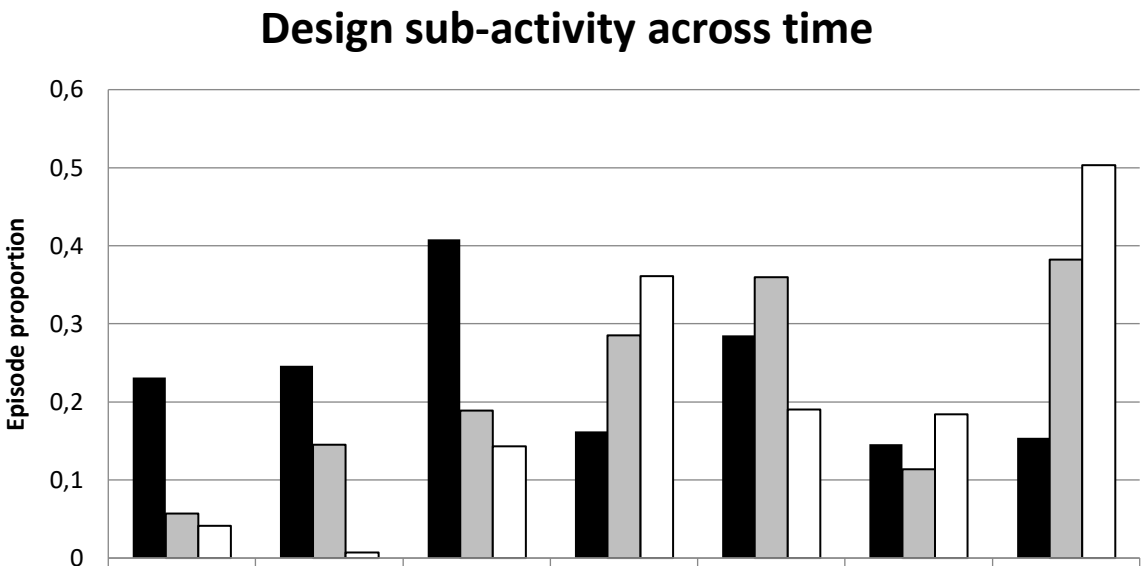
In order to explore the length of each oscillation by design sub-activity, we compared the mean length of each episode containing a type pf design sub-activity to a baseline of all other episodes not containing that design sub-activity. Two design sub-activities displayed significantly longer than baseline episode length while the remaining design sub-activities did not differ from baseline: Idea generation episodes (M=0 1:36, STD= 01:56), $F(1,504)=19.56$, $p<.001$, and problem defining episodes (M=02:25, STD=02:43), $F(2,504)=34.56$, $p<.001$.

The major observations appear in alignment with oscillation expectations: frequency and length of episodes of joint attention fluctuate across the type of design-sub activity. Especially activities associated with transition phases appeared longer and/or more frequent, while action phases

appeared shorter and/or less frequent. As a notable exception, there was only a few (yet lengthy) problem-defining episodes.

Exploring temporal development in joint attention episodes

Across the three consecutive days of observing design activity, all design sub-activity except for delegation (F=1.78) displayed significant distinct differences between the days (F's ranging from 6.33 to 19.27). Linear decreasing patterns over time were found for information search, idea generation, and problem definition. Conversely, linear increasing trends were found for feedback and detailing. Finally, decision-making displayed an inverted-U shape relation to time (see Figure 1). To examine the length of episodes across time, we compared the mean episode length across days of design activity. The mean episode length differed significantly across days (M Day 1=01:22, M Day 2=01:05, M Day 3= 00:45), F(2,504)=5.69, p<.004.



	Problem definition	Information search	Idea generation	Feedback	Decision making	Delegation	Detailing
Day 1	0,231	0,246	0,408	0,162	0,285	0,146	0,154
Day 2	0,057	0,145	0,189	0,285	0,36	0,114	0,382
Day 3	0,041	0,007	0,143	0,361	0,19	0,184	0,503

Figure 1. *Proportion episodes with joint attention by design sub-activity across three time points.*

Follow-up t-tests revealed that compared to Day 3, Day 1 t(275)=3.91, p<.001 and Day 2, t(373)=2.09, p<.04 were significantly longer, while Day 1 and 2 did not differ. The analysis illustrated that across the design process, the speed of oscillation between individual work and team activity increased.

The major observations of episodes of design sub-activity across time seem mainly in alignment with normative design models. Planning activities appeared at a constant high throughout the process, displaying an elevated level of decision-making mid-way. At the later part of designing, a frequent (but short) set of episodes involved checking with the team for being on track.

Modelling successful and unsuccessful attempts to attract joint attention based on usage of communicative resources

The number of successful to unsuccessful attempts to attract joint attention did not vary significantly over the course of days, χ^2 (2, N = 196) = 1.99, p=.37. For the successful and unsuccessful attempts to attract joint attention, we carried out a logistic regression for the use of communicative resources. An evaluation of the final model versus a model with intercept only was statistically significant, χ^2 (4, N = 196) = 52.32, p < .001. The model was able to classify correctly, with an overall success rate of 75%. Table 2 shows the logistic regression coefficient, Wald test, and odds ratio for each of the predictors. The odds ratio indicates that successful compared to unsuccessful attempts to attract social attention is more likely to be drawing on the communicative resources of visible and not visible analogue media, or visible digital media. Successful switches to social dialogue were also more likely to involve gesturing (as opposed to verbal only) attempts to attract attention.

Table 2 *Logistic regression predicting successful attempt to attract joint attention from the usage of communicative resources.*

	B	SE	Wald	df	Sig	Exp(B)
Digital Visible	1.64	.44	14.03	1	.001	5.16
Digital Not Visible	.47	.42	1.27	1	.26	1.60
Analogue Visible	2.06	.68	9.01	1	.003	7.81
Analogue Not Visible	2.44	1.09	5.01	1	.03	11.51
Gestures	2.39	.76	9.76	1	.002	10.87
Constant	-.45	.29	2.35	1	.13	.78

In general, the deployment of communicative resources was effective at turning an attempt to attract into joint attention and social dialogue. Analogue media displayed larger effect sizes compared to digital ones. Only digital media that was not visually available or shared with the team appeared ineffective at mediating the relation between attempts to attract and joint attention.

This initial analysis surfaced characteristics of the shifts between working individually and socially in the groups, which prompted subsequent questions about what motivated the shifts, how shifts were initiated, established, maintained, and interrupted? And which mediators enabled these

shifts and stabilised or destabilised the given activity? In order to explore these questions, we conducted in-depth qualitative analyses of illustrative episodes, where we explore team interaction through a micro-level lens in order to consider both the motivating factors and the mediators.

Qualitative analysis

Transitions in interactions

The analysis of three data extracts below demonstrates the dynamic shift from working individual to working collectively, how certain types of sub-activity moderate attempts to attract attention, and how digital and analogue recourses may be used to mediate joint attention. As these examples illustrate, the actions occurring in the episodes are constructed and mutually elaborated through the simultaneous use of multiple communicative resources.

The sequential stricture of the interaction is illustrated by the name of the person speaking. Selected frames are added with a timestamp in *mm:ss.t* format, where **bold** indicates *when* the frame is captured. Verbal utterances are transcribed as pronounced along with action following a CA-inspired multimodal transcription notation (Heath et al., 2010, pp. 70–83; Jefferson, 1984). The: symbol indicates prolonging of sound, < or > indicates fast or slow speaking, [ ] indicates overlapping speech, ° °indicates whisper, and (.) or (1.8) indicates pauses. Speech is translated from Danish into English. We provide detailed transcripts for readers to grasp the process of interaction as it unfolds, with the aim to show the natural flow and interaction with materials frame by frame.

Concept development and decision making using analogue materials

Our first example is a 15.4s video clip. It demonstrates how social action in terms of *concept development* and *decision-making* is built up through question-answer sequences and by combining communicative resources with different properties. In this transcript, we see Tara working on her laptop, sitting at the table with Lilly and Vera. They are working on a developing a persona as a part of their project deliveries. In this sequence, they are talking about adding a plane to the poster, which later becomes part of the personas characteristics as ‘someone who travels’. While Tara is working on her laptop, Lilly and Vera are also engaged in individual activity, Lilly is cutting out images, Vera is flipping through a magazine. A poster with magazine cut-outs is placed in the middle of the table.

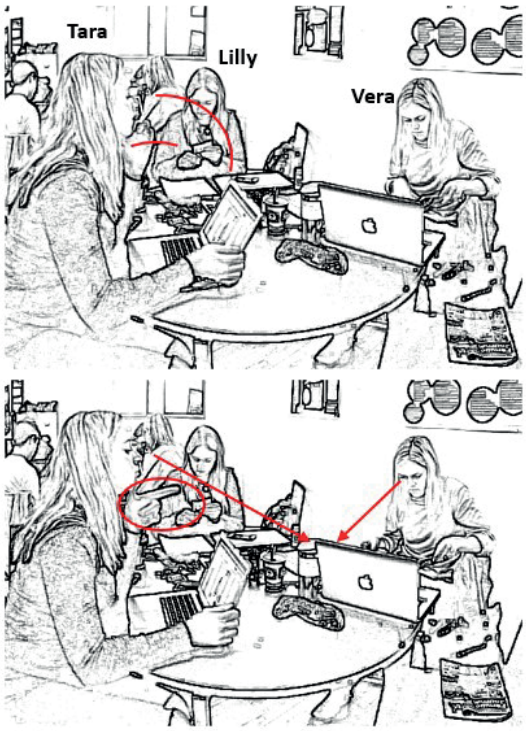


Figure 2 *Attempt to attract attention. Video captured images have been manipulated in order to retain participant anonymity.*

In frame 1, Figure 2, Tara, who has been looking at her laptop screen, looks up at Vera saying 'oka:y?', while moving her left hand to her chin. With a rise in intonation, head (and gaze) movement and a chin-stroking gesture, Tara indicates an attempt to attract attention, where her talk, simultaneously with her bodily organisation, displays a questioning and possibly evaluating attitude towards something they are working on. Neither Vera nor Lilly reacts immediately to Tara's attempt. In frame 2, Tara ask a question 'why is there a plane (.) there?', while making use of a multimodal gesture compound of gazing and moving her hand from her chin to a pointing gesture towards the plane on the poster. In frame 2, Vera reacts to Tara's question by looking at the poster, when Tara says 'there' with emphasis while pointing in what may be an attempt to establish shared focus (Goodwin 2003, 219).

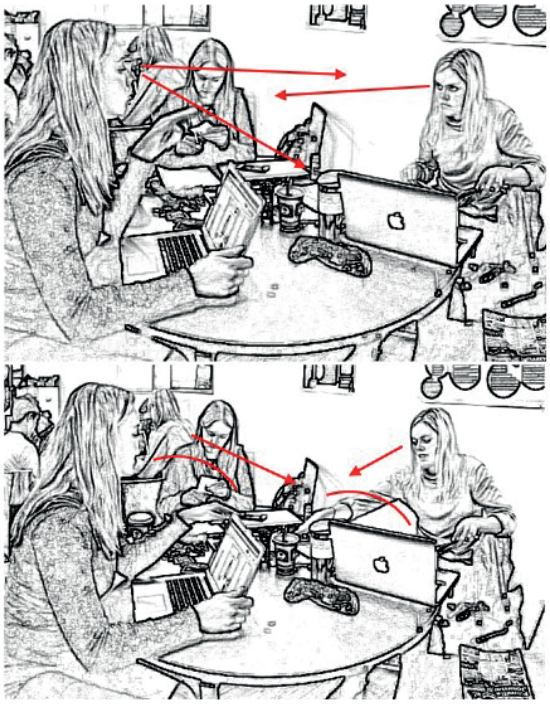


Figure 3 *Discussing the task.*

In frame 3, Figure 3, Vera establishes eye contact with Tara, who continues her questioning; 'Should the plane not be down there?' while still pointing. Vera begins to nod repeatedly while maintaining eye contact with Tara. Vera nods while Tara continues to question her in frame 3, where Tara rapidly says '>why did you put the plane up there<?'. In frame 4, Vera looks down at the poster, and points, while explaining her reason '>because<…' for placing the plane this particular place. Vera uses her pointing finger to indicate to Tara a specific place on the poster, while visually searching for the argument, she uses the poster as reference point, while saying '>what was it she said<?', not directed to Tara, but related to the topic of reference in the dialogue. In frame 5, Figure 4, Vera finds her argument on the poster; 'likes to travel', pointing with a tapping gesture at a particular place on the poster, displaying the argument for placing the plane here. Tara's gaze follows Vera's movement and she says 'oh::' as she withdraws her hand to her chin, with her fingers in her mouth as if evaluating.

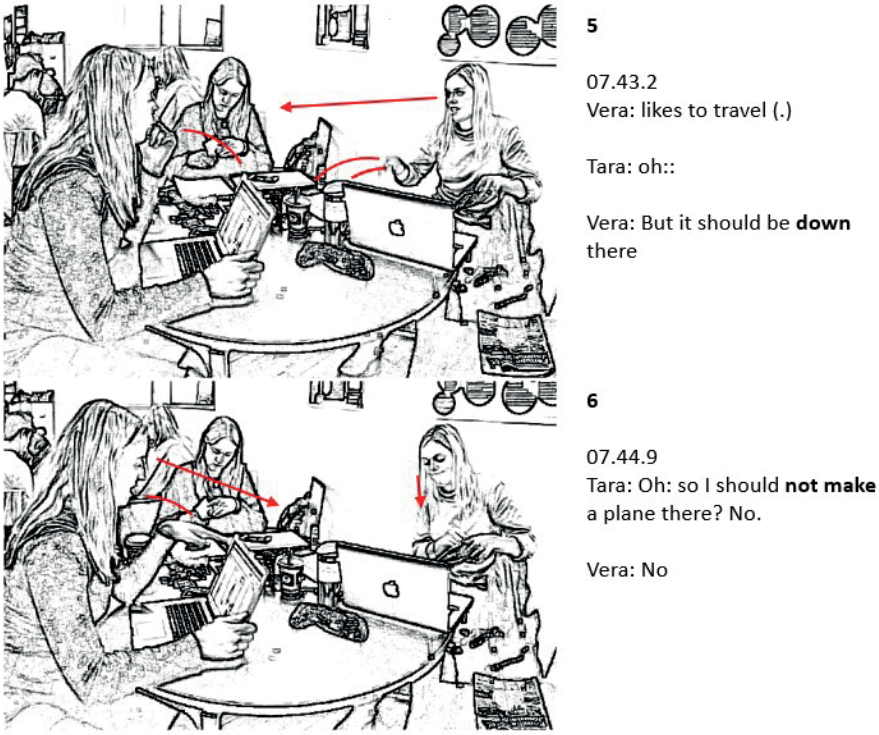


Figure 4 *Reaching agreement.*

Vera is building up her answer to Tara by combining communicative resources with different properties, which has advantages to the repertoire of possible action available to her in the situation (Streeck, Goodwin, and LeBaron, 2011, 2). In frame 5, Figure 4, Vera agrees with Tara's critique, saying 'But it should be down there', while gesturing towards the place on the poster. In frame 6 Vera looks down, returns to flip through the magazine, she is holding, with a tight lipped smile which may demonstrate a refusal to say no more (Ford et al., 2012).Tara takes a final look at the poster, while pointing, and then withdraws her proposal, accepting Vera's argument, while Vera confirms with a short 'No'.

In this excerpt, we see how Tara and Vera are drawing on a combination of communicative resources when negotiating the development of the persona as part of their concept, collectively justifying what they agree on and coming to a decision (McDonnell, 2009). The topic of assessment is significant in a design education context, likewise is learning how to judge and reflect upon the design and the design process (Oak & Lloyd, 2016; Schön, 1983, 1987). The analogue material (the poster and the plane on the poster) is central for the course of action (the negotiation) between Tara and Vera. The poster becomes a mediator for joint attention, and we see how they both actively are including the poster as a point of reference while reaching

agreement. This coordination of individual and shared representation plays a central role in achieving a shared goal in the collaborative process (Bietti et al., 2016). What is interesting is how they continuously shift from working individually to addressing each other with questions or proposals to the task, as a interactive reflection on the design with shift in individual and social activity during the design process (ibid.) It is also worth noticing how the primary activity seems to be individual, and the social activity is only established shortly to align and decide details.

Proposing an Idea Using Digital Resources

In the second excerpt, we show how joint attention is mediated by the use of a laptop during an *idea proposal*. The video clip is 9.6s in length. We enter into a group of three; Dan, Lea and Holly. Lea and Holly have just returned to the table and are talking about how to present their project. Dan, who has been working individually at his laptop, looks up, turns his head, and nods in an attempt to attract their attention. In frame 1, Figure 5, he establishes eye contact with Holly and immediately initiates his proposal 'I was thinking', after which he turns to look at the screen of his laptop to show what he is 'thinking'. Lea turns to look at the screen. In frame 2, Figure 5, Dan moves back in his chair as if to make space for Lea and Holly to see his screen, while slightly turning the laptop in their direction. He utters the proposal 'about an email to eh:: Julie Nord'. This creates a focus for attention and locus for shared work (Goodwin, 2013) and the others display appropriate commitment to the joint activity (Bratman, 1992). Holly looks towards Dan, and in frame 3, Figure 6, she leans over the table towards the screen.

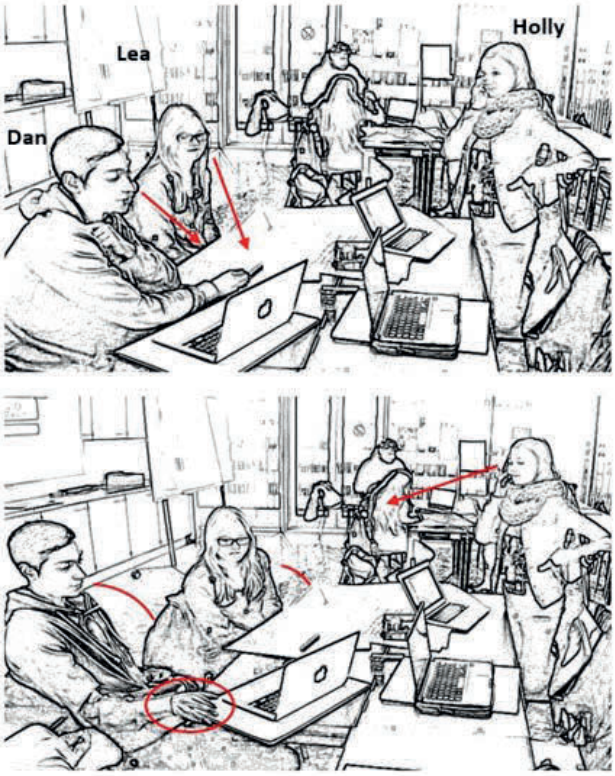


Figure 5 *Establishing contact and focus for shared attention.*

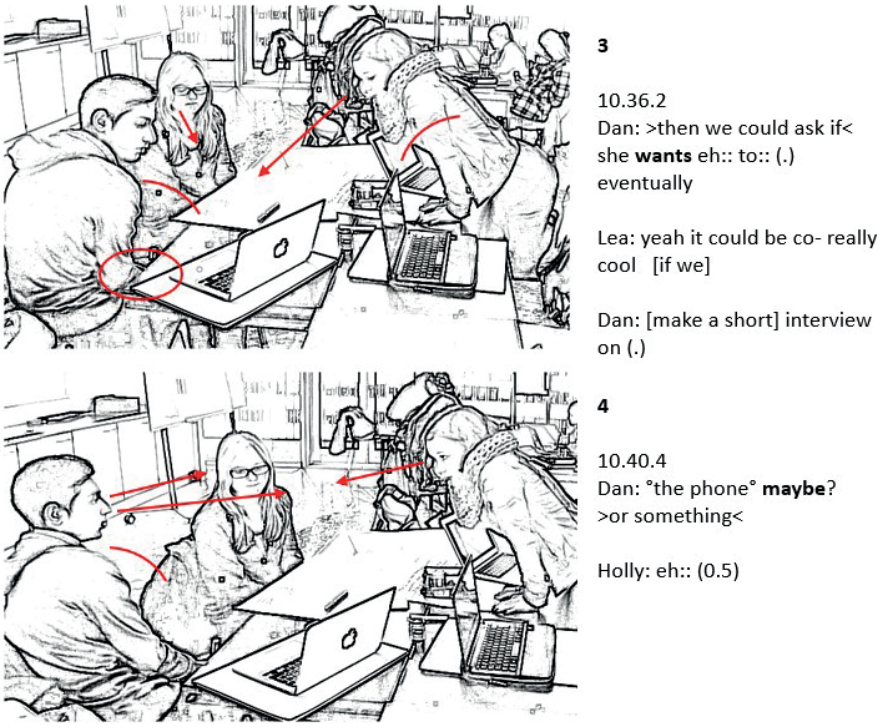
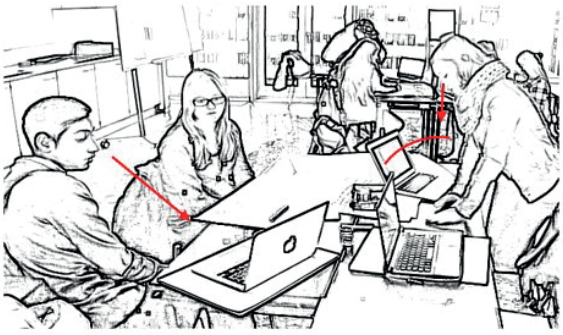


Figure 6 *Rejection followed by withdrawal of proposal.*

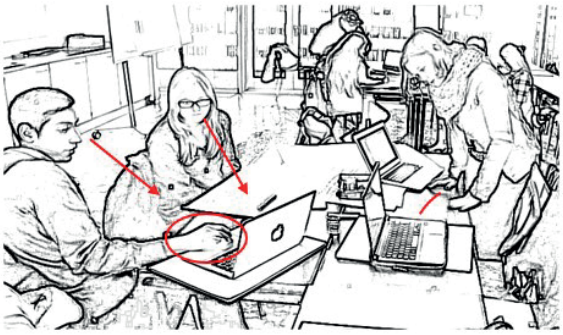
Dan elaborates on his proposal in frame 3, Figure 6. He talks fast and hesitates '>then we could ask if< she wants eh:: to:: (.) eventually', while placing his hands between his legs and bending his body inwards, displaying a closed body language. He maintains his gaze towards the screen while uttering his proposal as if using what is displayed on the screen as verification in relation to the proposal. Lea interrupts with confirmative displays 'it could be really cool [if we]', orientated towards the screen, while Dan adds details to his proposal '[make a short] interview on (.)'.

In frame 4, Figure 6, Dan lowers his voice '°the phone° maybe? >or something<', looks from Holly to Lea, while leaning slightly back, displaying uncertainty with a questioning and indefinite closing to his idea. Holly looks at him, while uttering a prolonged 'eh::' followed by a pause. In the next frame, she leans back, looks down and expresses an seemingly enthusiastic 'Yes!' immediately followed by a 'that might be' while lowering her gaze and wiping the table with her hands, which may indicate resistance rather that acceptance. Meanwhile, Dan is already expressing a withdrawal of his idea with a whispering '°maybe°'.



5

10.42.1
Holly: [Yes!] **that might be**
Dan: [°Maybe°]



6

10.44.2
Lea: °where is the email?°
Dan: **°here°**
Holly: we got *lucky* >surely we are not the *first* ones to come up with that idea<

(2.9)

Lea: But we can always try

Figure 7 *Reattempting to support idea.*

In frame 6, Figure 7, Lea is attempting to support Dan's idea, she lowers her voice, asking where the email is, seemingly ignoring Holly's hesitation. She refers to 'the email' and gazes at Dan's screen as if to build up new action towards acceptance of the idea rather than dismissing it, by

reusing resources provided by the prior action in frame 2 (Goodwin, 2013). Holly continues, saying they might 'be lucky' and adds that they are 'surely' not the first ones to come up with the idea, shaking her head slightly. A long silence follows (2.9 seconds), perhaps indicating disagreement or rejection (Davidson, 1984; Pomerantz, 1984). Lea then ads 'but we can always try', glancing towards Holly. After this extract, Holly agrees to the idea and they decide to go with the idea of an interview.

What this excerpt exemplifies is how Dan is able to attain joint attention mediated by a personal laptop. The reason, we may assume, is that Dan actively draws on his laptop as a communicative resource during his idea proposal by organisation his utterances around it (bodily orientation, gaze, and verbal references). It is worth noting how he turns the screen towards the others, and thus shares his screen. This seems like an effective way of establishing joint attention, making it possible for Dan to not only propose his idea but also establish a common point of reference for decision-making when the need arises. In line with Goodwin's analysis on the discursive role of vision within different professions (1994), we argue that talk, gesturing, and image, mutually enhance each other in establishing joint attention.

Failed Attempts to Attract Joint Attention

Unlike the previous excerpts, the following episode illustrates an incident where one group member is attempting to attract attention *without* success. We enter into a group of four: Seth, Carol, Ben, and June. They are all engaged in individual screen-based activity. Ben has tried to attract the attention of the others several times by either asking a question or, as we see in frame 1, Figure 8, talking out loud about his doings.

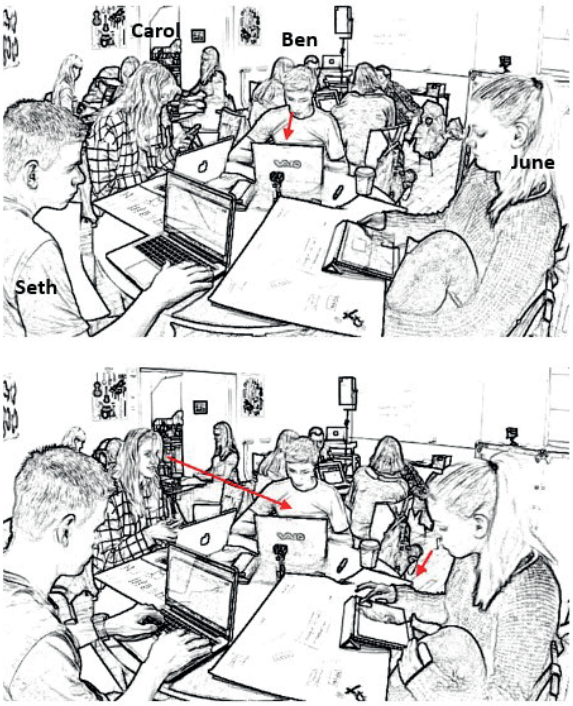


Figure 8 *Failing to attract attention. Two examples.*

Later in the activity, Carol also attempts to attract attention, but unlike Ben, she is mentioning the name of the person. In frame 2, she calls out 'June!', and looks in the direction of June. June may be ignoring Carol, since she does not react to the calling of her name, but is in proximity to hear Carol. The long silence in frame 2 may also display potential rejection from the recipient (Davidson, 1984). In both cases the topic, to which Ben and Carol are trying to establish a common focus, is somewhat hidden from the others because of the non-shared laptop/smartphone screen, illustrating how digital media such as personal laptops may create a shielding effect during collaborative activities.

Discussion

The present results contribute to procedural understandings of collaborative design practice, by honing in on oscillations between individual activity and joint attention in co-located student design teams. By examining episodes of joint attention, we found that the frequency and duration of social episodes fluctuate over the course of designing in predictable patterns dependent on phases and activities involved. The descriptive models of design processes were informed by the theoretical separation of design sub-activities into transition and action processes. The empirical evidence suggests that many sub-activities carried out in transition phases seemed to contain more

and longer periods of joint attention. We found that idea generation and problem defining activities were of longer duration and the most frequent types of episodes related to concept development and planning. Conversely, action phases were mainly somewhat shorter and less frequent as illustrated by the infrequent joint episodes on information search, with later design phases characterised by decreased shared attention duration, possibly due to numerous short touchback episodes to check with shared team goals keeping individual design activity on track. The findings clearly illustrate that the currently held general conception of team designing as entirely social in nature is overly simplistic: much of collaboration in team designing entails individual activity, albeit delegated to individual sub-goals, and less than half of co-located team designing in our data contained joint attention.

In the context of ubiquitous personal mobile computing, the present article attempted to examine the role of communicative resources in attaining the sought after joint attention in teams. We found that both visual and hidden references to analogue media effectively mediated the relation between individual attempt to attract attention, and subsequent joint attention. Similarly, visible digital media (e.g., sharing a screen) was also effective, but references to invisible digital referents did not support shifts to shared focus. Follow up qualitative examples helped illustrate that the frequent and inadvertent shielding of personal screens in co-located designing was unhelpful in providing visual cues to gain an understanding of the cause of interruption.

The awareness that team design efforts do not always involve joint activity attenuates the battle for individual attention taking place in co-located team designing. Thus, the present findings have implications for the organisation of design, and for the design of design tools, in educational settings. For example, the frequent, but short, joint attention episodes during later design phases may imply the need for continuing brief social engagement in the team even when many design teams would have delegated that activity to an individual. Further, quick visual access to cues for what is causing attempts to attract attention is important for establishing dialogue. Design process tools might do well to further consider how to incorporate shared visual cues, and allow for quick episodes of team touchback at later design stages.

Future research should further investigate the oscillating nature of team activity in professional design teams. The present study made use of a co-located in-situ educational design setting, and it is unclear to which extend the present findings will generalise to more professional contexts. It is, for example, noteworthy that the student designers in the present study spent limited time

exploring the design problem, which is unlike known design expert behaviour (Atman et al., 2007; Dorst & Cross, 2001). The professional designer working individual in a team may also implicitly play several roles or act as "a team of one" (Cross, 2011, p. 119; Goldschmidt, 1995). Furthermore, for the present purposes, we restricted our analysis to shifts from individual to social activity, ignoring the opposing directionality due to difficulties in coding non-verbal individual design activity. Individual activities may be examinable in other ways than through verbalisations (e.g., through observational estimates of their functions), and hence their future study could help explore further the nature of individual-social oscillations.

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12 Article two: How Task Constraints Affect Inspiration Search Strategies

Abstract

Searching for sources of inspiration is central to creative design; however, we have limited knowledge of individual inspiration search strategies in response to varying levels of task constraints. We studied 39 high-school students' inspiration search strategies using Google Images. Low task constrainedness led to divergent search marked by quick iterations, limited design task usage, and a heterogeneous image set. Intermediate constrainedness prompted in-depth, on-task exploration characterized by slow and careful iterations with more search result examination, extensive design task usage, and homogenous images. High constrainedness led to flexible bracketing with quick, flexible design task use, ending with heterogeneous images. Images from the intermediately and highly constrained conditions generated more ideas and were perceived as more inspiring (relative to low) in a new group of students. We discuss the idea of a 'sweet spot' of constrainedness in an inspiration search process in design and consider implications for design research and future work.

Introduction

American film director Jim Jarmusch (2013) once explained how he abides by a set of rules to guide his creative process, including the search for sources of inspiration. His fifth rule is "Nothing is original. Steal from anywhere that resonates with inspiration or fuels your imagination. Devour old films, new films, music, books, paintings, photographs, poems, dreams, random conversations, architecture, bridges, street signs, trees, clouds, bodies of water, light and shadows. Select only things to steal from that speak directly to your soul" (para. 8). Such reliance on sources of inspiration is key in movie-making and the arts but is no less important in design education. Generally, design research has examined various types of sources of inspiration that might trigger creativity, e.g., artifacts and phenomena as in the above quote, or how sources of inspiration can be operationalized as resources in a creative design process. Exactly *how* designers and other creative persons search for inspiration—their *inspiration search strategies*—on the other hand, has received surprisingly little attention in the design and design education research communities.

Using digital technology such as web browsers to search for sources of inspiration among the abundance of files on the Internet has never been easier. This makes it relevant to understand how inspiration search strategies are carried out; not just among seasoned professional designers, but also among novice designers and design students undertaking creative tasks that rely on finding sources of inspiration. Professional designers will often use various tools for particular purposes. This could be non-specialist applications such as Instagram, Flickr, YouTube, or Pinterest, or more professionally oriented tools such as Behance or Dribble for showcasing one's own creative work and perusing other designers' projects to find inspiration (Koch et al., 2018). For design students, such specialist tools will rarely be the first choice. Therefore, this paper specifically studies the use of Google Images as a familiar, mundane search tool that novices and students are accustomed to use for both personal and school-related tasks. Moreover, searching for images on the Web has been identified as one of 19 ideation techniques most frequently utilized in design practice (Herring et al., 2009). The search strategy involved in searching for inspiration is fundamentally different from searching for information or facts. Quiz-like search tasks such as finding out who directed a particular movie are usually decisively determinable. In open-ended inspiration search strategies, the person engaged in the search activity will often not know what s/he is looking for, but hope to discover something, which as a source of inspiration might 'fuel his/her imagination,' to paraphrase Jarmusch.

To supplement previous work on the specific ways in which sources of inspiration are utilized in a creative process, this paper takes one step back to examine concrete inspiration search strategies meant to bring about a generative result. Specifically, the paper explores how dissimilar levels of *task constraints* affect actual inspiration search strategies. While constraints are not inexpedient in creative processes in general, having too many options to choose from might often be detrimental to creativity (Joyce, 2009; Schwartz, 2005). It would, therefore, seem plausible that the *constrainedness* (Onarheim, 2012a) of a given creative task, i.e., how broadly/vaguely or narrowly/precisely the task is defined, will affect the actual inspiration search strategy. This makes it relevant to study how varying levels of constrainedness in the formulation of a creative task will affect a person's inspiration search strategy when s/he has access to a huge number of sources of inspiration. So far, this specific, local effect on inspiration search in a design process has not been fully investigated.

We present an empirical study of how high-school students use Google Images to search for inspiring images in response to three creative design tasks. The three tasks represent varying levels

of constrainedness as expressed by their specific wording, from a clearly open-ended creative task (*low* constrainedness) over a more standardized creative task featuring some keywords (*intermediate* constrainedness) to a very detailed creative task (*high* constrainedness) with several keywords that as search terms can be typed into the web browser immediately to initiate the image search process.

Our *main contribution* is based on this empirical study and offers insight into how varying levels of constrainedness in creative tasks affect inspiration search strategies. We discern three such strategies, which we refer to as a) *divergent searches*, b) *in-depth, on-task exploration*, and c) *flexible bracketing*, pertaining to a low, intermediate, and high level of constrainedness, respectively. Inspiration search processes are initiated in response to the information stated in a creative task. Our study finds that neither too little, nor too much available information conceived as constraints will be conducive to creativity. The inspiration search strategy will thus often entail that the person engaged in the search activity will either add or temporarily remove (bracket) information in order to establish a *'sweet spot'* of constrainedness with neither too many, nor too few constraints expressed as the terms represented in the formulation of the creative task. This insight is relevant to *design researchers* interested in inspiration search strategies as an important design activity, and to *design practitioners* and *design educators*, who solve or devise creative design tasks where finding sources of inspiration is critical.

The paper is structured as follows. First, we provide an overview of research on sources of inspiration, constraints, and search strategies of which most studies have focused on the relevance of information obtained through search queries. We then present our empirical study of 39 high-school students' inspiration search strategies using Google Images. We analyze our data using mainly quantitative and, to a lesser extent, qualitative measures and discuss our findings, including the idea of a 'sweet spot' of constrainedness in an inspiration search strategy. Finally, we consider our study's limitations and our findings' implications for design research and future work.

Sources of inspiration in design

When referring to inspiration in a creative design process, it is important to distinguish between *inspiration* and *sources of inspiration*. Etymologically, the former can be traced back to 13th century French and is often conceived figuratively as "A breathing in or infusion of some idea, purpose, etc. into the mind; the suggestion, awakening, or creation of some feeling or impulse, especially of an exalted kind" (Simpson & Weiner, 1989, p. 1036). More recently, Thrash and

Elliot (2003) gave a less abstract, domain-general conceptualization of 'inspiration,' arguing that it has three characteristics. It includes *motivation* as directed behavior, it is *evoked* rather than arising through will alone or 'out of the blue,' and it involves *transcendence* in exceeding ordinary human actions and cognitive processes. Conversely, sources of inspiration are concrete elements of information deliberately brought into a creative design process as stimulus objects or *triggers* to evoke inspiration for a specific purpose or *target* such as a creative product or a personal aim (op. cit.). This means that inspiration should not be seen as a *source* of creative ideas but as a motivational *response* to creative ideas in the sense that "inspiration explains the transmission, not the origin, of creativity" (Oleynick et al., 2014, p. 2). The focus of the present paper is neither inspiration as an abstract 'exalted feeling or impulse,' nor its well-established domain-general relevance, e.g. as a potentially universal effect on creativity arising from the aesthetic experience of art (An & Youn, 2018). Rather, it is the *search strategies* involved in finding sources of inspiration, here images obtained online.

Sources of inspiration are considered integral to design (Sanders, 2005) and necessary for continuing creativity (Eckert & Stacey, 2000). Using sources of inspiration instrumentally in design is a familiar topic (e.g., Bonnardel & Marmeche, 2004; Gonçalves, 2016), and its relevance to the emergence of design concepts is well-known (Halskov, 2010; Halskov & Dalsgaard, 2007). How, and to what extent, introducing sources of inspiration might influence creativity depends on the level of expertise of a designer or any other creative person involved in a design process (Bonnardel & Marmeche, 2004). Several studies on the role of sources of inspiration in design have examined textile design, particularly knitwear. Eckert and Stacey (2000) showed how a design process can be initiated through the use of previous design artifacts, objects, and images. Petre, Sharp, and Johnson (2006) identified overarching categories of inspiration in this domain, e.g., other garments, works of arts, and natural phenomena. Their categorization echoes Mete's (2006) investigation of the fashion industry, showing how sources of inspiration might improve originality of the final design, but might also be utilized in a deliberately regulatory or constraining way so as to ensure harmonious color schemes and uniformity in a fashion collection. In another design domain, Kelley and Littman (2001) documented how designers at IDEO would collect gadgets and materials as sources of inspiration and store them in file cabinets so that the artifacts could be used in future design projects. In the context of industrial design education, Santull and Langella (2011) reported how examples from nature might inspire the design of sports items with regard to requirements such as safety, comfort, and multi-functionality. Undertaking a broader

scope, Luo and Dong (2017) argued that learning to engage with sources of inspiration is particularly critical in design education. They explored the role of two kinds of cultural inspiration—textual inspiration and pictorial inspiration. Interestingly, they found students working with textual inspiration to be more creative than those using pictorial inspiration. Finally, and since inspiration often occurs in Sudden Moments of Inspiration (SMI), Wu and Wang (2015) discovered a clear effect of subconsciousness on SMI in the sketching process of industrial design.

Sources of inspiration in design and design education, therefore, have a dual role. While they can facilitate idea generation, e.g., via analogical thinking (Christensen & Ball, 2016) such as in said biologically inspired design (see also Helms et al., 2009), and potentially lead to original ideas, they can also be detrimental to creativity. One example is Marsh, Ward, and Landau's (1999) study, showing how participants, who were tasked with creating English nonwords after having seen examples of nonwords embedded with regular orthographic structures, would come up with nonwords conforming to the examples—even though they were instructed to *avoid* using features from the examples. In this way, sources of inspiration might lead to design fixation (Crilly & Cardoso, 2017; Jansson & Smith, 1991), which design novices and experts will often approach in dissimilar ways (Moxley et al., 2012; Sio et al., 2015). It is important to remember, however, that while cognitive fixation may lead to inefficient search strategies during information retrieval (Mumford et al., 2006), this might not necessarily be a bad thing in design (Cross, 2006, p. 104). To better understand how sources of inspiration take on this dual role in a creative task by both enabling and constraining creativity, it is relevant to look toward research on the role of constraints in design.

Constraints in creative design tasks

Etymologically, to 'constrain' might suggest an exclusively restraining property in the sense that constraints are seen as "limitations on action [that] set boundaries on solutions" (Vandenbosch & Gallagher, 2004, p. 198). In design, this understanding is not adequate. As Boden (2004) observed, "constraints on thinking do not merely constrain, but also make certain thoughts—certain mental structures—possible" (p58). This dual role of constraints has been underlined by several researchers (e.g., Elster, 2000; Joyce, 2009; McDonnell, 2011; Onarheim & Wiltschnig, 2010) and marks a break with previous research, which often saw design as the ability to meet specific sets of requirements. This prior understanding can be traced back to seminal work on rational problem-solving in Human-Computer Interaction (HCI) and computer science. Reitman (1964)

described how "each problem defines a set of constraints that must be met by subsequent transforms if they are to lead to a solution of that problem" (p305). Later, and informed by Reitman's work, Simon (1969) contributed the oft-cited definition of design according to which "everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (p111) so that "design […] is concerned with how things ought to be" (p114). This view on design is also based on constraints insofar as "design solutions are sequences of action that lead to possible worlds satisfying specified constraints" (p124).

As noted by Dorst (1997), Schön (1983, 1992a) gave an alternative to this rational problem-solving approach to creative design tasks by underlining the reflective practice of design and that each creative design problem be seen as unique—"a 'problem space' is not given by the presentation of the design task" (1992, p11), nor simply by the constraints it encompasses. Schön stressed the active role of the designer in the sense that "the designer *constructs* the design world within which he/she sets the dimensions of his/her problem space, and invents the moves by which he/she attempts to find solutions" (ibid., orig. emphasis). According to Schön, a designer does not suddenly 'jump' from problem to solution. Working with constraints in a creative task means working toward a creative event (e.g., an insight moment) when a unique problem-solution pairing is framed. Schön (1983) called this 'problem framing.' This idea of problem-solution co-evolution, in which working with constraints in a creative design task is critical, has been picked up by other researchers (e.g., Maher & Tang, 2003; Wiltschnig et al., 2013).

Understanding how sources of inspiration take on the dual enabling-restraining role of constraints in a creative design task thus requires a more nuanced conceptualization of a *design space* (Dove et al., 2016) than "a space of possibilities" (MacLean et al., 1991, p. 203) or something that "constrains design possibilities along some dimensions, while leaving others open for creative exploration" (Beaudouin-Lafon & Mackay, 2003, p. 9). As Reitman, Simon, and others stressed, having a clear understanding of the importance of constraints is critical to understanding design as a problem-solving activity, but just as important is Schön's insight that a designer, when engaged in a creative activity, works with constraints in a manner that goes beyond purely rational constraint satisfaction. We thus subscribe to the idea of seeing a design space as a conceptual space comprised of "the *creativity constraints* that govern what the outcome of the design process might (and might not) be" so that a design space is "co-constituted, explored, and shaped by the designer throughout the design process" (Biskjaer et al., 2014, p. 461 orig. emphasis). This means that a designer can, to some extent, shape, his/her design space by selecting or deselecting, various

sources of inspiration that serve as creativity constraints that are not necessarily *per se* either completely free or fully fixed, but can be challenged, modified, or even ignored.

The total 'pressure' of the creativity constraints, which can be referred to as *constrainedness* (Biskjaer, 2013; Onarheim, 2012a), might vary significantly and is highly relevant in design, e.g., as time pressure in industrial design projects (Hsiao et al., 2017). Stacey and Eckert (2010) introduced graduating this constrainedness in a loosely defined continuum of overconstrained versus underconstrained creative problems. In their terminology, overconstrained problems are creative problems or tasks with many strong constraints that must be met unconditionally as exemplified by engineering; a view echoing said work by Reitman and Simon. Underconstrained creative problems, as illustrated by more art-oriented creative design practices such as the knitwear designers whom Stacey and Eckert studied, are marked by having many more weak constraints that can be relaxed. This idea of a continuum of underconstrained versus overconstrained creative problems and tasks builds on previous conceptualizations of creative problems, among them ill-defined (Eastman, 1969; Reitman, 1964; Schraw et al., 1995), ill-structured (Goel, 1992; Simon, 1973), and wicked problems (Buchanan, 1992; Churchman, 1967; Rittel & Webber, 1973), albeit these do not focus primarily on levels of constrainedness. Stacey and Eckert's (2010) underconstrained versus overconstrained continuum has two extremes. In practice, few (if any) creative problems or tasks are located at either end. Rather, most creative problems and tasks can be challenged in accordance with Schön's (1983, 1992) idea of problem-framing and malleable design spaces. This makes it relevant to consider the *strategies* behind how such constraints are treated in a creative task, e.g., in the choice of working with and adopting either more or fewer sources of inspiration, which will thus take on the dual enabling-restraining role of constraints.

A 'sweet spot' of constrainedness in a creative task

Studies of expert engineering designers working with highly complex, overconstrained problems have revealed how these designers use various creative strategies to alleviate constrainedness (Onarheim, 2012b). Such strategies include black boxing (treating certain constraints as unchangeable), removal, revision, and, occasionally, introducing additional constraints (p9). Similarly, research has shown how it might be beneficial to introduce (radically) new constraints into a creative activity (Biskjaer, 2013) in order to establish "a way into the problem" (Darke, 1979, p. 38). Introducing such new constraints might even become decisive for the final design (Mose Biskjaer & Halskov, 2014). Joyce (2009) summed up the role of constraints by saying that

"while absolute constraint undermines creativity and intrinsic motivation, too little constraint is also counterproductive, resulting in decreased creativity and originality. Although some degree of choice has repeatedly been shown to be essential to creativity, the 'freedom' of the blank page can actually stifle creativity" (p8). Consequently, designers must find creative strategies of coping with design tasks marked by very many—or few—constraints.

In practice, a *too high* level of constrainedness (too little creative freedom) will make it hard for the person involved to initiate a resolution of a creative task, since it is cognitively more difficult to process all the given task constraints. This prompts the need to apply a creative strategy to manage this constrainedness. A *too low* level of constrainedness (too much creative freedom) might for some cause the 'paradox of choice' (Schwartz, 2005) where it is difficult to establish a primary generator (Darke, 1979) as a starting point. One way of framing this schism of neither too little, nor too much constrainedness is by the expression 'striking a balance' (Onarheim, 2012a). A well-known, related example of such balancing is Csikszentmihalyi's (2008) concept 'flow,' which, in a simplified form, can be explained as the benefit of matching challenges and skills in order to reach a state of complete immersion in a creative activity. Csikszentmihalyi's flow model, however, does not target *perceived inspiration*, but perceived challenges and the skills needed to resolve them as the two co-evolve. An alternative to his diachronic model is a more snapshot-like, synchronic illustration of any given point in a creative process as seen from one person's perspective. If neither too much, nor too little constrainedness is favorable for creativity, this suggests the benefit of positioning oneself in a fertile middle ground. This theoretical proposition can be depicted as an inverted U-shape with a person's perceived potential for creativity (Y-axis) as a function of a creative task's level of constrainedness (X-axis), see Fig. 1. This desirable middle position can be referred to as a person's '*sweet spot*' (Biskjaer, 2013; Onarheim, 2012a) based on the level of constrainedness of a given creative task. The inverted U-shape illustrates how a person's perceived potential for creativity drops when moving toward a notably lower (underconstrained) or higher (overconstrained) level of constrainedness, showing that neither a too low, nor a too high level of creative task constrainedness is desirable.

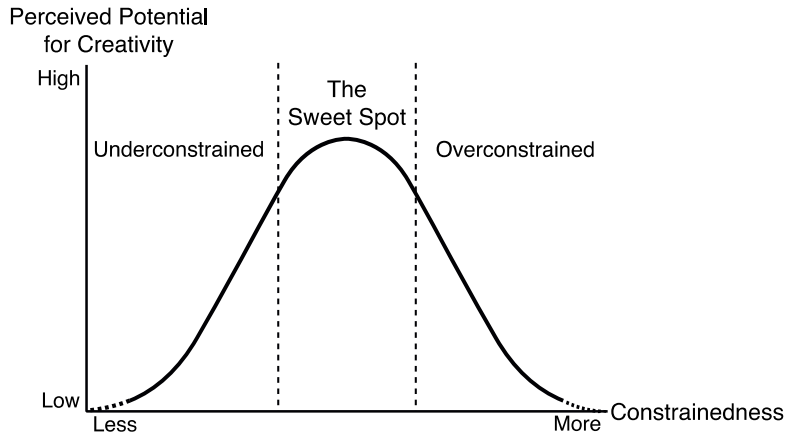

Fig. 1 *The 'sweet spot' model of striking a desirable balance between a creative task's constrainedness and a person's perceived potential for creativity (see Biskjaer 2013; Onarheim 2012b)*

Building on this theoretical proposition, we argue that the idea of a 'sweet spot' based on a desirable level of creative task constrainedness is equally valid in terms of sources of inspiration in the sense that the Y-axis might denote a person's level of *perceived inspiration*. This connection between varying levels of constrainedness and its effect on perceived inspiration has, to some extent, been foregrounded by Elster (2000) who saw inspiration as "the rate at which ideas move from the unconscious into the conscious mind" (p212), so that inspiration becomes "an inversely U-shaped function of the tightness of the constraints" (ibid.). Elster, however, never explored this connection between creative task constrainedness and inspiration in any great depth. As a designer engaged in an inspiration process, having too many sources of inspiration will often be detrimental to creativity, since sources of inspiration, as information, function as constraints. The same goes for having too few sources of inspiration. If one has *too many* sources of inspiration available, it becomes necessary to *bracket* or *ignore* some, i.e., move toward one's individual 'sweet spot' from the *right-hand, overconstrained* side of the inverted U-shape. If one has *too few* sources of inspiration in a creative design task, it becomes imperative to *add* new, relevant sources of inspiration, i.e., move toward one's 'sweet spot' from the *left-hand*, *underconstrained* side of the inverted U-shape. Adding sources of inspiration, therefore, gives rise to the critical question of how to find them.

Inspiration search strategies in design

Although sources of inspiration is a familiar topic in design research, e.g., in studies of the creation of mood boards (Lucero, 2012) and the use of digital pin boards for everyday ideation (Linder et

al., 2014), surprisingly few studies have examined in detail the concrete *inspiration search strategies.* Most studies have focused on *general* search strategies for retrieving information conceived as fact-finding in order to determine questions such as who directed a particular movie. Several studies have examined strategies of information search and processing in decision making (Payne, 1976), e.g., how time pressure affects such activities (Verplanken, 1993). A number of studies have examined search strategies in specific domains, e.g., how so-called 'search tactics' can improve bibliographic and reference searches (Bates, 1979); how tourists' information search strategies involve different media and information resources (Fodness & Murray, 1998); and how age affects online search strategies and the retrieval of correct answers to a task (Stronge et al., 2006). Other studies have explored where best to draw the line between configurability of a search system and relevant user control (Bates, 1990); why novice searchers struggle to develop an effective information search strategy (Debowski, 2001); and strategies for vetting, managing, and interpreting content online when searching for other people—or even oneself (Kuzminykh & Lank, 2016).

Most studies of search strategies interpret searching as an activity for obtaining information such as an answer to a well-defined problem, often related to decision-making. Recently, however, an important contribution was made by Harms, Reiter-Palmon, and Derrick (2020) who separated and measured information search as an intermediary process in creative problem solving. By studying 221 undergraduates at an American Midwestern university as they worked on a problem pertaining to juggling personal, social, and academic demands, the authors found that the "length of time spent searching, the quantity of information viewed, and the breadth of information search mediate the relationship between problem construction engagement and creativity across categories" (p1). This led to the conclusion that when engaged in problem construction (Reiter-Palmon et al., 1997), "the more efficiently they [the participants] searched for information, the more creative their solution" (ibid.), suggesting that "broader information search is necessary to generate solutions to ill-defined problems" (p10). This lends empirical evidence to the general agreement that the quality of information search affects creative performance (Illies & Reiter-Palmon, 2004).

Interestingly, Harms et al. (2020) never discuss *inspiration*, which points to the fact that few studies have focused specifically on strategies for finding sources of inspiration as a distinct activity that should not be subsumed under creative problem solving proper. So far, some studies included the design of new digital search tools, e.g., based on social media chatter

(Paraskevopoulos et al., 2014) or as a semantic-based image retrieval algorithm (Setchi & Bouchard, 2010), to explore inspiration search. Others examined design students undertaking a self-set, naturalistic information search task, noting how they would prefer images as inspiration content and manifest diverse use behavior when working with sources of inspiration (Makri & Warwick, 2010). Another study explored teens' information experiences with social media and Google Images for finding and working with sources of inspiration conceived as 'information literacy' (Harlan et al., 2012).

In design education research, few studies have examined information search strategies. One notable exception is Quintana, Pujol, and Romani (2012) who compared students with general school training in ICT (Information and Communication Technology) and students without, focusing on Web literacy in general. Students with ICT training showed better command of digital technology but still lacked key skills in terms of Web literacy. Chen (2016) carried out a quantitative study of industrial design students' use of resources in the design studio. The category 'objects,' which included objects found on the Internet, comprised 30% of the resources used by the students. In a comparative study, Gonçalves, Cardoso, and Badke-Schaub (2014) studied students' and experts' preferred inspirational approaches and observed that both groups often ignore additional, proven efficient, design creativity methods for ideation. Chan, Dow, and Schunn (2015) showed that citing sources of inspiration tends to be associated with more original ideas although conceptually closer, as opposed to farther sources, seem to be more conducive to the emergence of creative ideas. Mougenot, Bouchard, Aoussat, and Westerman (2008) studied expert car designers' information gathering strategies when searching for inspiration. When comparing the designers' use of online media and printed magazines, the study found visual materials, primarily images, to be predominant although the expert industrial designers preferred printed magazines to searching online when looking for inspiring images. It seems likely that this preference might have changed over the past decade. Indeed, Koch et al. (2018) showed that "the Internet has become a prevalent source for ideas in design" (p1), and "most designers nowadays find potentially inspiring visual material and solutions online" (p10).

This prevalence of *images* when searching for inspiration would suggest the presence of one or more specific search strategies for finding the most potent sources of inspiration for a creative task. Still, even seasoned image professionals rarely adopt a clear strategy. By analyzing two samples of search logs from a big commercial image provider over a one-month period, Jörgensen and Jörgensen (2005) found that even though descriptive and thematic search queries were more

common, the search tactics overall "do not appear to be carefully thought out and seem to be largely experimental" (p1346). This led the authors to conclude that although these professionals were experts in searching for inspiring images, they seemed to have an "inability to do so in an effective way" (ibid.). The same lack of application of deliberate inspiration search strategies is evident in design.

Informed by these insights and the limited literature on how inspiration search strategies are carried out in response to varying levels of task constrainedness, we conducted the following study.

Method

Participants

Thirty-nine Danish high-school students (age 16-18; 14 female) participated in an experiment on inspiration search strategies (part I) as part of a weeklong interdisciplinary project in two mandatory courses—Business Economics and Social Studies. The project was part of a design case competition challenging the students to design the best (fictional) business from scratch; a task that, given its open-endedness, made the students' initial inspiration searches thus more relevant. We collected data during the first day of the project week where the students were in the preliminary ideation phase. Subsequently (part II), 42 Danish high-school students (the same students as in part I plus three new students) used the obtained sources of inspiration in creative selection and idea generation tasks.

Procedure and coding

Participants were randomly divided into three conditions of design task constrainedness: Low (n=14), Intermediate (abbreviated Med.) (n=11), and High (n=14). They were instructed to imagine that they had to come up with an idea for the design of a new business and needed sources of inspiration. This was followed by a condition-specific task description (see Table 1 for the formulations of the design task) containing approx. 1, 7, and 13 task words suitable as search terms in an online image search.

Low	*Task:* Find sources of inspiration for a new business.
Med.	*Task:* Find sources of inspiration for an innovative, sustainable, new business that uses digital technology for products or services.
High	*Task:* Find sources of inspiration for an innovative, sustainable, new business that uses digital technology for products or services for experiences at Kongens Nytorv [a large public square in downtown Copenhagen], e.g., within tourism, sports, art, or culture.

Table 1 *Manipulations of constrainedness in the design task (transl. from Danish)*

Apart from the different design tasks, the procedure was identical across conditions. The subsequent procedure entailed tracing individual search behavior online, ending in the individual selection of inspiring images (part I) followed by tests of whether the individually selected inspiring images were inspirational to a new group of students, and led to more ideas generated (part II). For an overview, see Fig. 2.

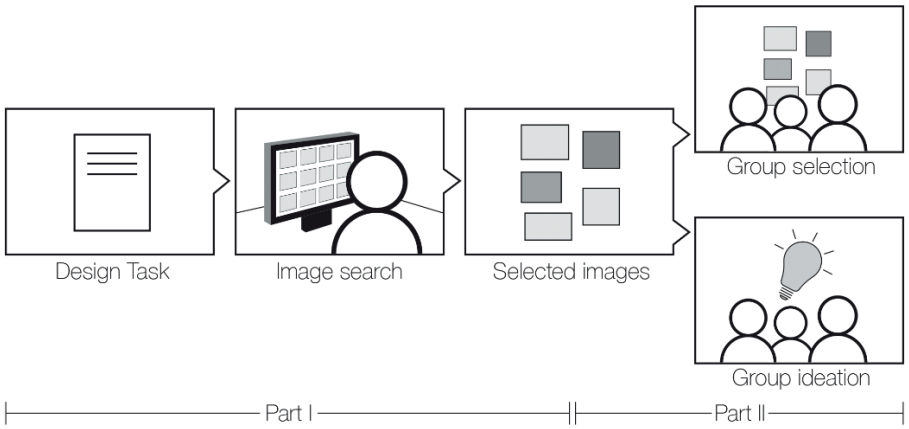

Fig. 2 *Experimental procedure overview*

Part I: Individual search

All participants received the design task in paper format. They were seated individually in front of their personal laptop and asked to perform Google Image searches and select five inspiring images that would aid their subsequent design process. The students searched for images individually for 15 minutes while their screen activity was recorded using *screen-capture software*

(Open Broadcaster Software). The five images selected as inspiring by each participant were collected for use in the second part of the experiment.

Based on their extensive coding experience from an international design research project, one graduate student and two research assistants (with master's degrees) examined the screen captures and *coded* the onset time and individual search strings, the number and content of images selected for enlarged viewing under each search string, images selected under each search string and the positions of the images in the search result, the duration of the search (defined as the difference from the search string onset time to the onset of the next search string). The ten most frequently used search terms per condition are shown in Table 2.

Low	**Med.**	**High**
Business(2	Digital(2	Nytorv(2
Innovative(1	Technology(2	Copenhagen (2
Success(1	Business(2	Innovative (2
Conor McGregor(1	Sustainable (2	Sustainable (2
Design(1	Innovation (2	Art(2
Interior(1	Recycling(1	Kongens/Kings(2
Inspiration(2	Product(2	Tourism(2
Giant(1	Sources of inspiration(2	Digital(2
Smart(1	Services(2	Technology(2
Fashion(1	Energy(1	Ideas(1

Table 2 *The ten most frequent search terms per condition (transl. from Danish). Numbers indicate whether the term was present in the design task formulation: 1= absent, 2=present*

The search term content was then *categorized* by the coders as entailing one of *three types of searches*: 1) search strings *not* related to the stated design task (labeled 'None' in Fig. 3 and 4); 2) search strings *partly* selected from the design task ('Some'), and 3) search strings *entirely* selected from the design task ('Only'). Interrater reliability for the search type coding was excellent as checked by an independent coder on 8% of the data (Cohen's κ=.844). Due to the objective character of the other codes (e.g., onset time or search string entry), additional interrater reliability was not carried out.

We also conducted *semi-structured interviews* with one student from each of the design task groups, i.e., Low, Med., and High, asking questions related to search strategies behind each of the

five images they had chosen as most inspiring. These three interviews were recorded and transcribed. Finally, two coders, blind to condition, examined whether the images stemming from each condition varied in level of *homogeneity*. In an image sorting exercise, the entire pool of images was sorted into a number of categories of varying sizes by image content similarity. The coders were asked to sort the images by content until no more meaningful clustering could be done. This resulted in categories ranging from one to ten images, with categories of one being images that did not match any other image content-wise (i.e., unique content in the set).

Part II: Group selection and ideation

To examine which condition led to more inspiring images, a subset of the images selected in Part I was evaluated and selected and subsequently used in ideation in group settings. The purpose was to collect behavioral consequences of the individual image selection on subsequent group performance. In order to avoid confounding group effects with individual ownership biases, the students worked with images they had not selected themselves for both the selection and ideation task.

Selection: Fourteen groups of three students were given a complete set of five images (each group was randomly assigned complete image selections from different participants in part I) from each of the three conditions, yielding a total of 15 images per group. These student groups were blind to which condition the images originated from. The groups were asked to select the five most inspiring ones from this pool of 15 images.

Ideation: The same fourteen groups as in the selection task were asked to perform three group ideation sessions for five minutes using as inspiration new sets of five images (each group received complete image selections from different participants in part I) stemming from the three conditions. The three ideation sessions were counterbalanced across groups for the ordering of the levels of constrainedness. For each of the three ideation sessions, the group received a full set of five inspiration images. The subsequently generated ideas were then recorded for each group member.

Analysis

The analysis of the effects of the constrainedness condition was divided into four parts, relating to effects on individual search behavior (part Ia); the homogeneity of the resulting selection sets

(part Ib); effects on images being selected as inspiring by a new group of students (part IIa); effects on the number of ideas generated by a new group (part IIb). Descriptive statistics relating to search string entry counts, search length, search duration, clicks per image, and the number of ideas generated are shown in Table 3.

	Low		**Med.**		**High**	
	M	SD	*M*	SD	*M*	SD
Search string length (terms) per search	1.9	1.1	2.4	1.3	2.7	1.2
Search string entries per participant	21.6	10.3	12.1	5.6	20.7	8.5
Search duration (sec.) per search	38	49	54	51	39	42
Clicks per search	1.4	0.9	2.3	1.9	0.8	0.5
Ideas generated per group participant	2.9	1.5	3.3	2.0	3.3	1.9

Table 3 *Descriptive statistics by constrainedness condition*

Part Ia: Effects of constrainedness on individual search behavior

As expected, the length of the search strings (number of terms) varied with constrainedness condition $F(2, 722) = 28.48$, $p = .001$, with follow-up Tukey HSD tests illustrating a linear increase of search string length with constrainedness where Low was significantly shorter than Med. ($p = .003$) and High ($p = .001$), with Med. also being significantly shorter than High ($p = .02$).

The three constraint groups differed in terms of the number of search strings each participant entered, ANOVA $F(2, 38) = 4.54$, $p = .02$, with follow-up Tukey HSD tests revealing that the Med. constrainedness condition performed fewer image searches than the Low ($p = .02$) and High condition ($p = .04$), but with Low and High not being significantly different ($p = .96$). Correspondingly, the three conditions differed in terms of the duration of each individual search, ANOVA $F(2, 722) = 5.81$, $p = .003$, with follow-up Tukey HSD tests revealing that the Med. constrainedness group performed *longer searches* than the Low ($p = .004$) and High condition ($p = .008$), but with Low and High not being significantly different ($p = .95$).

The level of constrainedness significantly affected the *type of search* conducted, $\chi^2(4, 725) = 169.01$, $p = .001$. As shown in Fig. 3, there are several key differences. Follow-up 2x2 Chi-Squares

revealed that the Med. constrainedness group stood out as entering *significantly more search strings* with terms *only* stemming from the design task than the Low $\chi^2(1) = 102.05$, $p = .001$ and High condition $\chi^2(1) = 35.13$, $p = .001$, even though the High condition had many more design task words to choose from when searching in Google Images. The High group significantly exceeded the Low group $\chi^2(1) = 23.14$, $p = .001$. Conversely, the Med. constrainedness group also entered *fewer search strings without any words* stemming from the design task (labeled 'None') than both the Low $\chi^2(1) = 139.38$, $p = .001$ and High condition $\chi^2(1) = 28.59$, $p = .001$. The Low group significantly exceeded the High group $\chi^2(1) = 66.30$, $p = .001$. The Med. group, therefore, behaved very differently from the other two groups in the type of searches conducted.

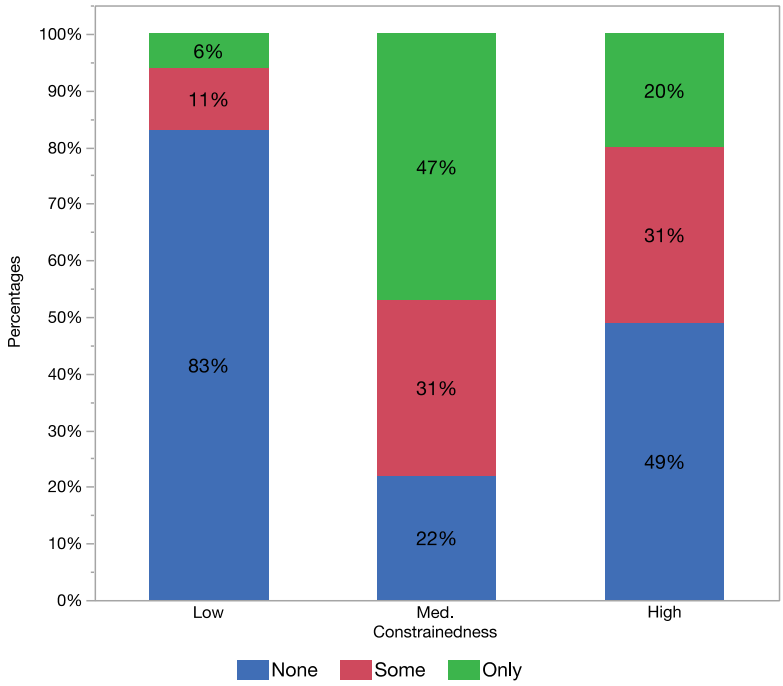

Fig. 3 *Search type (whether the search string used None of, Some, or Only words from the design task formulation) in percentages by condition*

Comparing across conditions for search string types, there is a notable development over time, see Fig. 4. The proportion of searches containing None of the search terms from the design task that were executed in the first half (relative to the second half) of the search varied by condition, $\chi^2(2) = 12.74$, $p = .002$. Follow-up 2x2 Chi-Squares showed that the Low group made more of these None searches early on compared to Med. $\chi^2(1) = 8.94$, $p = .003$ and High $\chi^2(1) = 6.09$, $p = .02$, while Med. and High did not differ $\chi^2(1) = 2.87$, $p = .09$. For the Some category, no differences

across time could be identified $\chi^2(2) = 2.97$, $p = .23$. Due to expected counts less than five, the 2x3 Chi-Square could not be performed for the Only category, but follow-up 2x2 comparisons revealed that the Low and Med. categories did not differ (2-sided Fisher's exact test, $p = .11$), but that both Low $\chi^2(1) = 9.91$, $p = .002$ and Med. $\chi^2(1) = 6.80$, $p = .01$ exceeded the High category. Taken together, these results indicate that the Low condition seemed to use mainly searches without any words from the design task, but insofar as Only searches were used, they were used early in the process. The Med. condition deployed fewer searches, many of which were Only searches early on, but then None at a later stage. For the High condition, a more even distribution over time for all search type categories was evident.

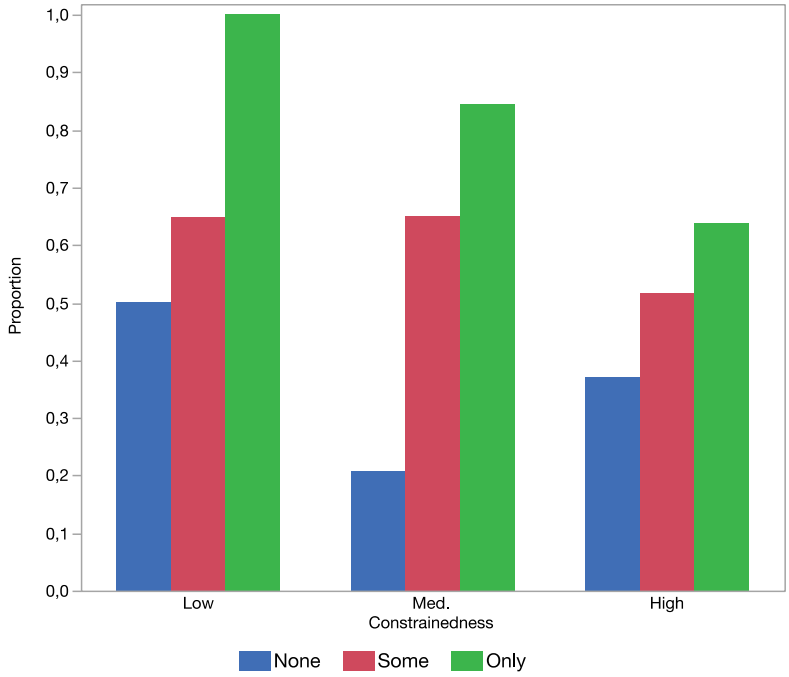

Fig. 4 *Proportion of search string query types conducted in the first half of the search process (relative to the second half) by constrainedness condition*

The constrainedness conditions also differed in terms of the number of different image clicks each search generated ('clicks per search'), ANOVA $F(2, 722) = 13.56$, $p = .001$. Follow-up Tukey HSD tests showed that the Med. group had significantly more clicks than both the Low ($p = .002$) and High category ($p = .001$), while Low and High did not differ significantly ($p = .11$). This indicates a *continued and elevated effort in searching through the search results* in order to find more hits in the Med. constrainedness condition. There was, however, no significant difference in

how deep into the image search results the students would look, i.e., how many lines they scrolled down among the search results before clicking, $F(2, 596) = 2.05$, $p = .13$.

Qualitative observations

Students in the *Low constrainedness condition* used search strings where the most frequent words in the searches were 'business,' 'innovative,' and 'inspiration', while the majority of search strings could not be traced back to the design task. In the follow-up interview, one participant said: "*I applied a principle, where I thought, 'okay, how do you create a new business? … You need new ideas!'.*" This guiding principle led him to type in "how to be innovative" and "new ideas," resulting in selecting two "how to" images depicting a process ("Ten ways to make anything more innovative") rather than an abstract or iconic image, see Fig. 5, top left. Compared to the Med. and High conditions, the Low condition seemed to include more images for guiding the inspiration process as opposed to containing inspiring content in and of itself.

Students in the *Med. condition* used search strings where the most frequent terms were 'digital,' 'technology,' 'business,' and 'sustainability.' A student in this condition exclaimed frustration concerning the outcome of the search 'sustainability': "*It [the search] was like superficial green, so it was not there it [the idea] came… You had to scroll down.*" She clicked on several images but did not choose an inspirational image until ten minutes and seven search strings later, resulting in selecting an iconic picture of a sustainable car, see Fig. 5, top center. The Med. constrainedness condition seemed to yield more such sustained and effortful engagement with the search results.

A student from the High constrainedness condition did not use search strings directly from the design task in his first search: "I started thinking of what was realistic when it was to be located in the city, and then I came up with this 'walk and talk,' because it is something you've heard before. And then I worked on improving that." He typed in 'walk talk and listen' as his first search. This prompted an image with inspiring text, which he chose as one of the five inspiring images, see Fig. 5, top right. In the High condition, the students more often applied search strings pertaining to location (Kongens Nytorv is a large public square in downtown Copenhagen), either the location itself or some recognizable activity related to the location as a starting point for their search. The most frequent words in the High condition searches were 'Copenhagen' and 'Nytorv' alongside 'innovative.'

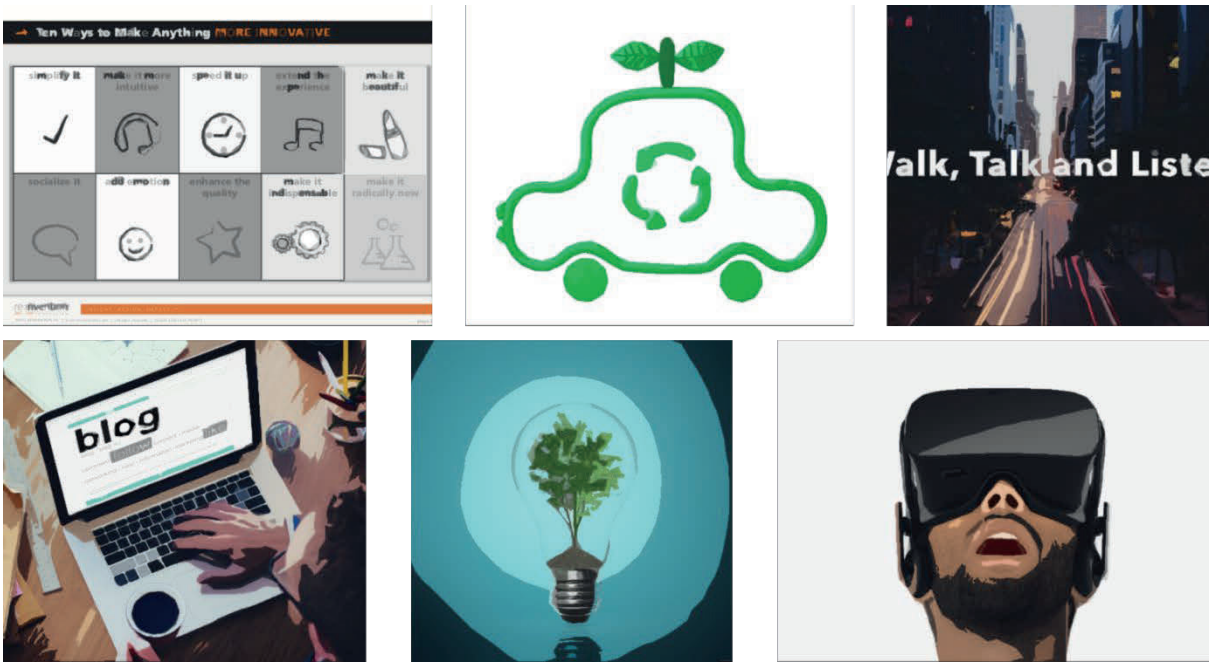

Fig. 5 *Sample images* selected from the Low (left), Med. (center), and High (right) constrainedness conditions. (*Images from Google Image searches have been manipulated for publication).*

Part Ib: Effects of constrainedness on the homogeneity of the set of inspiring images

After all the students had selected five images as sources of inspiration, we studied whether the images stemming from each condition varied in level of *homogeneity*. The entire pool of images was sorted blind to the condition by two coders into a number of categories by content similarity. This led to categories containing one to ten images.

To account for the Poisson distribution of the dependent variable (count data), a GzLM Poisson regression was run to predict category size based on constrainedness condition. With Low as referent, the Med. category significantly predicted category size $\chi^2(1) = 7.89$, $p = .005$, but the High category did not reach significance, $\chi^2(1) = .22$, $p = .64$. Switching the referent category to High similarly showed that the Med. category significantly predicted category size, $\chi^2(1) = 5.28$, $p = .03$. This result shows that the images selected in the Med. constrainedness condition were *significantly more homogenous* (i.e., images were sorted in relatively larger categories) than the other two groups, see Fig. 6. The effect was, however, driven by the largest group of images (a category of ten images very alike, mainly from the Med. constrainedness condition).

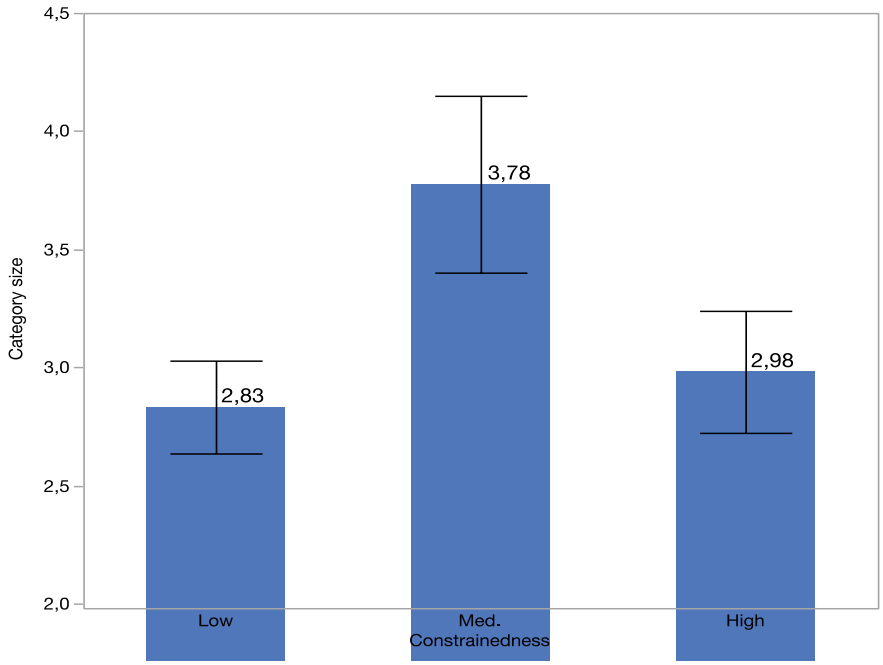

Fig. 6 *Mean category size in the image sorting task by level of constrainedness*

Part IIa. Effects of constrainedness on images being selected as inspiring by a new group of participants

After the image selection, new groups of students, who had not seen the images, were given a Low-Med.-High image set (15 images in total) and asked to select for a final set the five images they found most inspiring. The groups selected blind to condition. A logistic regression analysis was run to test if the constrainedness level of the individual image predicted subsequent image selection. The model was overall significant $\chi^2(2) = 10.91$, $p = .004$, Nagelkerke $R^2 = .07$. With the referent category Low, the Med. ($p = .002$, odds ratio=3.35) and High ($p = .03$, odds ratio=2.38) categories significantly predicting image selection. With the referent High, the Med. category did not significantly predict image selection ($p = .33$, odds-ratio=1.41). The results indicate that the images derived from the Med. and High condition were judged as being *inspiring* by the new group of students significantly more often than images from the Low condition.

Part IIb. Effects of constrainedness on the number of ideas generated by a new group of participants

New groups of students were asked to ideate for five minutes using a complete set of Low, Med., or High level of constrainedness images counterbalanced for ordering. Idea generation was recorded per participant and a repeated measures GLM, with group affiliation set as a between-

subject factor, showed a significant within-subject effect for constrainedness, $F(2, 56) = 3.24$, $p = .047$. Images from the Low condition led to a mean of 2.9 ideas per participant, while the Med. and High constrainedness images led to identical idea counts per participant, i.e., 3.3 ideas. Within-subject contrasts showed a significant linear $F(1, 28) = 5.02$, $p = .04$, but insignificant quadratic effect $F(1, 28) = 1.57$, $p = .22$.

Discussion

Three distinctly different inspiration search strategies

Our experimental results illustrate a strikingly diverse, and quite distinct, set of inspiration search strategies and subsequent effects on inspiration and ideation resulting from the three constrainedness conditions. This is particularly noteworthy given the fairly subtle experimental manipulation where adding a few key constraint words in the formulation of the creative design task seemed to make a large difference on both individual search behavior and later inspiration selection. As might have been expected, the availability of more constraint keywords with higher levels of constrainedness in the design task prompted a linear increase in search string query length. It is, however, notable that the variance in search string queries was limited across conditions (from 1.9 to 2.7 words on average) compared to the number of available constraint keywords in the design task formulation (from one to 13 main keywords). Even so, for the three constrainedness conditions, distinct search strategy patterns and subsequent effects emerged.

Low constrainedness: Divergent search

The condition with the lowest degree of constrainedness (Low) in the design task formulation showed a pattern with a large number of quick and primarily divergent searches without much usage of design task keywords throughout the process. We label this strategy *'Divergent search.'* The very few search strings that made heavy use of design task keywords would be conducted early on and abandoned entirely in the second half of the search. In the search results, only a few images would be clicked for further inspection. The search strategy ultimately led to a rather heterogeneous set of inspirational images, but also a set that to a lower degree would be selected as inspirational by others, inciting fewer ideas in the group ideation session.

Intermediate constrainedness: In-depth, on-task exploration

The intermediate constrainedness condition (Med.) showed a rather different search strategy pattern, which we label '*in-depth, on-task exploration*.' Here, we note what may be characterized as slow, effortful, in-depth search iterations with correspondingly few overall search queries that mainly consisted entirely of words from the design task, especially in the first half of the search (but also with a number of searches with no use of task keywords later on). These search results were carefully screened, with more individual images clicked for further inspection per search, albeit without evidence that the search would continue further downwards on the search result page than the other two conditions. It is noteworthy, and perhaps surprising, that the Med. group would display such continued effort on the search results—even beyond the High group. We speculate that an explanation might be that the participants in the Med. group would consider their search queries *near-optimal*, or even exhaustive, given the search utilization of most constraint keywords in the design task formulation, possibly leading participants to presume that any desirable sources of inspiration should be available among the search results.

This interpretation can be further supported through Perkin's (1994) concept of Klondike spaces based on the fundamental principle "Gold is where you find it" (p121). This means that in a search process, "although you can look in more likely and less likely places, you have no reliable strategy that will lead you to the gold," so "You have to invest considerable search in a relatively clueless realm" (p122). With regard to the Med. constrainedness group, their dedicated effort to keep using the keywords from the design task formulation in the inspiration search might be explained by reference to Perkins' conceptualization of the 'oasis problem,' which says that "regions of payoff or even promise are hard to leave […] Even if a rich area becomes nearly mined out, it's tempting to stay and rework it. After all, when will one really find another?" (ibid.). This means that the Med. group might perceive their individual search queries as an 'oasis of false promise' given the built-in bias of reluctance to leave and begin to type in new search terms in Google Images. Conversely, the Low constrainedness group might be facing Perkins' 'plateau problem' where "search processes often cannot tell in what direction to search for increasing promise or payoff" (p124). Perkins' point, which is highly relevant to all three constrainedness groups, is that "creative systems discover adaptive novelty [here: inspiring images] through search. Each of these characteristics of a Klondike space works against the discovery of adaptive novelty. The sheer rarity of adaptive novelty makes searches long and rewards sparse" (ibid.). It is notable that the sets of inspiring images in the Med. constrainedness condition were more homogenous than in the

other conditions but were still selected often by other students as inspiring, leading to a high number of ideas in the group ideation sessions. One possible explanation for this might be an image familiarity effect, since familiar pictorial images seem to increase the variety (and potentially also the number) of design ideas generated in a task (Purcell & Gero, 1992).

High constrainedness: Flexible bracketing

The highly constrained condition (High) displayed yet another strategic approach, which we call '*flexible bracketing.*' As in the Low condition, search iterations were quick and numerous, containing a balance of search types (a mix of search queries with and without the usage of design task keywords), both early on and later in the process, leading to few image clicks per search. Unlike the Low condition, the high-paced search seemed to not be caused by a lack of appropriate task-related search terms, since these would be employed both early and later. The higher number of available keywords compared to a standard Google Image search entry may in effect have caused what Perkins (1994) called a '*combinatorial explosion'* of possibilities where keywords could continually be re-combined. Related to his idea of a Klondike 'rarity problem,' this means that the possibility of making "innumerable configurations" in a search activity tends to "generate far too many combinations to be explored by exhaustive search processes in reasonable periods of time" (p122).

Here, the resulting inspiring images were heterogeneous (unlike the Med. condition), often selected by others as inspirational, and led to a high number of ideas in group ideation (similar to the Med. condition). The heterogeneous nature of the images in the High condition and the frequent use of random search terms is a bit surprising. The present results do not lend support to predictions that a highly constrained search space will lead to a restricted sample of inspirational sources. On the contrary, our results show that the high number of available search terms in the design task with a High level of constrainedness allowed for *flexible* search behavior and with a *breadth* of searches. This importance of breadth mirrors central findings in the above study by Harms et al. (2020).

A potential preference for three-four word queries

One possible explanation for the slow and continued effortful search strategy deployed in the Med. constrainedness condition might in part be related to heuristics (and biases) resulting from normal Google search behavior. We have not been able to obtain data on search query length specifically for Google Images; however, a standard Google search string entry contains one to

seven words with approx. 3.32 query terms on average (Taghavi et al., 2012). Interestingly, Google has a "much higher average than most other search engines and was thus the cause of an imbalance in the overall average of 3.08 terms per query" (p166) among all search engines analyzed. The average of the outstanding search engines was 2.74 terms so "Google users have a tendency towards longer queries" (ibid.). It is possible that the finding that the Med. group makes fewer, but more in-depth searches may in part be caused by the fact that the Med. group had available to them from the design task a number of constraint terms similar to a so-called 'standard' Google search. The participants in the Med. condition might have 'dug deeper,' because the Med. constrainedness they experienced matched very well their typical Google search entries. We speculate that the availability of the said number of keywords in the design task may have sparked an individual assumption that no further search strings were needed given the near-exhaustive use of terms in search string entries, akin to a type of framing effect (Kahneman & Tversky, 2000; A. Tversky & Kahneman, 1981). Such a situation could possibly have resulted in the observed slowing down of search iteration and in part have led to the more homogenous set of resulting images.

Managing search terms to enter into a 'sweet spot'

As opposed to recent work in game design where an inverted U-shape relationship between a player's choice of game difficulty and motivation has been demonstrated (Lomas et al., 2017), the present study does not conclusively establish a similar, unequivocal relationship between constrainedness and perceived inspiration. As stressed by Teigen (1994), there have over the years been several instances of suggested inverted-U relationships to help explain any number of topics, not least in psychology, and so we acknowledge that one should tread lightly. These concerns notwithstanding, we argue that our findings do lend some support to the idea of a 'sweet spot' of constrainedness in inspiration search.

Participants in the Low condition seemed to deploy a torrent of divergent searches. This might be interpreted as *adding random constraints* to the search activity in order to enter into a 'sweet spot' of constrainedness from the underconstrained (left) side of the inverted U-curve. On the other hand, while the High condition included longer search queries, these remained rather short (2.7 words on average). In this respect, *bracketing of constraints,* akin to the practice of expert engineering designers working with over-constrained design tasks (Onarheim, 2012b), occurred between searches with individual search strings making use of only a small subset of constraints in the form of the keywords stated in the design task. This moving toward the inverted U-curve

from the right-hand side suggests that the Med. condition might, to some extent, be seen as a 'sweet spot' of constrainedness in terms of inspiration. Even so, it is notable that the Med. group's slow and effortful, in-depth search behavior led to an image set that was more homogenous than the other two conditions. This invites the interpretation that a *subjectively perceived* 'sweet spot' of constrainedness might in effect cause *less than optimal* search behavior and image selection insofar as a diversity of sources of inspiration is often desirable (Eckert & Stacey, 2000; Gonçalves et al., 2014; Mougenot et al., 2008). This underlines the need for more insight into inspiration search strategies and moving beyond what a person might feel as immediately comfortable in terms of constrainedness in a given design task. Such new insights will also be beneficial for future work on a more detailed and comprehensive demonstration of what we interpret as an inverted U-relationship between constrainedness and perceived inspiration in inspiration search strategies in design.

Limitations

Although what we present here is a rather comprehensive study, it has some limitations. The selected participants (n=39) were all high-school students following a business design course so we cannot estimate to what extent the search behavior observed might apply to professional designers (see Koch et al., 2018). The design briefs, including the number of keywords, were formulated in collaboration with the experienced course lecturer, who vetted each based on the Med. constrainedness category as very typical for a business design task aimed at high-school students undertaking a design education. We can thus only speculate if these levels of constrainedness may be generally applicable, including to professional design, and how they may relate to more advanced design briefs in experimental research, which often emphasize polysemy, innovation, and communication (Sosa et al., 2018). While we have chosen (primarily) quantitative measures, it would be interesting to augment these with more qualitative data, e.g., post-hoc reflections. Since coming up with a complete business design is rarely done individually throughout the entire creative process, it would be beneficial to also study how small groups of design students search for inspiration together. Finally, we appreciate that searching for inspiration will often last much longer than the 15-minutes interval studied here. As Jarmusch (2013) points out, creative professionals such as artists and designers will often find themselves in a permanent inspiration-search mode. This insight is echoed by Mougenot et al. (2008), who, in their study of expert car designers, found that "inspiration does not fit the constraints of a '9-to-5-job' but is rather a continuous, and almost unconscious, activity" (p. 335-336).

Implications for design research and future work

Until now, there has been surprisingly *little scientific knowledge* of how *inspiration search strategies* are carried out in response to varying levels of *constrainedness* in a creative design task. This is true for the general design research community as well as the specialized field of design education. In this paper, we have shown how search strategies not only target information but *frame the entire design process* in continuation of Schön's work on problem framing (1983, 1992b). Also, we have argued that the idea of a *'sweet spot'* of constrainedness (Biskjaer, 2013; Onarheim, 2012a) might also be relevant to a person's individual level of *perceived inspiration* but with the caveat that this perception might be sub-optimal in terms of efficiency of search behavior. The three distinct inspiration search strategies that we have discerned—*divergent search* (low), *in-depth, on-task exploration* (med.), and *flexible bracketing* (high constrainedness)—are relevant to design researchers as a launch pad for additional work on how to search for and select among the plethora of potential sources of inspiration online for use in a design process. These inspiration search strategies are also relevant to professional designers and, especially, design educators, who often devise and solve various design tasks in which obtaining potent sources of inspiration as efficiently as possible is critical; not just for the purpose of working efficiently but also as a way to ensure a significant learning outcome. By giving all design students—from business design over interaction design to engineering design—more insight into the careful use of inspiration search strategies as a core design skill, design educators might help students avoid the inexpedient, and very frustrating situation where they passively "rely on inspiration to hit them whilst they ponder a blank page" (Bruton, 2011, p. 329). Jarmusch (2013) might be right that one should only select sources of inspiration that "speak directly to your soul"; however, the difficult question is still how to find them. In this study, we chose Google Images due to its predominance as a generic search tool. For future work, it would be interesting to also study other online resources such as Instagram, Flickr, or YouTube, since this would shed new light on videos as inspiration in addition to the still images studied here. Finally, it could be relevant to also deploy a more visually-oriented design task.

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13 Article three: Kinds of 'Moving' in Designing with Sticky Notes

Abstract

We explore why and how designers move sticky notes by conducting a visuospatial analysis of sticky note moves as they unfold across time in design practice. We find that individual sticky note moves have a relatively stable sequential order containing strategies for directing and maintaining shared attention. Further, three kinds of sticky note movements are found pertaining to the formation of associations, categories, and partial solution structures. Moving sticky notes provides support for conceptual design centrally through attending to the proximity between notes across time in gesture and placement. Proximity serves as a marker of associative strength and category centrality, and also plays a key role in the structural build-up of relationships between objects.

Introduction

The type of design situation that occupies us in the present paper is commonplace and mundane: A group of designers is positioned in front of a whiteboard already populated with filled-in sticky notes, engaged in a creative process to advance a design project. A designer grabs one of the notes, removes it, and re-affixes it in another location on the board.

Below we explore how and why designers move sticky notes. Specifically, our interest hones in on trying to understand the peculiar and perhaps puzzling practice where the designer uses the sticky note's flexible repositionability by moving an already filled-in note (typically containing a couple of words) to another spatial location on the board. When viewed in isolation, sticky note moves may seem like a puzzling design practice– what could be the purpose of moving that note a few inches?

The study of how specific forms of representation or materials support design has been important to design researchers in advancing our understanding of design practice and cognition (Cash & Maier, 2021; Ball, Christensen & Halskov, this volume). Several studies have explored visualization and prototyping (Chafi, 2014; Pei et al., 2011) in order to understand how representations may provide external support for design cognition (Scaife & Rogers, 1996; B. Tversky & Suwa, 2009), for example, to resolve uncertainty (Cash & Kreye, 2017; Christensen & Ball, 2019). The ubiquitous sticky note represents one of the most commonly deployed ways of visually supporting design yet remains one of the least studied and understood (Ball,

Christensen & Halskov, this volume). Currently, we do not have an empirically qualified understanding of how sticky notes facilitate design processes. We know that sketching supports design cognition through the visual reinterpretation of ambiguous forms (e.g., Goel, 1995; Tversky & Suwa, 2009), and prototypes allow for processes of detailing, collaboration, and filtering the design space (Lim et al., 2008). However, it remains theoretically unclear what sticky notes offer, and we know little about how the proximate and relational repositioning of objects and words over time facilitates design progression. With this study, we aim to help further theoretically explicate *how* visualization plays important roles in designing with sticky notes.

By honing in on the trademark quality of sticky notes—the flexible repositionability offered by the strip of adhesive on the rear side—we ask what the relative repositioning of words and sketches on paper offers to a design process.

Analysing sticky note moves poses a challenge to the standard research methods used in design cognition. Often, no new information is explicitly added by moving a note, and the nature of such moves renders the activity short on verbalization that might explicate their purpose. Consequently, it is necessary to draw into the analysis the visuospatial layout and content of the rest of the board along with the situated and embodied interaction of the design team to understand the sequential order and kinds of sticky note moves. This aligns well with a new and growing body of practice-based design research which focusses on the study of embodied, situated, and multimodal design practices often conducted in natural settings (Ball & Christensen, 2018; Comi et al., 2019; Lloyd, 2019; Luck, 2012a; Matthews & Heinemann, 2012). A few recent papers have focused on social practices in using sticky notes as design artifacts (Due, 2018; Matthews, 2009; Matthews et al., in press; Nielsen, 2012), and others have focused on mundane kinds of cognition and reasoning (Livingston, 2008; Luck, 2012a).

This paper deploys a multimodal methodological approach to analyse sticky notes moves as a type of design activity. We aim to empirically explore and theoretically advance knowledge of *kinds of design moves* by giving primacy to a *visuospatial analysis* of observable design moves using sticky notes. First, we aim to uncover the situated sequential order of sticky note moves. Second, we will explore the different *kinds of sticky note moves* that help create new connections, combinations, and relations amongst sticky notes, and the visual strategies and processes used for their explication.

Theoretical background

Sticky notes as design material

Visual design materials are central to architects' and designers' professional vision, as these materials help the formation and articulation of their design intentions (Comi & Whyte, 2018; Luck, 2007, 2012a) and coordinate design activities (Luck, 2010; Rakova & Fedorenko, in press). Sticky notes are a particular type of design material, and how they feature in the course of design activities is underexplored within design research. The past decades have seen the emergence and popularization of the sticky note as a material to support a host of – mainly collaborative – design processes (Christensen et al., 2020). Unlike classical design materials mastered only over years of training in the studio, sticky notes are intuitive and require little training. As a medium, they are representationally flexible (allowing, e.g., for sketches and words), with words as the most common entry. Their small size and flexible repositioning invite wasteful, divergent productions of many disconnected concepts that are later moved around and brought together to create new, meaningful, structural wholes.

The most common use of sticky notes as a design material involves relatively short-term situational collaborative design processes where the group is positioned in front of a whiteboard, with each participant armed with a block of sticky notes. Over time, the board becomes populated with aspects and ideas (each written on a different note) related to the problem at hand, and with each note placed visibly in a non-layered manner on the board for all to see. The specific design method employed varies (e.g., mind-map, brainstorm, empathy map). Given the popularity and relative homogeneity of such collaborative sticky-notes-on-board design activities, it seems likely that they are experienced as supporting design progression in essential ways, where both novice and expert designers finding design value in their application (Ball, Christensen & Halskov, 2021).

As a visual support tool for design, sticky note techniques deploy the graphical mapping of concepts represented as text or visual elements in order to organize information visually (Bresciani, 2019). Using sticky notes inherits some of the advantages of using other types of visuospatial displays, including how they provide the ability to use Gestalt principles to support cognition (Hegarty, 2011). Gestalt psychologists emphasized that organisms perceive entire patterns or configurations (gestalts), not merely their individual elements. In perception, elements tend to be grouped together if they are part of a pattern which is a 'good gestalt' ('prägnanz'), for

example, in their simplicity, order, balance, symmetry, or coherence, also known as the *principle of perceptual organization* (Kosslyn, 2006). Good gestalts are aesthetically pleasing, as also found by theories of perceptual fluency (Alter & Oppenheimer, 2009; Reber et al., 2004). The Gestalt 'Law of Proximity' states that spatial proximity may be used to group and organize conceptually related information, even for abstract information. Similarly, the utilization of colour or graphical devices (such as lines and circles) may also serve to illustrate proximity (Wickens & Carswell, 1995).

In sticky note sessions, the principles of perceptual organization may serve an essential function in allowing a vast number of initially disconnected elements (visual disorder) to be dynamically moved into emergent clusters and groups (creating visual gestalts and order).

Design making and thinking

Designing may be described as a process that transforms initially disparate elements (*parts*) into new, aesthetic, and relationally structured configurations (*wholes*) through the coevolution of problem and solution (Dorst & Cross, 2001; Wiltschnig et al., 2013). In this process, designers effectively move around in two spaces. One is an embodied, materially messy space of making things, populated with objects and parts that are seen by eyes and are combined, built up, and broken apart by hands (Luck, 2018). The other is a cognitive space, where possibilities are explored and created through framing, constraining, and restructuring (Cross, 2011; Newell & Simon, 1972; Simon, 1969).

In design practice, designers seem surprisingly capable of merging these two spaces by *thinking-in-the-middle-of-making-things* (Livingston, 2008), as illustrated in practice-based studies (Luck, 2012a) and the literature on situated cognition (Ball & Christensen, 2018; Hutchins, 1995). Theoretically, *thinking* and *making* approaches tend to study design moves in somewhat different ways, as will be reviewed below.

Design thinking moves

In the early days of design research, design was conceived as a cognitive search in a space of possibilities (Newell & Simon, 1972), bounded by cognitive capacity limitations (Simon, 1969). A 'move' was considered the change between two states in the problem space through the application of an operator. Moves were considered to be hypothetical cognitive steps taken by the problem solver in a space of possibilities, with linear progress prohibited notably by cognitive capacity limitations and the nature of the problem. Following in this tradition, Goldschmidt (1995,

p. 195, 1997) characterized design moves as ‘a step, an act, an operation, which transforms the design situation relative to the state in which it was before the “move”’.

Aligning with the definition of a design move as the application of an operator that changes the current state, a critical class of design moves pertain to the combination, building of a structural relation, or association of objects (e.g., sticky notes) in the design space. Such moves (operations) may be considered a low-level kind of cognitive activity (often occurring outside cognitive awareness), which may be studied by exploring the shifting spatial relations among elements. The type of design moves occupying us here considers a design move to be perceptible through a study of design behaviour (Chiu, 2003) instead of being constituted solely as a discursive move that may not produce any physical change (Trousse & Christiaans, 1996). Thus, we focus on the micro-operations connecting visual objects instead of studying design moves involving mainly higher-order cognitive functions such as framing (Paton & Dorst, 2011) or reinterpretation (Stones & Cassidy, 2010). Through the study of situated object interaction, we will observe the role of sticky note moves that combine notes and build up structure, as well as moves that relate notes to other notes through mere association. We build on the approach of Dove et al. (2018), who investigated how sticky notes support categorization qualities associated with semantic long-term memory and showed how sticky notes may be considered nodes in an emerging semantic network.

In design cognition research, the theoretical distinction between associations and structural relations has been investigated and related to expert behaviour. Thinking in terms of structural relations between parts and elements constitutes a central component of how expert reasoning differs from novice reasoning, whether in design (Cross, 2011), chess (Chase & Simon, 1973), or the categorization of physics problems (Chi et al., 1981). Thinking about structural relations is a deliberate and controlled type of cognitive activity, drawing heavily on the capacity of attention span, executive functions, and working memory (WM), that is sometimes tied to expert reasoning. Conversely, novice reasoning has been described as relying on superficial similarity or the mere associations between elements, drawing centrally on associative memory through automated processes undemanding of WM resources. The current understanding in cognitive psychology is, however, that the two forms of similarity are mutually dependent. Associative memory (Anderson & Bower, 1973) and superficial resemblance can play an essential part in supporting the build-up of relational structure. For example, analogical reasoning implies a conceptual mapping and transfer of structural relations whereby knowledge from a base domain is mapped onto an objective from another (target) domain (Gentner, 1989; Gentner & Markman, 1997). It has been

shown that the process of retrieving analogies relies heavily on quick, parallel, and automated associative similarity (Forbus et al., 1995; Holyoak & Koh, 1987) before a subsequent WM-taxing process of mapping and transfer may take place (Markman & Gentner, 2005). Therefore, associations may play key roles in forming new structural relations and are important for novices and experts alike. A current example of the close interplay between association and creating structural relations comes from dual-process theory. Dual-process theory's premise is that there are at least two types of cognitive processes: Type 1 is intuitive, associative, and fast, and Type 2 is analytical, deliberate, and slow (Evans & Stanovich, 2013). Designers typically move between such associative and analytical periods as they explore and refine their concepts (Steinert & Leifer, 2012; Wiltschnig et al., 2013), and most design tasks appear to involve some interaction between these two types of processes (Badke-Schaub & Eris, 2014). Ideation is often characterized by rapid bursts of associative idea generation (Type 1), interspersed with deliberate, reflective periods of interpretation and structural build-up of design elements (Type 2) (Ball et al., 1994; Cash & Maier, 2021; Gonçalves et al., 2016). While we do not usually refer to associations as 'design moves', we here draw attention to associations as an ordinary and meaningful way to connect and relate objects that help establish associative networks of potential importance as a foundation for building up structure.

Design making moves

A different approach to design moves is attributable to Donald Schön (1983; Schön & Wiggins, 1992), who famously described how designing involved repeated micro-episodes he labelled move 'experiments', wherein the designer engages in a conversation with the material. Schön described in detail the 'kinds of seeing' involved in the designers' professional 'vision' (Goodwin, 1994) in these sequences, where the consequences of a move would be explored. Schön & Wiggins (1992) distinguish several kinds of seeing that perform distinct functions in design but all draw on visual apprehension. They may involve seeing spatial gestalts that may guide their thinking in terms of object relations. Episodes of seeing-moving-seeing often entail perceptually discovering emergent but unintended and unexpected consequences of design moves.

Much of practice-based research builds on the concept of 'professional vision' (Goodwin, 1994), whereby professionals 'see' and 'articulate' events and visual objects in their perceptual field. Through video analysis of professionals in action, Goodwin studied socially situated activity, including interactions with visual objects, and identified three practices of 'seeing' and 'articulating': coding, highlighting, and producing visual representations. In this tradition, it is

notable that a 'move' is a process involving the perceptual act of 'seeing' by applying professional vision to the design situation through 'seeing-moving-seeing' sequences. With Schön, we thus gain a language for the process of 'design moves' where designers engage in material-making. We note that not all visually available objects can be attended to at any one time. In this respect, Whyte et al. (Whyte et al., 2007) made the distinction between 'fluid' (open and unfolding) vs. 'frozen' (unavailable for change) visual objects. While fluid visuals seemed to support activities relating to collective sense-making and exploration, frozen visuals mainly enable keeping records of design decisions and mobilizing consensus. In the design process, objects, however, do not become frozen or fluid in any absolute sense, but, dependent on the situation and the task at hand, may become unfrozen or refrozen, with the specific pattern playing essential roles in setting the tempo and direction of design activities. In offering primacy to movement and change, the concepts of freezing and unfreezing may be used to describe and understand how the complex set of visually available objects in sticky note sessions may iterate between stable and active positions.

Methods

Data

We analysed three select episodes of naturally occurring collaborative sticky note interaction from datasets previously collected. Example 1 stems from a study of sticky note interaction in student design teams with facilitated brainstorming and clustering activities (Abildgaard, 2020; Christensen & Friis-Olivarius, 2020). Examples 2 and 3 stem from a dataset of a professional design team working for a European car manufacturer, which has previously served as a shared dataset for the Design Thinking Research Symposium 11 (Abildgaard & Christensen, 2017; Christensen et al., 2017)[4]. Example 2 has been partially analysed for how sticky notes support semantic memory in a previous study (Dove et al., 2018), and we extend the analysis here to focus on the kinds and structure of design moves in a more fine-grained analysis. We refer the reader to descriptions of the datasets and methods in the previous publications. Each example is selected based on a thorough screening and initial coding of the two datasets, where interaction with sticky notes occurs. The first dataset (from which example 1 is drawn) consists of moves with 867 sticky notes. The second dataset (from which examples 2 and 3 are drawn) consists of moves with 160 sticky notes in the two design sessions. To give an idea of the frequency and commonness of

[4] We are grateful to the designers in the DTRS11 dataset for allowing us to re-analyze the dataset for the present purposes.

sticky note moves in our data, the design team, in example 1, moves 15 sticky notes a total of 40 times during a 6 minute-and-30-second-long convergent episode. Our analytical interests extend to the visual relatability of individual notes through their movements to other notes on the board. We focus our selection of examples on convergent processes such as categorization and clustering activities, and ignore for the present purposes the divergent or ideation phases where the sticky notes were first filled in.

Analytical approach

Given that we will be zooming in on the situated practice of designing (Nicolini, 2009) and focusing on micro-episodes of individual sticky note moves, we are operating at very short-term timescales in design (Shroyer et al., 2017). To analyse the kinds of sticky note moving and their sequential order in design, we draw on the methodologies of ethnomethodology (EM) (Garfinkel, 1967) and conversation analysis (CA) (Sacks & Garfinkel, 1970) (henceforth EMCA) and combine this inductive approach with the methodological flexibility of cognitive psychology (de Ruiter & Albert, 2017) and an ethnographic approach to design research (Ball & Christensen, 2018; Button & Sharrock, 2000; Matthews & Heinemann, 2012). We rest our analysis on video recordings of naturally occurring interaction (Heath et al., 2010).

One of CA's basic analytical strategies is to locate the problem that certain observable talk and doing might be a solution to (ten Have, 2007, p. 16) by attending to the action's sequential order on a turn-by-turn basis. Our theoretical assumption is that designers working with sticky notes, more specifically *moving* sticky notes, seek to create order and connect parts into wholes by organizing and associating sticky notes. In this case, we are zooming in on what designers are doing, saying, and not-saying at a particular moment, and analysing how and in what ways these practices are the solution to the problem of creating an order. The sequential order of the social practice of moving is analysed in each example and illustrated with visual and verbal transcriptions inspired by the Jeffersonian system (Jefferson, 1984). We aim to describe the overall interactional order of design moves with sensitivity for the situated-embodied interaction and the material-semiotic environment.

Our microanalytic concerns begin with the transcription of the video recordings informed by video ethnography (Heath et al., 2010) and the branch of EMCA that focusses on multimodal interaction (Deppermann, 2013; Goodwin, 2013; Streeck et al., 2011). Our approach is inspired by similar approaches within EMCA studies of the here-and-now details of situated social interaction

(Heinemann et al., 2012; Luck, 2010; Matthews & Heinemann, 2012). Since our primary focus of the analysis is not verbal utterances but the moving activity itself, our analysis takes its beginning at the moving of a sticky note from one place to another. This entails that moves, like turns at talk and actions, are regarded as projectable, in that designers, given their professional vision (Goodwin, 1994), can see trajectories of moves as they unfold (Hindmarsh & Pilnick, 2007). The move of a sticky note may initiate a line of moves, which reconfigures the sticky notes and their relations and makes the designers able to recognize the current design/problem as being closer to a new coherent configuration. Thus, the organizing principle of the analysis and the transcription rests on the embodied actions of the participants and the objects in use, an approach similar to the study by Comi et al. (2019, p.102), which concentrates its analysis on the visual objects in use and not the verbal utterances. The transcription is centred on the timing of each move of a sticky note as the organizing principle. To make the visualizations of each move in the analysis as accessible as possible for the reader, we use still frames from the video data and draw simplified illustrations thereof. The illustrations show the organization of the sticky notes on boards and visualize the moving of each sticky note illustrated with a number for the order of each move. We show the time it takes from moment the sticky note is lifted from the board, moved, and placed again with time measured in seconds (e.g., [2.9]). Each illustrated frame has a timestamp (hh:mm:ss.s). Alongside the visual illustration of the moving sequences, we transcribe parts of the verbal actions where they are sequentially connected to the embodied actions of the moves. Acknowledging the challenges for multimodal transcription exceeding talk, body, and gaze (Mondada, 2018), we aim at a precise transcription of the details relevant for this study, in particular touch, moves, and talk, and their sequential order. In some cases, we have also included animated images from the video data in a simple form (GIF) to illustrate certain moves or gestures in detail[5]. We aim to design a visual and verbal transcription of the here-and-now details of the moving activity with sufficient details for the readers to grasp the process of the interaction.

Analysis

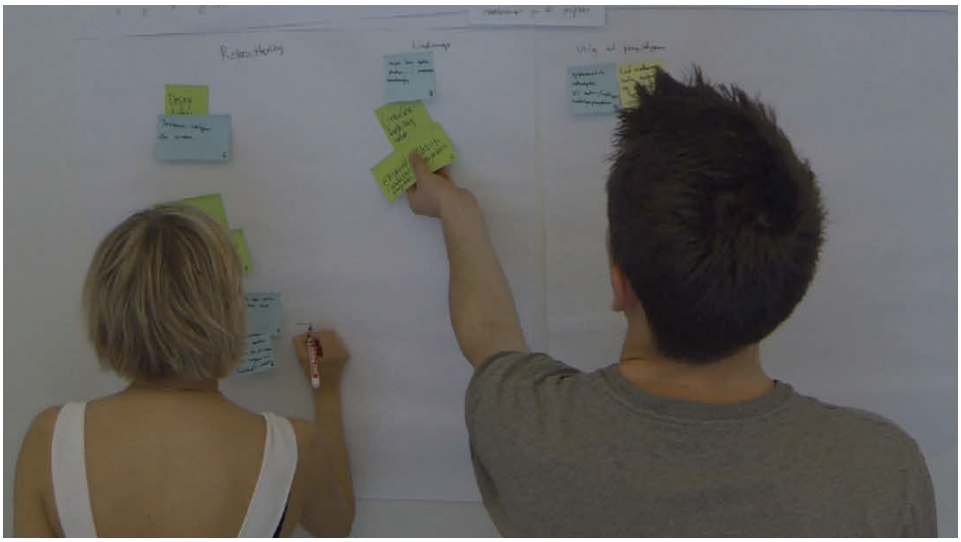
We have chosen three examples derived from the abovementioned datasets to illustrate how design teams collaboratively move sticky notes and why these moves make sense in their particular design processes. The three examples have been chosen in an abductive analytical process where we have screened the datasets for sticky note moves and interesting empirical

[5] Since the print version of this manuscript cannot display animated images (GIF), the print version contains three images to illustrate the moves and gestures.

findings, discovered blended and distinctive types of moves, and after detailed microanalysis of candidate extracts, selected and examined the three examples below in a theoretical context, where the observed design activity is accounted for rather than predicted (Svennevig, 2001). The three examples which we analyse below are not an exhaustive list of 'kinds of moving' but are the most prevalent, repetitive, and legible examples in our datasets of design activities with sticky notes.

Example 1

We begin our analysis of kinds of moves by looking at a student design team of three working in a convergent design phase after a facilitated brainstorming session on developing a strategic design proposal on recruitment of clients for a credit card company. The design team had selected several sticky notes from a previous brainstorming session, which have been placed in categories below three headlines (see frame 1, Figure 1).



Picture 1. *Two of the team members at the whiteboard moving sticky notes.*

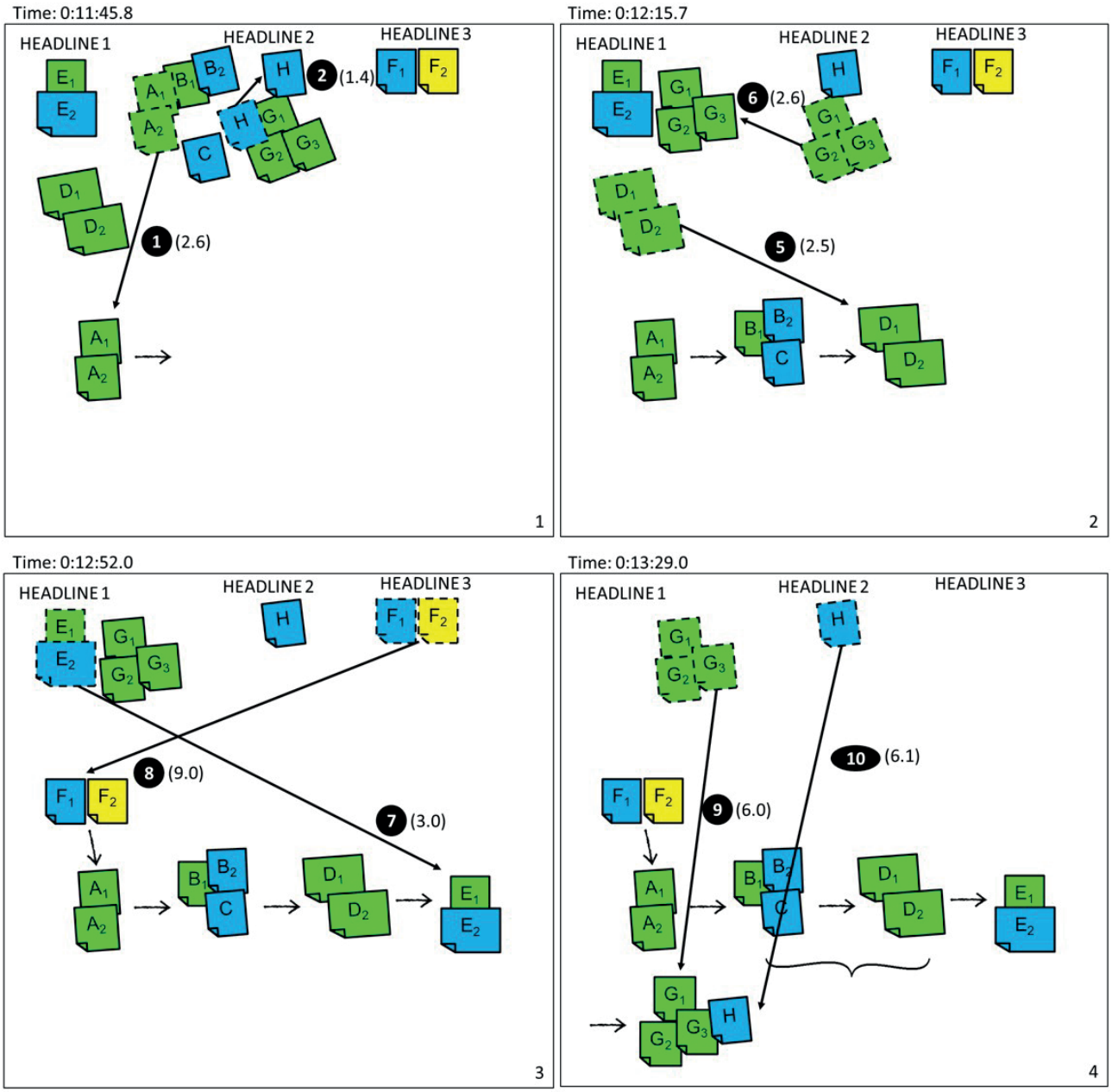


Figure 7. *Moving sticky notes from categories with headlines to flowcharts.*

We enter the data when the design team begins to move the sticky notes from the headlines downwards on the whiteboard. The moves result in a flowchart representing the necessary steps and decisions in a process (frame 4, Figure 1). Creating the flowchart is not something the team has discussed prior to the moving of the sticky notes. It is something that happens during the process of moving and is never verbalized as a specific goal. As we see in the first frame in Figure 1, sticky notes A1 and A2 are moved to the bottom of the whiteboard (move 1, [2.6]). The person moving the sticky notes, Karen, draws an arrow after placing the note to mark something to follow. In this excerpt, the trajectory of the move becomes immediately apparent to the co-participants as

the first pair of sticky notes are moved and now visually represent a sequence of steps in the flowchart that is beginning to take shape. The moving of sticky notes from a categorical representation to the developing flowchart continues in the following turns and comes to an end when all the sticky notes have been reorganized to visually represent a flowchart (see Figure 1). We notice a longer pause between the moves in frame 3 (move 7, [3.0] and move 8, [9.0]), where the flowchart at this point consists of four steps/sequences. The design team takes some time to move and place the sticky notes following an organizing principle where all parts must fit into the flowchart. However, some sticky notes (F1, F2, G1, G2, G3, and H) are still left below the headline categories. Next, the team moves the last notes from the remaining categories to fit into the flowchart at the bottom of the whiteboard. They move one cluster of notes to the front of the flowchart (i.e., move 8) and cluster the leftovers (G1, G2, G3, and H) as if to fit them into a final sequence of the chart (See move 9 and 10, frame 4, Figure 1). The notes G1, G2, G3, and H did not belong together when they were placed below the headlines, and none of the team members explicitly argues for a connection between the notes, nor does the content of the notes directly interrelate. However, H is stuck onto the G cluster in the final move, and now all sticky notes fit into the flowchart representation.

When we turn to the linguistic form of the utterances accompanying the moves, we notice how the turns are formatted around each move in a way that displays attention to an expected course of action. First, we focus on how Karen begins to move the first pair of sticky notes while also reading aloud the content of each note, enabling the two other members to locate 1) which note is being moved and 2) what the written content on the note is (Excerpt 1). As we observe in the following examples, the reading aloud of the sticky note prior to the move or parallel to the move is part of the sequential order of sticky note moves.

Time: 0:11:42.7

(1) Karen: Der' en ansøgningspulje↑

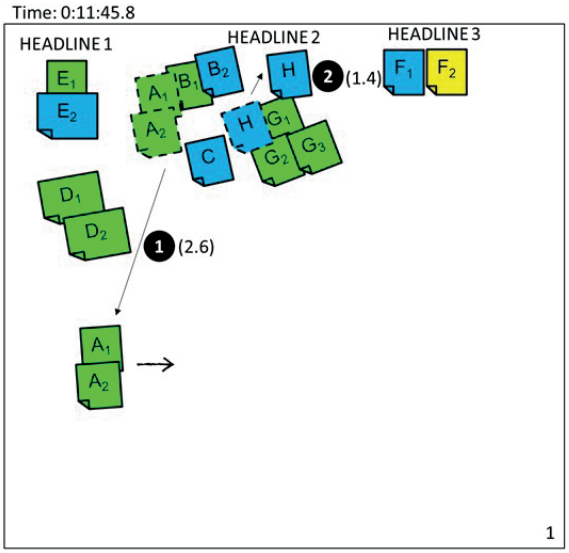
there's an application pool

(0.7) ((move 1))

(2) Karen: De- de- der ansøger man til ↓

that you apply to

(3) Karen: ((draws arrow))



Excerpt 1. *Reading aloud and moving sticky notes.*

The first part (line 1) of the turn is produced with a rising intonation (indicated in the transcription by the upward facing arrow) and the second part (line 2) ends with a falling intonation (indicated by the downward facing arrow). This format indicates something similar to what Jefferson (1990) names as 'lists' in natural conversations, where the variation in intonation arouses the expectation of a listing of sorts (rising intonation) and eventually the ending thereof (falling intonation). In this example, the prosodic practice of 'listing' follows the moving and drawing in the interaction. At move 5 (Excerpt 2), the sequential order becomes more established.

Time: 0:12:05.7

(5) Karen: og så↑ så spiller man ↓

and then ((draws arrow)) then you play ((move 5))

(6) Mike: Sygt nok

crazy

(7) Karen: og så ↑ (1.8) og så er ↑

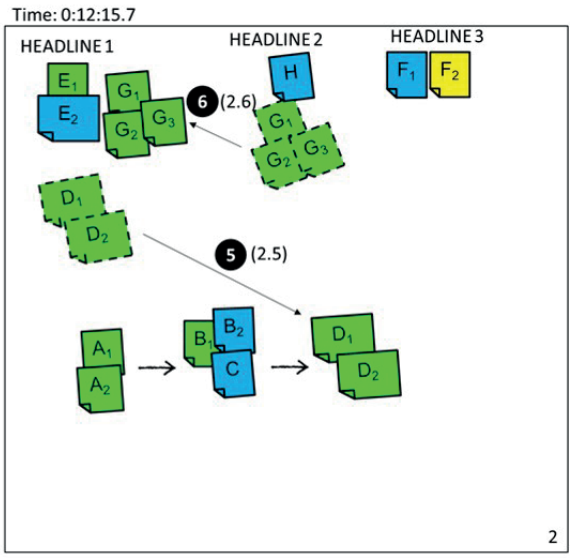
and then, and then ((points at E1 and E2))

(8) designmanden med til og

the design guy is part of and (.) ((draws arrow))

(9) og så ↑ vinder man ↓

and then you win



Excerpt 2. *Listing sequences in flowchart and moving sticky notes.*

Karen uses a '*and then'* with rising intonation to display to her co-participants that something is next up, a listing of sorts, after which the move is made. Karen then draws an arrow (line 8), and a falling intonation indicates the end of the move (line 9) and the new placement of the sticky notes. The order of moving in this example is as follows: 1) localization of note move by reading aloud, 2) moving note, 3) drawing of arrow, 4) localization of next move by reading aloud, 5) moving note, and so on until all sticky notes have been reorganized. In this example, the speech produced by Karen creates expectations for what comes next; another set of sticky notes will be moved from the categories at the top of the whiteboard and reorganized as a part of a sequence in the flowchart at the bottom. This example illustrates how the team moves notes in clusters and visually establishes and maintains an inter-note connection while reorganizing the notes. As we will return to in the discussion, this example shows how markings in the form of arrows between the notes being moved serve as a strategy to visualize causality and direction in a new emerging whole.

Example 2

This example is drawn from a dataset of a team of professional designers developing a concept for a workshop with lead users of specific car accessories. The notes on the board illustrate different elements of the workshop design, such as user personality traits, values, and habits, which have been developed during a brainstorming session and placed on the whiteboard in emerging categories. We enter the data when the design team is rearranging the sticky notes after the initial placement. In this example, we see how the design team is figuring out how to move and place two sticky notes in relation to the existing sticky note categories that have just been formed. Four categories have already been formed on the board, but some sticky notes are yet to be placed in their 'correct' location. In the example, we see the design team discussing the association between the sticky notes and the existing categories, which results in a row of moves relevant to 1) how one sticky note is associated to, but not part of, one category and 2) how another sticky note is not associated to the other categories (dissociation) and is thus placed in a new emergent category. The analysis begins with 1) moving to associate to a category.

The move follows an order consisting of several elements. Before moving sticky note A, Ewan, the project leader, reads the headlines of the four existing categories aloud to the rest of the team (Excerpt 3). While reading each headline, Ewan gestures by pointing at the corresponding sticky

notes ‘level of investment’, ‘personal traits’, ‘ability to connect’, and ‘expertise’. The three moves before the sticky note A is placed happen parallelly with Ewan stating that the note ‘is somewhat connected here’ (line 4, Excerpt 3). The note is moved closer to the left-hand category of notes, as illustrated in Figure 2. After three moves slightly varying the spatial proximity to the category, taking less than 3 seconds in total, the sticky note is placed relatively close to the category to the left, but not symmetrically aligned with or close enough to visually represent being a member of the category (See Figure 2 or GIF 1 for visualization). This example illustrates how the moving of the note is sensitive to proximity to other notes. The (correct) distance between the note and the category is the driver behind the move; if the note stayed at the original placement, it would be too far away from any categories to indicate category membership or association. However, if the note is moved too close to the category to the left, it would be wrongly placed since it is not a member of the category entirely but only ‘connected’—proximity matters in this case (Dove et al., 2018). Thus, the new placement of sticky note A indicates an association (not membership) to the left-hand category.

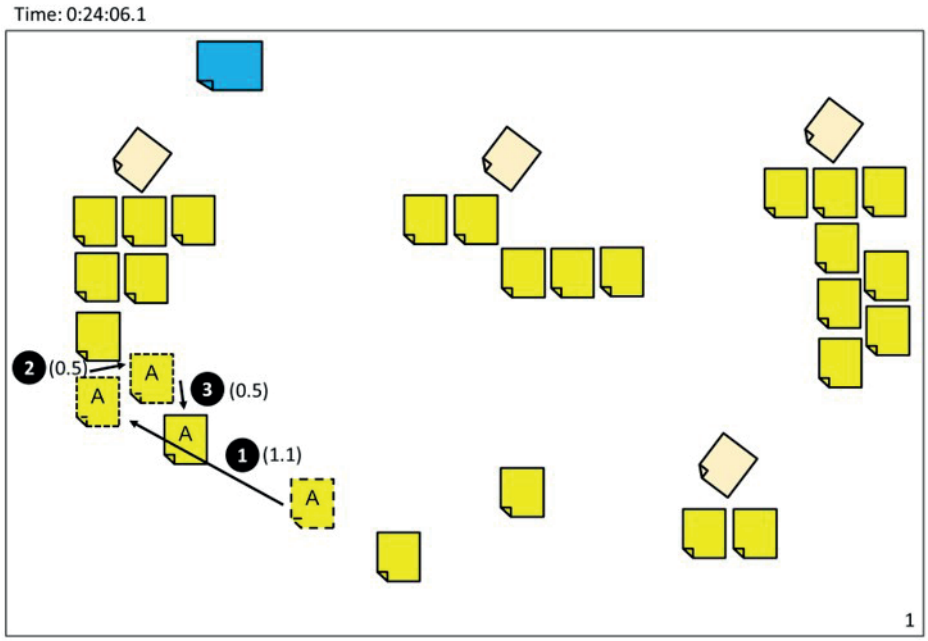
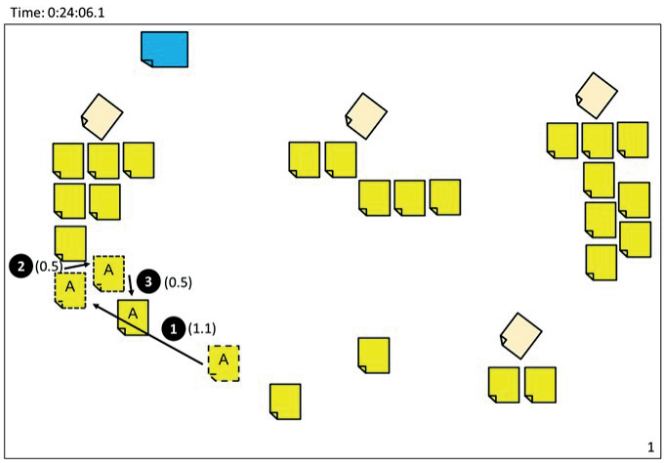


Figure 8. *Moving sticky note A closer to the left-hand side category.*

Time: 0:23:52.0

(1) Ewan:	yeah so level of investment, personal traits
(2)	ability to connect, expertise h.
(3)	these are kind o:f (.) yeah this is ((move ❶))
(4)	somewhat connected here ((move ❷))
(5)	(0.5) ((move ❸)) (2.1)
(6) Ewan:	((places note A)) this is just a:
(7) Anna:	=yeah
(8) Ewan:	a-a-a: range
(9) Kenny:	=yeah
(10) Ewan:	=right? a-a spectrum of
(11) Kenny:	mmm



Excerpt 2. *Moving sticky note A closer to the left-hand side category.*

GIF 1. *Ewan moving sticky note A.*

Moving a sticky note from place to place by holding it without placing it finally on the board can be a way for the design team to examine or test whether the note belongs to a category or not (i.e., membership categorization). In the next excerpt from the same session, we see how a sticky note is being moved from place to place many times as a way to collaboratively examine its membership to each category and reach an agreement on the final placement of the sticky note.

This example continues where the last move ended; after moving sticky note A closer to the left-hand category, Ewan turns to move sticky note B to figure out where it can be placed. As illustrated in Figure 3, sticky note B is moved while in hand a total of 7 times before it is placed conclusively on the board. However, the moving of the note occurs in two parts with a reaffixing pause in between. In the following, we will analyse the first part of the move, the pause, and the

last part of the move to show the details relevant for understanding how the note is moved and what order the move follows.

First, the note is moved twice before being placed between the two categories, ‘ability to connect’ and ‘expertise’ (see Figure 3 or GIF 2 for visualization). The move is initiated with Ewan reading the content on the note aloud, ‘profession and prototyping’ (line 1, Excerpt 4), and then asking David, who wrote the note, what the note means (line 2, Excerpt 4). Ewan begins to move the note before David replies to the question (move 1), and Abby, another team member, also formulates an (incomplete) reply to the question. David formulates a reply with hesitation and a question-format proposal, ‘kind of like extending expertise maybe?’ (line 6-8, Excerpt 4), referring to the note as being a possible extension of the left-hand category ‘expertise’. Immediately after, David adds an alternative placement ‘in between’ the two categories. Ewan asks David for confirmation ‘somewhere in between here?’ (line 9, Excerpt 4). The note is moved closer to the left-hand category ‘expertise’ and placed between this and the category to the right, ‘ability to connect’ (move 2, frame 1).

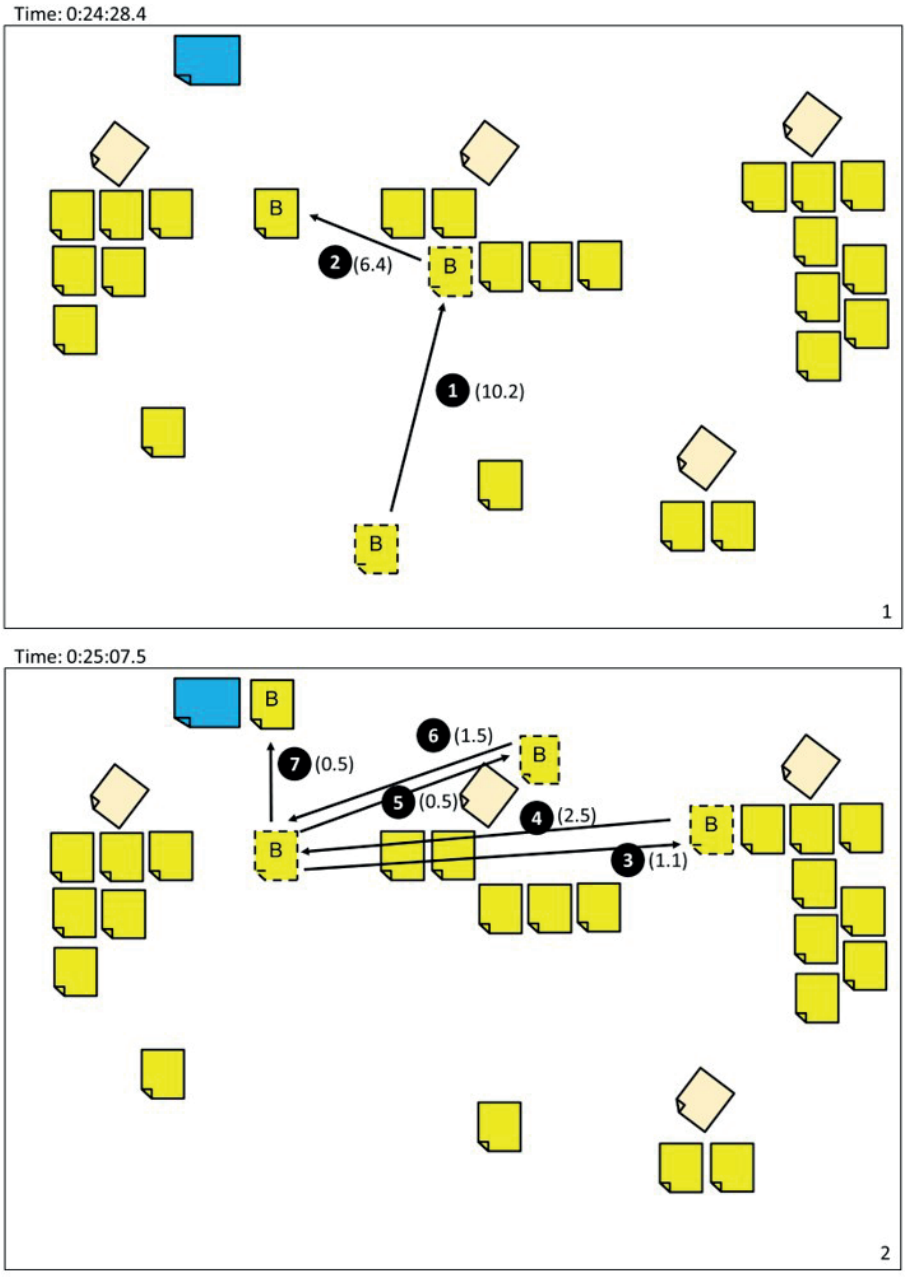
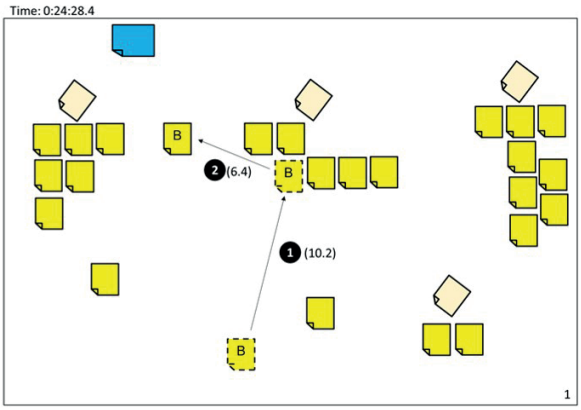


Figure 9. *Moving sticky note B to the top of the whiteboard.*

GIF 2. *Moving sticky note B between two categories.*

Time: 0:24:09.2	
(1) Ewan:	profession (.) profession: and prototypi:ng ((reads aloud from sticky note B))
(2)	(1.0) or or >what< did you mean with this one again?
(3) David:	kind of alignment with eh: (0.5) the
(4) Abby:	>=they told us that we<
(5)Ewan:	((move ❶))
(6) David:	it's the it's the in- >the kind of like< extending expertise maybe?
(7) Ewan:	yeah
(8) David:	or in between the whole thing there ((points towards whiteboard))
(9) Ewan:	somewhere in between here? ((move ❷))



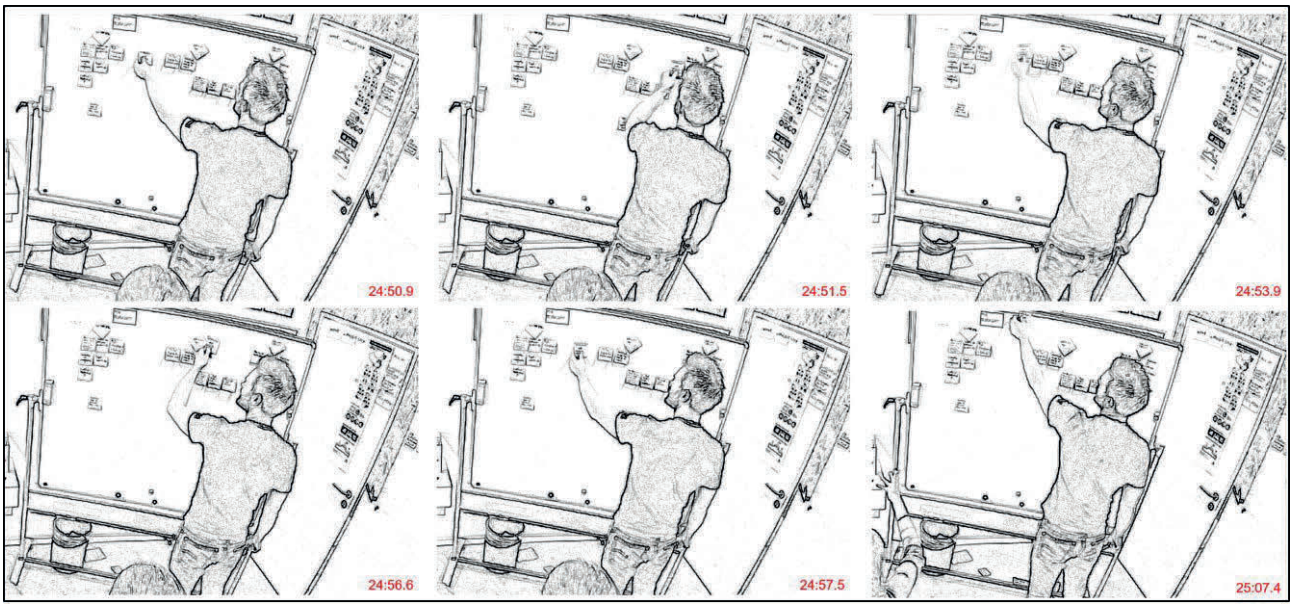
Excerpt 3. *Moving sticky note B between two categories.*

After placing the note between the two categories (frame 1, Figure 3), Ewan returns to the note, points to it, and holds on to it while discussing the meaning of the content with David (see GIF 3 for visualization). Ewan touches and rubs the note with his thumb and index finger as a kind of prolongation of his turn, indicating a doubtfulness of the placement between the two categories. In the production of this gesture of touching and holding, we observe how Ewan in a verbal pause directs visual attention to the (mis)placement of the note and how the other team members orient to this particular note as Ewan holds on to it. This practice of physically holding on to the note and fiddling with it for 12 seconds appears to display how the placement of the note is not yet final; the note is still in the process of being moved. This sequence of actions displays orientation to the note as a misplaced element on the board and an unfinished move in the process of categorizing the notes.

GIF 3. *Fiddling with sticky note B.*

The second part of the move of sticky note B occurs in five moves before it is finally placed on top of the board (see GIF 4). The moving begins with Ewan proposing a new potential placement in the category 'personal traits' to the farthest right (line 1-2, Excerpt 5). In the first move (move

3, frame 2, Figure 3) to the potential category, the note is moved in line with the other notes at the top row of the cluster formation. Ewan moves the note back to its original placement (move 4) but expresses hesitation ‘maybe there’ and moves the note to the level of the headline of the category ‘ability to connect’ marked by a yellow rotated sticky note (move 5, frame 2, Figure 3). As Ewan moves the note between the categories as if to decide their membership, he verbalizes his thoughts to the other team members. After Ewan has tested if the note belongs to two other categories, Abby objects, ‘but it's not anything we need for the screening’ (line 5-7, Excerpt 5). Abby and David arrive at the agreement that the note is something ‘to keep in mind’ (lines 6-10). Ewan displays an understanding of Abby's objection by saying ‘you mean the tools’ and makes the final move (move 7) where he places the note at the top of the board next to a blue sticky note (move 7, frame 2, Figure 3).



GIF 4. *Moving sticky note B between categories and placing it on top of the whiteboard.*

Time: 0:24:51.0

(1) Ewan: it's kind of also a little bit between this and this ((move 3))

(2) the personal trait ((move 4)) (2.3).

(3) it's more a h. ((move 5)) (.)

(4) yeah maybe ((move 6)) maybe there:

(5) Abby: but it's it's not anything that we:

(6) David: =no no

(7) Abby: =we need for the screening

(8) David: =no no

(9) Abby: >but it's something< to keep in mind

(10) David: yeah

(11) Abby: I mean [the: I mean] if we are:

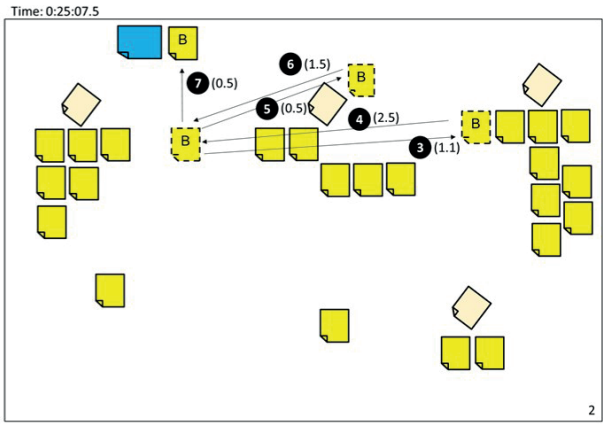
(12) Ewan: [you mean the tools]

(13) David: =it's more yeah

(14) Ewan: ((move 7))

(15) Abby: for example focusing [on people]

(13) David: [yeah exactly]

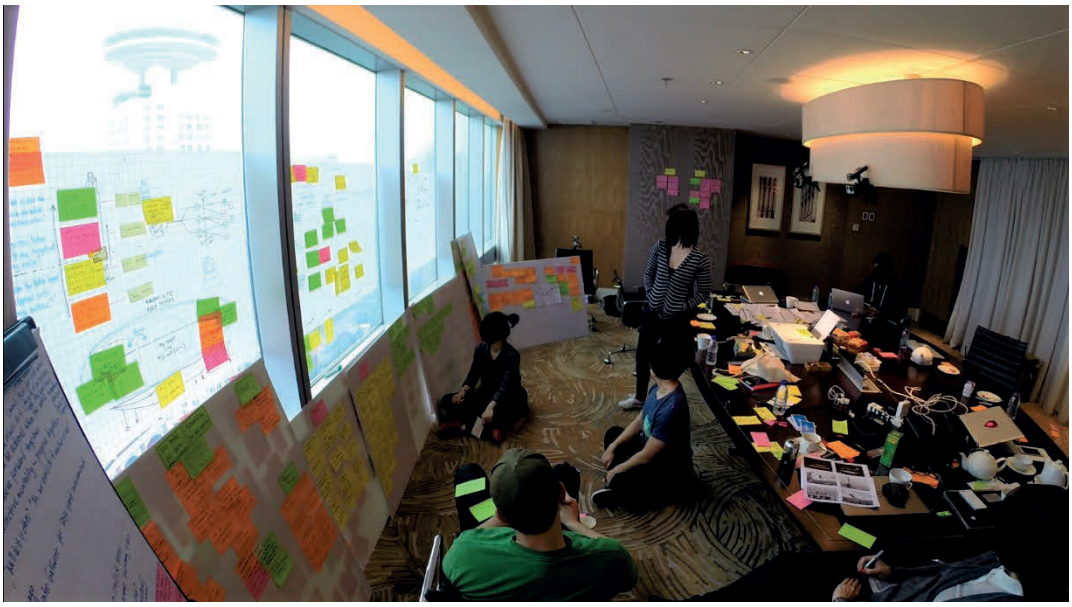


Excerpt 4. *Moving sticky note B between three categories.*

The order of the move in this example is somewhat complex since it consists of several moves in the search for a fitting category with a long pause in between. However, the order of the move can be described as follows: 1) localization of note to move by pointing and reading aloud, 2) move to test membership of category, 3) discussion with the team about the meaning of the note, 4) move to test membership category, 5) collaborative reinterpretation of the meaning of the note, 6) final placement of note. Interestingly, this example tells us something about how the design team collaboratively constructs the meaning of the note while examining where the note belongs by moving it back and forth between categories to find association or dissociation.

Example 3

Moving can also indicate the centrality of certain notes in a design process, which may lead to the development of new solution structures. In this example, we shall look at how moving three sticky notes results in the build-up of a new subcomponent and how additional content is added to the new category. The example is drawn from the data from the same professional team of designers as in the previous example, but this example is from further into their design process. The designers have conducted the workshop with the lead users, which has led to many new insights and ideas which have been documented on various boards with sticky notes (Picture 2) that they are using to develop and refine their final deliveries.



Picture 2. *Design workshop setting.*

Picture 3. *The two boards with sticky notes.*

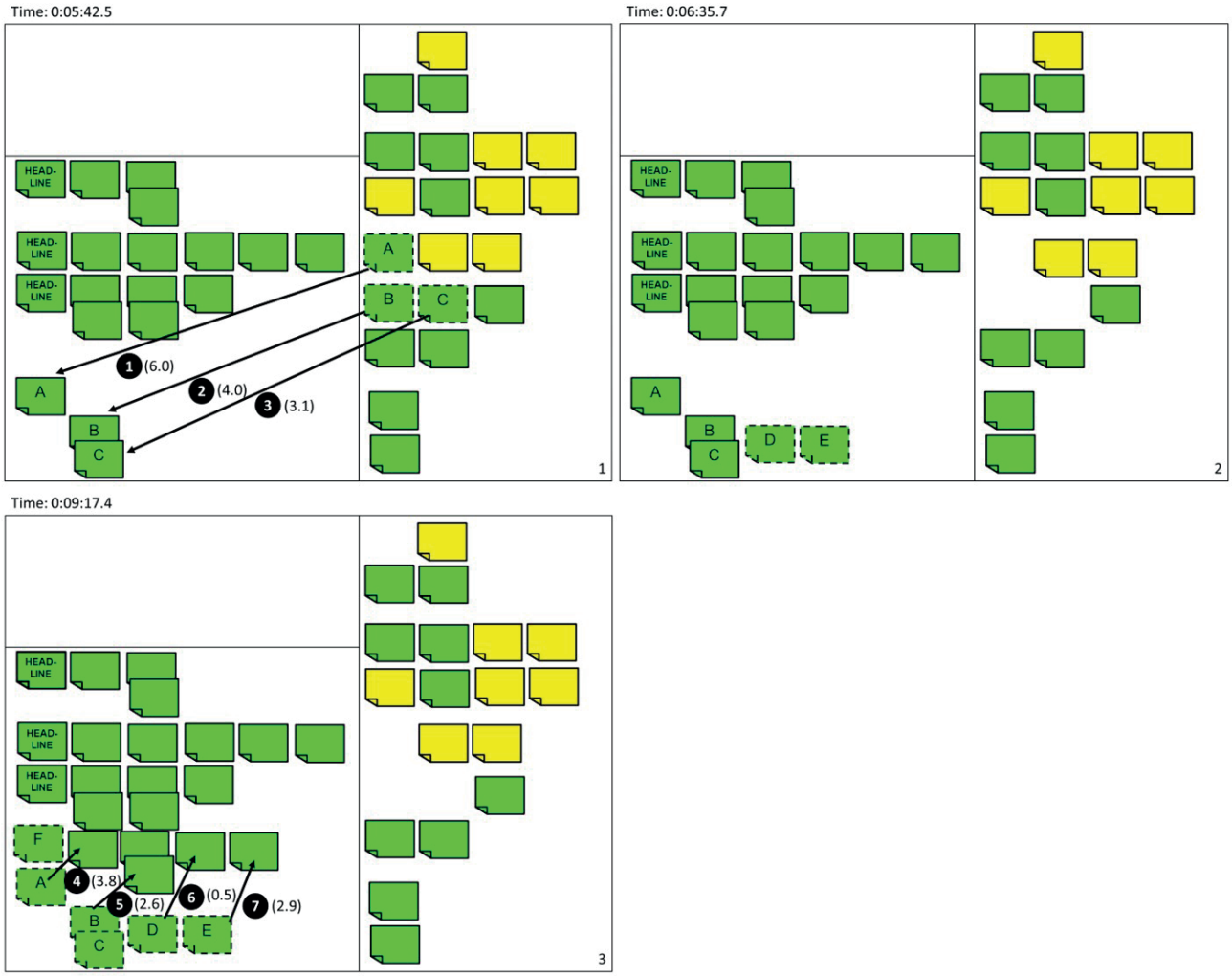


Figure 10. *Moving sticky notes and creating a new category.*

The design team is revisiting two boards of sticky notes. The board to the left consists of three categories arranged in horizontal rows, which maintains a structure where the leftmost note of each row represents a headline for a different subcomponent. The board to the right consists of quotes and notes from the workshop with lead users central to the design concept they are working on (Picture 3). We enter a conversation about concept development where the design team, led by Rose, discusses how sticky notes A, B, and C may be part of the 'opportunities areas' central to the design concept they are working on (frame 1, Figure 4). Rose initiates the move by pointing to the note, which she refers to as a potential area in the developing concept. One of the team members, Kenny, agrees with her, adding that 'this could be an area' while pointing towards the board with the notes in a similar way to Rose (line 1-2, Excerpt 6). As they agree, Rose moves sticky note A, followed by note B and C, while Kenny states that 'we have several examples of it' (line 3-6, Excerpt 6) to support the decision to move the notes. We observe how note A is

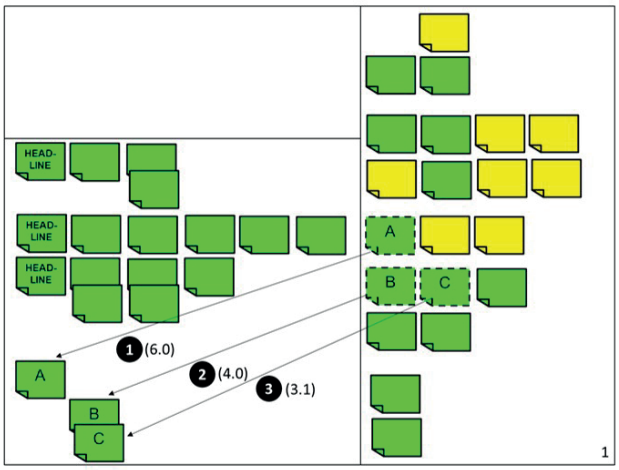
placed in a position to the farthest left to indicate a headline similar to the above rows of existing categories with note B and C placed on top of each other to indicate content in the category (frame 1, Figure 4). Additionally, Rose draws two quotation marks on the top of note B and the bottom of note C to indicate the two notes' merger into one. The following interaction is now centred on the board to the left where the sticky notes have been moved.

The conversation continues, and while Kenny, Rose, and Ewan are talking about details concerned with the concept development, Rose writes two new notes (D and E, frame 2, Figure 4). Rose asks Kenny if the notes are 'on the same or a different level', and Kenny replies 'the same level', after which Rose places the notes on the same level as notes B and C (see frame 2, Figure 4). On one level, the new notes serve cognitive functions by facilitating the record-keeping of what is being discussed (Dove et al., 2018). At another level, the particular way these new notes are made serves interactional functions in relation to the design's progression; they mark the formation of a new category and its added content.

Time: 0:05:38.6

(1) Rose:	so this ((points at sticky note A, nods)) could potentially be: an
(2) Kenny:	=I think this could be an area ((points towards sticky notes))
(3) Rose:	okay
(4) Kenny:	yeah
(5) Rose:	((move ❶))
(6) Kenny:	and I think we have (0.8) I think we have several examples of it
(7) Rose:	yeah but
(8) Kenny:	also:
(9) Rose:	((move ❷))
(10) Kenny:	we have this Tesla buying guy he wou:ld (.) only by (.) organic (.) food.
(11) Rose:	((move ❸))
(12) Kenny:	I think (0.9) it's hard to remember.
(13) Rose:	((ads quotation marks on sticky note B and C))

Time: 0:05:42.5



Excerpt 5. *Moving three sticky notes from one board to another.*

The design team goes on to discuss details around the concept to arrive at a mutual understanding. Rose removes sticky note A from the board during the talk, leaving a blank spot at the 'headline' position. While keeping note A in her hand, she places a new sticky note on the board, note F, as a new headline to the category being formed. Then sticky note A is moved to the right to indicate

content in the new category formation, and the rest of the notes (B, C, D, E) are also moved one by one to the right to indicate content belonging to the category (move 5-7, frame 3, Figure 4).

Discussion

We aimed to answer the research question of how and why designers move sticky notes around on boards through a visuospatial study of the temporal dynamics in 'sticky note sessions', supported by an analysis of team verbalization. Our EMCA-inspired analysis focused on understanding how individual moves are ordered and what kinds of moves are used.

Across episodes, we note that sticky notes are most frequently moved a single note (or one group of notes) at a time, as opposed to the movement of several notes in parallel. The visual orderliness (‘prägnanz’) of the board layout (Kosslyn, 2006) seems to serve as a way for the group to easily assess the progression of its chosen task. Initially, the notes will usually be placed in a disorderly array scattered throughout the board, but upon the sequential movements of notes one at a time, the board ends up in a visually more orderly state, with clear sets of visual gestalts (groups of notes placed in order/symmetrically in visually distinguishable categories). The attendance to the degree of visual orderliness as an indicator of task progression is evident even when only a few notes placed in a disorderly manner are left. We see that the group will try to order these last remaining disorderly notes in alignment with the developing representation, even when these last notes do not fit well into the developing structure (see examples 1 and 2). Only upon having completed the reorganization of the visual board by moving all notes into organized visual gestalts does the group tend to halt its work on the subtask.

Our analysis of three episodes of sticky note movements reveals the internal order of each move and samples the kinds of movements that are at play.

The sequential order of individual sticky note movements

Moving sticky notes is a dynamic process intertwined in the material environment and social interaction. In these examples, we observe how the primary social action and the shared point of attention are oriented to the material environment, the sticky notes as design materials, and the embodied interaction, not the speech system per se. The design materials and the embodied interaction with them are strong resources for the progressivity in the design process. For individual sticky notes moves, we notice they can be described as maintaining a sequential order.

Pointing to or touching a sticky note is used as a specific interactional resource that frames the imminent moving of a note and projects the next relevant actions (e.g., moving more notes, adding content, or reorganizing notes). To establish shared attention, pointing and touching is used as a main resource for 'unfreezing' (Whyte et al., 2007) and initiating the move of a sticky note. In some cases, we also see how the reading aloud of a sticky note may be used to initiate the move. Pointing, touching, or reading aloud functions as 1) resources in the conversation for framing and initiating the move, and 2) an invitation for the other team members to take part in the moving of the sticky note with next actions relevant for proposing an appropriate reorganization by association, dissociation, reinterpretation, category formation and so on.

When the sticky note in focus has been established, one team member takes the note from the whiteboard, and the process of moving the note to its final location begins. The person making the first move projects the next actions, whether this is 1) establishing agreement about the content by asking the other team members what the meaning is, 2) moving the note directly to potential placements, and determining the connection by asking the team members about the fit (connected, related, different from, something else, etc.) or, 3) moving the note without verbalizing the reason, but through the material structure and embodied action, displaying the trajectory of next actions. The movements vary considerably in terms of their duration, extending from less than 1 second to minutes. During the moving, the design team members may display agreement or disagreement with the positioning of the note with arguments related to the interpretation of the note's content or with minimal responses. These actions are sequentially produced in a way that emphasizes how specific places on the board represent features of the design or concept and how specific notes are essential parts of the developing orderly visual structures in the layout of the board. The sticky note structure on the whiteboard and the accompanying gestures, as opposed to the speech system, most often become resources in the co-construction of how to move a sticky note and where exactly to place it. We observe how minute moves to one side or the other relating to the already placed sticky notes are central to the final placement of the note 'on the move,' and in some cases, the members display high sensitivity to the precise placement of the note in the structure already created. However, we also observe how the established structure can be fragile if one note is taken away, resulting in a complete reorganization of all notes (example 1). Several gestural indicators (e.g., holding and continued touching of the note; pointing; the group facilitator physically placing him-/herself next to a specific note) serve to illustrate that a move is still 'in process' and that the note has not yet reached its final destination. Placing the sticky note involves touching its top with

adhesive to secure attachment, but this gesture also functions as a resource to display the finalization and 'refreezing' of the move to the other members. At this time, the individual sticky note movement seems to be considered final by the group, allowing it to progress to the moving of the next note.

Kinds of sticky note moves

The analysis illustrated that individual sticky note moves involve a rich set of inter-note relations being both explored, established, connected, and built up, as well as dissociated, discarded, and broken apart when traced as they unfold across time. We explore here the kinds of inter-note relations, as well as the situational strategies deployed for their visual establishment, with particular attention to the role of visuospatial and temporal proximity. The relations between sticky notes that are traceable when viewed across time may take several forms, three important ones being of associating, categorizing, and structurally relating.

Association

One recurring kind of sticky note movement pertains to the holding of a note while moving it towards and away from other notes, with a short or long pause at each explored associative position. Such movements seem to explore inter-note associations, often as a way to link the note to a group of similar notes. We noticed how the associative explorations made use of spatial proximity between notes to illustrate seeming associative strength between concepts, and it sometimes required several incremental adjustments to positioning before a final position was settled on, and the note reaffixed to the board, indicating that precision in the spatial distance to other individual notes was considered important. Importantly, when viewed across time, it is apparent that indicating associative strength is not just carried out by positively finding one good association, but also of positively exploring, but discarding, other potential connections, thereby creating active *dissociations*. However, when repositioning notes, it is mainly positive associations (not dissociations) that are displayed through visuospatial proximity. The moving strategies used to visually indicate association include holding a note while moving it towards other notes, but may also deploy pointing, the direction of gaze, or verbalization as communicative resources.

Categorization

Once reaffixed in a new position, several strategies pertain to visually establishing and maintaining an inter-note connection, in connection to forming a new category or cluster of notes.

Group membership is illustrated through the primary strategy of visually ordering notes symmetrically and/or with close proximate distance ('prägnanz'). Between-category discriminability is illustrated by placing note groups at a greater spatial distance from each other (Dove et al., 2018). Other strategies to illustrate grouping are also evident and pertain to the use of category headlines (e.g., using a different colour/different positioning/bold font sticky note to indicate a category headline), encircling a group of notes, or positioning notes on hierarchical levels.

A notable strategy pertains to placing notes on top of each other in chunks. In this note-on-note strategy, we saw how the notes become so tightly interlinked as to be moved in conjunction with each other, even across shifts in the kind of visual representation (see example 1). In this way, chunks of notes may inherit their internal coherence and structure across visual representations, even while the rest of the board changes visual structure entirely. Thus, grouping appears to serve the main function of allowing the chunk to be used subsequently as a 'building block' (Christensen & Friis-Olivarius, 2020). But it should be noted that for nonlayered categories, the internal category structure is usually not maintained if the entire category is repositioned. This may indicate that, upon establishing a category, the relative spatial proximity within groups no longer serves a main purpose. This is not to say that all category members are equal, as indicated by category headlines pointing to select notes, central positioning of select notes, the rereferral to some notes in a category more than others across time, or the order of selecting notes as category members (first members appear more central).

Structural relations

Establishing relations between notes does not only pertain to establishing associations and categorizing notes. In working towards more complex concept build-up, the relations between notes often involve illustrations of causal relations. Here, inter-note marking in the form of arrows, lines, or brackets on the whiteboard (e.g., example 1) serves as a strategy to visualize causality, direction, or hierarchical relations in an emerging whole. Sometimes, a partial structure is established before fitting it into the overall solution under development. In example 3, we noticed how a sticky note was singled out as a potentially interesting novel subcomponent, which was elaborated upon by grouping it with both existing notes and newly written ones. The sticky note group was finally given a new headline that aligned with the pre-existing solution structure, making it a subcomponent.

The examples serve to illustrate how sticky note moves may be of several different kinds and may involve both, the establishment of associations and dissociations, the grouping of notes into clusters and categories, and the establishment of inter-note relations between notes in the structural build-up of organized wholes. Each of these kinds of moves deploys a relatively distinct set of resources and strategies to move from unrelated and disconnected elements to partially structured wholes.

The role of proximity in relating sticky notes

While spatial proximity is not the only strategy identified in the relating of sticky notes, proximity often seemed in our examples to take primacy over the speech system and is likely a main reason why visuospatial support systems (sticky notes on whiteboards) are used to support collaborative design processes. In architecture, the capacity for spatially proximate arrangement of elements is amongst the most central of skills. While the importance of visual proximity is thus well known in design, our findings are surprising in a number of respects:

While exact spatial proximity is of crucial importance in architectural design, it is not at all obvious that exact spatial distance should matter in relating words and concepts. Why should increasing or decreasing the *spacing* between two words carry relevant information to the perceiver? Nonetheless, these minute relative movements of sticky notes seemed important and meaningful to the designers, thereby allowing proximity to serve as information in conceptual design processes.

Further, relative proximity between design objects seemed to have similar roles across modalities in the design process. Spatial proximity seemed to be used as an indicator of certainty, associative strength, or category centrality. Similarly, temporal proximity (the length of time a note-to-note relation took to explore or establish) also seemed to function as a way of indicating associative strength, category centrality, or certainty.

Importantly, proximity seems to play different roles across distinct kinds of sticky note moves. Whereas inter-note proximity preoccupied the designers when they were making associations and categorizing, proximity seemed to play a different role when building structural relations amongst sticky notes.

This finding may be explained through the dual-process theory of design cognition (Goncalves & Cash, 2021). Relating dual-process theory to our findings, it seems that associating and

categorizing sticky note moves are closely related to Type 1 associative processes, which may explain their reliance on proximity as a primary indicator of associative strength. Conversely, more deliberate and reflective Type 2 processes are involved in trying to connect parts and categories into newly organized wholes. Indeed, in reasoning about structural relations, exact note-to-note proximity no longer seems to serve as a main source of information, with effortful reasoning instead directed towards the *content* of relations: causality, directionality, hierarchy, sequence, and so on.

Type 2 design processes are characterized by demanding a high degree of cognitive load of WM. The capacity limitations of human WM make it extremely taxing to mentally combine, organize and structurally relate more than a few elements at a time. This makes cognitive offloading important by visualizing elements and moving them around for visual processing support. This mental work pertains less to associations of elements, and more to the structure amongst these elements. This may be the reason why the moving of sticky notes for establishing structural relations does not seem to rely on proximity in the same way: the type of reasoning conducted perhaps focusses less on the degree of association and more on establishing the content and organization of relations. Here exact note-to-note proximity plays a lesser role, being replaced by a focus on the *relative* positioning and proximity between all the notes in a structure (e.g., their relative positioning in a causal sequence or hierarchy).

This means that proximity has several roles to play in design cognition. As indicated through our examples, it may be argued that Type 1 reasoning with associating and categorizing moves effectively helps establish the chunks, or building blocks, that are subsequently organized and related structurally using Type 2 reasoning. Types 1 and 2 are thus not just two distinct types of processes. Their interplay may also partly help explain design progression from a multitude of disjointed elements to newly organized wholes.

Future Research

Our findings suggest that proximity plays distinct roles in different kinds of design moving. Future research should investigate the role of team alignment on the meaning of the—often silent—sticky note moves in order to clarify whether aligning on the interpretation of the meaning of sticky note moves impacts design progression. Further, in so far as kinds of sticky note movements differentially relate to Type 1 and 2 processes, it may be possible that aligning team task

instruction to their dual-process type in sticky note ideation, rather than to the standard 'brainstorming rules' (Matthews, 2009), may enable better visuospatial process support.

Our studies examined design sticky note sessions where the team initiated the process with the generation of parts before moving to inductive grouping and structuring. More research is needed on the kinds of sticky note moves at play in sessions initiating with a preimposed visuospatial category structure for notes to fit into (e.g., Business Model Canvas; Osterwalder & Pigneur, 2010). Our studies only looked at brief episodes of sticky note moves – more research is needed to capture structural build-up across longer stretches of time in the life of ideas (Goncalves & Cash, 2021).

We believe our analytical approach focusing on visuospatial design moves may further inform theories of design, beyond sticky notes. Design often takes place in rich visual environments (e.g., design studios) with a multitude of objects, and here it may be possible to trace objects as they become related across time, insofar as it is possible to parse the environment into distinct visual objects as was enabled here through the analytical focus on sticky notes. We anticipate that such types of analysis may help explicate further the process of how products *are made* and *take shape* through associative and relational processes that are not always explicated in talk.

Conclusion

With our visuospatial analysis of sticky note movements across time, we aimed to uncover the situated sequential order of sticky note movements and explore the different kinds of sticky note moves. We explored how these moves help create new connections, combinations, and relations to other sticky notes and the—mainly visual—strategies used to their explication. With our findings, we hope to have pointed out new directions for research on visual support in design, and design moves, by exploring how and why designers move sticky notes.

By tracing sticky notes movements across time, we show that individual moves seem to have a relatively stable sequential order. We identified several kinds of sticky note movements pertaining to the formation of associations, the creation of categories, and the building up of partial solution structures. For associations, we found that inter-note spatial proximity serves as a visual proxy for associative conceptual strength, and we note that both associations and dissociations are visually presented when viewed across time. Viewed across many moves, inter-note relatability seems to create a semantic network of note associations that may underpin the formation of categories, with

some of these categories and chunks maintaining their internal structures across shifts of representation. In turn, the clusters and categories may be used as components in solution build-up. In this way, sticky note moves serve to support the cognitive and social processes involved in collaborative design. Our findings lead to the contribution that a main reason sticky note moves support conceptual design seems to be due to the changing visuospatial proximity between notes across time in gesture and note placement. Proximity, however, does not play the same role across distinct kinds of moving. Inter-note proximity seems to serve as information on associative strength and category centrality in Type 1 reasoning. However, in the structural build-up of relations between categories or objects (i.e., Type 2 reasoning), proximity seems to play another role in the mentally taxing clarification of the content of note relations.

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14 Article four: “What do you think?”: Managing reflection during group supervision

Abstract

This paper addresses supervision in groups as a pedagogical method to teach students how to reflect on their own or others’ actions. It focuses on cluster supervision, a teaching format where multiple teams attend the same supervision session, take turns serving as the focus of the supervision and participate in peer feedback. It also examines how reflection is articulated, embodied, and managed during supervision sessions through a close analysis of students’ and teachers’ interactions. As a result, it uncovers aspects of the organization of reflective practice that have not been previously identified. Through a set of empirical examples drawn from a 16+h video-based dataset, this paper develops the case that students, when engaging in reflective practice, are oriented toward a social order that privileges an institutional discourse of turn-taking in a classroom setting, where teachers generally move first, a student responds, and the teacher subsequently re-engages—a so-called initiation-response-evaluation sequence. The analysis reveals how the institutional rules of social order in the classroom may disrupt the ideal of reflective practice: thinking about your own or others’ conduct. Four approaches to reflection are observable in the data: reflection as advice-giving, reflection as challenge-forecasting, reflection as a comparison, and reflection as evaluative praise. Contributing with empirical knowledge regarding the educational practice of supervision and group reflection, the paper highlights the role of facilitation and supervision when teaching and learning reflective practice. These findings offer insights useful for the development of methods for teaching and learning reflective practices in higher education.

Introduction

Reflection is a sought-after skill in higher education (Ryan & Ryan, 2013). Consequently, reflection has entered into the curriculum of many fields to prepare students for the workplace (Bulman et al., 2014), specifically to enhance students’ learning and professional practice (Ryan & Ryan, 2013). Although many researchers have theorized, studied, and measured both the concept and the outcomes of reflection, few have considered how reflection is structured, articulated, and embodied in the interaction between students and teachers in a classroom setting

(Veen & de la Croix, 2016, 2017). The purpose of this paper is to study how reflection happens in practice by focusing on what students and teachers say and do in situations where reflection is the topic being taught. Narrowing in on how reflection is carried out as reflective talk during a social interaction may 1) provide new insights into the dynamics of reflective practice that occur in everyday educational practice and 2) add empirical content of how reflection takes place *in situ* to the stream of research that has applied a mainly instrumental or quantitative approach to measuring the outcomes of reflection.

Foundation of the study

Research into reflection in higher education (HE) applies various approaches to explore and understand the concept of reflection, how to teach and learn about it, and how to measure its desired outcomes. The discipline of conversation analysis (CA), emerging from a sociological foundation with close ties to ethnomethodology (Garfinkel, 1997) and other disciplines such as linguistics, discursive psychology, and education (ten Have, 2007), is concerned with analyzing real-life practices through a close examination of the details of social interaction. Two complementary strands of literature provide the foundation of this study: (1) the literature on reflection in education and (2) the stream of literature on talk and interaction in an institutional context, namely analytic studies of the architecture of interaction in the classroom setting. These two literature streams are described in the following.

Reflection in education

Reflection is a term that is widely and interchangeably used to describe a way of thinking, and the concept has grown significantly, even fundamentally, in fields such as education, entrepreneurship, medicine, and social work (Bulman et al., 2014; Cope, 2003; Kirkwood et al., 2016; Lucas & Tan, 2013). In the educational context, reflection is often included as a curricular component of education programs, where reflection is understood as a way to acquire knowledge and enhance the effect of learning (Loughran, 2002). The theoretical roots of reflection go back nearly 100 years to when Dewey describes reflective thinking as a mode of thought among others, including belief and imagination (1933). In Dewey's work, reflection is conceptualized as a scientific, rigorous, and disciplined way of thinking. Reflection is not an isolated process but must occur in the interaction with others through communication, and reflection is connected with a set of attitudes and values such as directness, open-mindedness, and responsibility toward oneself and others (Rodgers, 2002).

In the 1980s, Schön introduces his concept of reflective practice in his work "The Reflective Practitioner: How Professionals Think in Action" (1983), leading to the concept gaining ground and growing in popularity among professionals, academics, education specialists, and politicians and its acceptance as a new approach to improve an action (or practice) on the way to mastery. Resting on a psychological foundation similar to Dewey, Schön conceptualizes reflection as a cognitive process related to thinking. Schön's conceptualization rests on the master-apprentice relationship, where the student collaborates and receives feedback and critique from an expert (1985). Schön's work led to a focus on the theory-practice gap in education, namely that to develop one's thinking and make progress, one had to learn by observing an expert (Bulman et al., 2014; Schön, 1985). Despite Schön's wide-ranging writings on the master-apprentice relationship, he does not offer specific guidance for teaching reflection (Attoe & Mugerauer, 1991).

According to these foundational theories, reflection is considered to be something that may be learned, expressed, promoted, measured, and assessed. The predominant methods from this instrumental-rational approach are quantitative and experimental, which have considerable strengths. However, scholars have identified two challenges. The first is the problem of assessing and conceptualizing reflection as a measurable phenomenon through written and spoken language. Proponents argue that reflection should be related to virtue ethics and understood as a value instead of a skill or knowledge to be taught and measured (Ixer, 2016). The second is the problem of empirical coverage. Although a great deal of research addresses the definition of reflection and its desired outcomes, few empirical studies discuss the actual practices of students and teachers who "do" reflection in a natural context. Existing research on this subject in an educational context focuses on developing models for reflection and how to measure it as an outcome through methods such as reflective writing (Ixer, 2016; Morrison, 1996; Tracey & Hutchinson, 2016; Veen & de la Croix, 2016, 2017). Qualitative studies use interviews to explore the outcome of reflection, where the researcher analyzes how the participant narrates and expresses individual experiences, issues, or challenges (Griggs et al., 2018; Tummons, 2011). In contrast, this paper focuses on the relationship between students and teachers, using video recordings to unravel how reflection is accomplished as talk-in-interaction and how reflection is articulated and embodied moment-by-moment in the classroom.

Institutional interaction

Understanding and exploring the dynamics of how talk-in-interaction unfolds and the social order emerges in the classroom has been, and still is, a massive topic of investigation for the "applied" CA field (ten Have, 2007, p. 174). The first studies of classroom interaction informed by CA were concerned with investigating how interaction in a classroom differs from other everyday interactions and ordinary conversations by focusing on the instructional setting and teacher-fronted pedagogical lessons (Mori & Zuengler, 2008). One of the most studied structures in the pedagogical activities in the classroom is the question-answer-comment sequence, also known as the initiation-response-evaluation (IRE) sequence (Macbeth, 2003; Mehan, 1983; Sinclair & Coulthard, 1977). The IRE sequence generally consists of three parts: the teachers take the first and third turn (initiating and evaluating) and the student the second (responding). CA researchers affix no normative judgment to the IRE structure regarding its potential learning effects. However, from a CA perspective, this three-part structure regularly appears in classroom interactions regardless of whether students and teachers prefer it.

Asymmetry is a characteristic of the institutional discourse of interaction (Drew & Heritage, 1992), with several types of asymmetries regarding participation, knowledge, and the right of access to knowledge, such as the teacher-student relationship. However, this does not mean that everyday conversation is symmetrical and institutional interaction is asymmetrical. Instead, asymmetries may occur in any activity that involves a non-static and continuously shifting relationship between the participants (Jacoby & Gonzales, 1991). For example, advice-giving is one activity where asymmetry between the participants is assumed or established (Hutchby, 1995), such as when a professor or supervisor gives feedback or advice to a student, or peer tutoring, where peers receive advice and feedback on their writing from other peers (Waring, 2007a, 2007b).

The social order manifested in the classroom is of central interest for CA studies of institutional talk (Fox, 2008; Macbeth, 2003; Mehan, 1979). The emergence of social order in an interaction can be explained by an example of a question-answer sequence. When asking a question, the next turn at talk will be expected as an answer (with adequate answer-ness), and the question-asker and the answer-giver will orient themselves toward the next turn in relation to the last turn, and, in doing so, reveal the normative social order that emerges in the details of turn-taking. In the interaction details, such as when a minimal silence in conversation (tenths of seconds) may

indicate misunderstanding, trouble, or mark a shift in speakership, the social order is organized and observable (Matthews, 2009).

"Doing reflecting"

As mentioned earlier, few researchers have considered how reflection is carried out in practice. However, in a recent CA study of instructions during guitar lessons and Japanese calligraphy, Arano (2020) unfolds reflection as an interactional accomplishment. The study focuses on instructions as a series of normative actions organized as an agenda to be followed. In this situation, the instruction-giver will continually formulate the instruction in an incomplete way concerning the details of the agenda, but this does not mean that the student cannot follow along. In fact, as pointed out by Garfinkel (1967), the recipient (i.e., the student) may assemble the unformulated parts of the instructions in an "ad hoc" fashion. The ideal of following instructions in a straightforward manner thus becomes close to impossible in practice. However, the recipient manages to handle the incomplete instructions in relation to their expectations.

On the other hand, in situations such as receiving supervision on a piece of text (Li & Seale, 2007) or receiving critique on a design (Oak & Lloyd, 2016), the student is not expected to follow and realize the instructions immediately. Instead, students are to consider the instructions and implement them in future work. Arano (2020) finds that in situations where students are not expected to follow the instructions immediately, they display an embodied confirmation of the instruction; by gesturing or imitating the teacher's gestures, the students are "*doing reflecting on the instruction on the spot*" (Arano, 2020, p. 267).

Data and method

This study applies an analytical framework inspired by the sociological traditions of ethnomethodological conversation analysis (EMCA), where video recordings of naturally occurring interaction serve as the empirical fundament. This analytical orientation draws on ethnomethodology (EM) (Garfinkel, 1997; Rawls, 2008) and conversation analysis (CA) (Heath et al., 2010; Sidnell, 2009; ten Have, 2007), fields that center on details to understand how people interact, organize, communicate, and establish shared understandings. These methods are used to unravel the supervision sessions' overall structural organization and analyze the sequential structure of the unfolding reflection in the classroom.

Data collection

The data in this paper consist of 16 hours and 39 minutes of video recordings of 24 supervision sessions with eight student teams comprised of three to five members and two teachers. The length of the 24 sessions ranges from 35 minutes to 50 minutes. The supervision recordings have been selected from a longitudinal video ethnographic study with more than 80 hours of data recorded during a MA course on strategic design and project management with students from an art academy and a business school. The ethnographic video study was conducted for the duration of the course from February to May 2019. All video recordings were made with the participants' consent and anonymized. The supervision sessions have been transcribed fully using Jefferson's notation system (Jefferson, 1984). Because the class consisted of students from different European countries, the spoken language was English. Video recordings are particularly helpful in such studies, as they allow for the analysis of nonverbal cues and embodied interactions while also ensuring a total overview of who is speaking when and to whom. These details can be challenging to convey with audio records in situations with many participants, such as classroom interactions. Three action cameras (GoPro label) were used to record the ongoing interaction from different spots in the classroom. As the first supervision sessions occurred a few weeks into the field study, the participants were accustomed to being recorded at this point and did not pay noticeable attention to the cameras. However, I acknowledge the camera as a non-passive instrument for observation, a "productive force" that has consequences, not only in terms of intrusiveness but also in terms of "*how a phenomenon materializes in the practice of inquiry*" (Mengis et al., 2018, p. 292).

Cluster supervision and the reflective team

The students worked in cross-disciplinary teams comprised of design, architecture, and business students, collaborating with external client organizations spanning from well-renowned architecture companies to start-ups within product design. The student teams were engaged in a strategic proposal to tackle a specific challenge within their client organization. The proposals manifested in outcomes such as prototypes, communication strategies, and architectural renderings. In total, three cluster supervision sessions were scheduled during the course. The purpose of the supervision was to support the teams to develop the strategic proposal for their client.

Table 3. *Overview of supervision sessions and participants in the study*

	Cluster supervision 1 02-28-2019	**Cluster supervision 2 04-02-2019**	**Cluster supervision 3 04-30-2019**
Round 1	Teacher A	Teacher A	Teacher A
	Teacher B	Teacher C	Teacher B
	Group 1 (five students)	Group 5 (four students)	Group 7 (three students)
	Group 2 (four students)	Group 8 (five students)	Group 8 (four students)
	Group 3 (three students)	Group 6 (four students)	Group 6 (four students)
	Group 4 (five students)	Group 7 (five students)	Group 5 (four students)
Round 2	Teacher A	Teacher A	Teacher A
	Teacher B	Teacher C	Teacher B
	Group 5 (four students)	Group 1 (four students)	Group 2 (four students)
	Group 6 (four students)	Group 3 (four students)	Group 1 (five students)
	Group 7 (four students)	Group 4 (four students)	Group 4 (three students)
	Group 8 (five students)	Group 2 (one student)	Group 3 (five students)

Teacher A provided the teams with a document framing cluster supervision as a way to orchestrate a reflective team: "*The groups take turns being in focus of the supervision, presenting their situation and considerations in a facilitated framework, in which the supervisors and the cluster members represent a reflective team*." The teacher would draw on the therapeutic method of the reflective team developed by Andersen (1987, 1991) and integrate this method into the cluster supervision pedagogy. In short, the reflective team format presents a dialogical and meta-dialogical approach to family therapy, where clients and therapists trade places and take part in an open dialogue about alternative understandings of the problem at hand. In such cases, alternative understandings and resolutions, not solutions, are the desired outcome. The therapy takes a format where a team of experts sits behind a one-way screen and listens to the therapist's interview with the clients (e.g., family members). Afterward, the experts are asked about their observations and viewpoints while the family members and therapists listen. Finally, the family members are asked to comment on what they have just heard (Andersen, 1987, 1991).

The cluster supervision sessions were facilitated similarly to the reflective format developed by Andersen (1987, 1991), and each session followed the same format. First (step one), a team presents their current status and notes any challenges they may face. While the team is presenting, only the supervisors can comment and ask questions, while the other three teams listen. Following the status report (step two), Teacher A drops an "invisible curtain," and the other teams are asked to reflect on what they have just heard. The "invisible curtain" represents the one-way screen used in Andersen's therapeutic method (1987, 1991). During this reflective session, the team in focus is not allowed to comment or reply to questions. Instead, the two supervisors comment on the

team's current situation and the thoughts of the other teams. After this group reflection (step three), the supervisor again engages the team in focus in a plenary discussion before the supervision of the team ends.

This structure is repeated four times as each team in the cluster presents their status, and the remaining teams have reflected on each presentation. Teacher A facilitates the interaction during the entire session, and Teacher B or Teacher C (depending on the day) engages in the activity by asking questions or commenting. The chairs in the classroom are organized in a circle-like formation, where the team in focus is positioned in front of the other groups with a teacher on each side (**Figure 11**).

Figure 11. *Layout of the classroom during cluster supervision.*

The instructions from the teachers have an observable effect on the following conversation and its structure. The teacher frames the sessions with a defined goal: to support the students in developing their strategic proposals. A secondary goal is to learn how to contribute to a reflective team. The students participate in the sessions with the specific goal of improving the quality of their projects. In the following analysis, I present five extracts from the dataset as exemplary cases of certain aspects of the reflective practice in the supervision sessions.

Analysis

"What do you think?"

The analysis begins by focusing on how the teacher initiates the team reflection and how the students and teachers co-construct a social order for participation. As mentioned earlier, each session has three parts (team status, team reflection, and plenum discussion). Extract 1 is drawn from the first round of the cluster supervision session in which groups 1–4 participate. In line 1, we see Teacher A (TA) closing the team status report with an "*okay, very good*" (line 1, Extract 1) and then initiating the conversation with the other teams. At the same time, TA marks the rules for participation, saying, "*then we draw the little line*" (line 1, Extract 1) using gestures to embody an invisible curtain between the team in focus and the other groups. This embodied curtain drop is carried out in each of the eight sessions in the first cluster supervision and constructs certain rules for participation: the team in focus must act as passive listeners while the other teams reflect on their project. In itself, this is a departure from the traditional rules for classroom participation. However, the "invisible curtain" is aligned with the therapeutic team reflection method (Andersen, 1987).

Subsequently, we see how TA verbalizes the reflection task for the other groups through a multi-unit turn with a series of questions that end with "*what do you think?*" One student, Karen, raises her hand and responds to TA's inquiries. Hand-raising, a phenomenon in classroom interaction that bypasses the issue of gaps and overlaps in turns, embodies being a knowing-and-willing answerer in a traditional classroom environment (Mchoul, 1978). Karen begins her turn with a positive assessment of the client company and then formulates a challenge based upon the team composition: the business students' task is straightforward, but the design students may be challenged. TA responds with an evaluation of Karen's comment and elaborates on the challenge the team may face. Karen's multi-unit turn shows how she first evaluates the client: they are interesting because they have a lot of experience (line 7, Extract 1). She gazes toward TA when talking. Then she turns to look in the team's direction while pointing to an opening or opportunity for them: the client lacks experience with business (line 7), which can be advantageous for the team (since they have business and design students). However, this also creates a challenge for the team, especially the design students, as Karen suggests. Karen changes her stance toward the team by changing the pronoun "they" to "you" and downgrades the epistemic strength of her assessment of the challenge "*I think, you might be*" (line 8, Extract 1). She also uses "quite" to

emphasize the challenge, framing her advice as two questions (lines 9–10, Extract 1) for the team to consider: "*how can you help them?*" and "*what is your role?*"

The three first turns follow the traditional IRE sequence (initiation, response, and evaluation), where TA takes the first and third turn and Karen, as the student, the second. However, the situation is more complicated. First, we notice how Karen's comment is not a direct answer to a straightforward question and how TA's many questions were all open-ended with no pre-assumed answers. In doing so, Karen and TA are co-constructing what reflection may look like in this setting. The many questions posed during the teacher's turn show the students what reflection may look like in conversation. For example, it can be direct answers to questions: What are the challenges? What do we hear? What type of project is this? Moreover, it can be contemplative: What do you think?

Cluster Supervision 1, Round 1, Group 1, Cam2 #01:13-02:40#

1	**TA**	okay. good. >very good<. >we are going to< dra::w the little >little< line. ehm: and	
2		we reflect upon what↑ what is the: what is the (.) the challenges for the group here?	
3		what do you hear and what do you read? what- what type of (.) project (.) are we (..)	
4		eh: eh: do we have here and what are their challenges (.) from that they are saying? (.)	
5		what do you think? come.	
6	**Karen**	(raises hand) ehm: it is quiet interesting the: company itself↑ because they have a lot	
7		of experience in co-design themselves but not in: eh:: business↑ eh:: so I think for the	
8		business students it is quite clear↑ what they do↑ but therefore the designers >i	
9		think< you might be quite challenged eh: to find how you can help them and what is	
10		your role? and that does not overlap with them 'cause they also work on the project ↑	
11	**TA**	(4.0) hmm. (.) so there is something about the (.) the kind of the boundary between	
12		them and (.) and (.) and us. eh:: you know eh:. our team. from the schools and and the	
13		actual company. so th' there is is very little boundary between them in a way. my	
14		sense is that they have been invited >kind of< into the (.) part [that matter.] ehm:: (.)	
15	**John**	[raises hand]	
16	**TA**	no, we're closed down here	
17	**Students**	(laughter)	
18	**TA**	£you listen and and then we come back to you in a little while£.	

Extract 1. *Initiating the group reflection.*

In rounds 1 and 2 in the first cluster supervision, where the groups are introduced to the pedagogical format for cluster supervision, a student from the team "in focus" breaks the rules of talking "behind the curtain." During TA's turn (lines 11–14, Extract 1), a student from the team

in focus, John, raises his hand. This hand-raising gesture interrupts TA during her turn, and she promptly responds to John with "*No, we're closed down here*" (line 16, Extract 1). TA rejects the hand-raising gesture, which serves as a typical classroom interaction. Consequently, the rules for participation become explicit through John's action—TA treats it as a breach of the newly established social order. The class laughs (line 17, Extract 1), and TA smiles, which may be used to soften her response to the rule break.

"Just talk"

In the second round, TA marks the rules for participation in a similar manner as the first. This time another rule is brought into play when a student, Yvonne, raises her hand to embody her willingness to respond to TA's question. TA's "*just talk*" (line 9, Extract 2) treats the hand raise with dis-preference: Yvonne is not supposed to raise her hand but, in fact, "just talk" as a way of "doing reflecting" (Arano, 2020). Yvonne responds with "*ah, okay*," displaying surprise and acceptance of the instruction from the TA, and carries on with her turn. Yvonne compares the team's situation with her own: they are questioning how to solve the problem from the client and what role to take. As Yvonne repeats, the team is in the same situation as her own.

Cluster Supervision 1, Round 2, Group 5, Cam_1_ #14:54-15:52#

1	**TA**	great. thank you. then we sort of dudududu (gestures curtain drop with hand)	
2	**Room**	(laughing)	
3	**TA**	£they can here us though.£	
4	**Room**	(laughing)	
5	**TA**	okay what is it that we: have here (.) what' ho' how do your hear and read (.) eh:	
6		where they're at↑ (.) in the group at this point. eh:: what are the challenges and and (.)	
7		and what type of (..) of of situation do they stand in. as as you [hear it and read it]	
8	**Yvonne**	[raises hand]	
9	**TA**	=just talk.	
10	**Yvonne**	ah, okay. eh: I think like us they are a bit eh: in doubt about (.) their role and how to	
11		(..) like solve the (.) problem. because it's yeah (.) it's the first time so- like (..) like	
12		just going (.) slowly forward and explore on the way I guess (.) I know we are a bit	
13		>thinking< how (.) how we are going to do it but I guess >we'll figure it out on the	
14		way↑<. I think they have the same situation.	

Extract 2. *Participating in the group reflection.*

These two extracts demonstrate how the teacher and students co-construct the rules for participation during the group reflection: the team in focus are only listeners and must not talk or react to what they hear or see. The other students are to "just talk" and explain "what they think"

as a way of "doing reflecting". Moreover, raising one's hand to signify one's willingness to talk is unnecessary in this particular setting. This approach may create an issue for the students in terms of showing their willingness to talk. It also challenges the teacher, who must locate the next willing speaker by eye contact alone. However, after only two turns, the hand-raising is re-established and followed by a go-ahead from the TA (a nod, name-calling, or pointing gesture), and it happens only a few times hereafter that a student will speak without raising their hand in situations with longer pauses, taking place only where the risk of overlapping with someone else is minimal. Throughout the data, the IRE sequence is observable with variations; sometimes, two or, maximum, three students take turns responding to TA's question before TA evaluates the responses and either adds another reflection to the situation or asks a new question.

The new social order in the classroom is also indicated by how the students can talk about the team in focus as a topic of conversation instead of addressing them directly, which would be unusual in everyday conversation. As observable in extracts one and two, Karen and Yvonne both treat the students on the team in focus as a multi-person unit, referring to them with the plural pronouns in the third person "they" or the second person "you," which I return to in the next section of the analysis. Treating others (or oneself and others) as a multi-person unit is a way of displaying alignment as a team and collectivity across teams in the classroom (Kangasharju, 1996).

Reflection and recipiency

Looking at the students' approach to structuring their responses as reflection, two recipient designs become observable in the data. One type of response is designed for the teacher as the recipient, where the student refers to the team in focus using the pronoun "they" and gazes toward the teacher while talking. In these incidents, the teacher takes the next turn and, in most cases, provides an evaluation of what has just been said. This sequence follows the IRE structure of traditional classroom interaction. The other type of response is designed for the team in focus, using the pronoun "you" (plural). In these situations, the students' gaze shifts between the teacher and the team. Since the response is a consequence of the teacher's initial request to reflect, this response is indirectly designed for the teacher, which is also indicated by the fact that the setting is institutional with specific learning goals: the students are aware of their performance in terms of being active and participating students. In the incidents where the students design their responses to the team as the recipient, the teacher, in most cases, replies with acknowledgment tokens such as "*hmm*" and does not immediately evaluate what the student has said. This response

leaves an opening in the turn-taking structure, where one or two other students will add a comment, either building on what has just been said, expressing disagreement, or comparing something to their own situation. As I will return to in the next part of the analysis, these are some of the ways "doing reflecting" is observed in this dataset.

Extract 3 is an exemplary case of how a student displays during their turn that the teacher is the intended recipient. In this exchange, TA asks the other groups "*what they think*" (line 1, Extract 3) and, after a long pause, where TA glances around the half circle, Joe responds. He begins by complimenting the team, "*they have a clear way of doing things*," but his gaze shifts between the two teachers (TA and TC) (lines 4–5, Extract 3). He then aligns with the teacher's evaluation of the team's status, which happened in the first part of the session, that it is unclear where the team is heading. Next, and then he gives an account, expressing that he thinks it is "*just the way of doing things in this kind of stage*" (line 6). Joe concludes with a positive assessment that the team is "*actually pretty structured for the huge topic*," and TC responds with the acknowledgment "*hmm*" and two nods. In this case, Joe is "doing reflecting" by positively assessing the team's situation at the beginning and the end of his turn. He acknowledges a challenge (the unclear direction, line 5) but accounts for this as a generalization of the current stage in the process (line 6). In lines 5–6 (Extract 3), Joe's "*I think that's just the way of doing things*" displays advice-giving in terms of the stage of the project. During the turn, his gaze shifts back and forth between the two teachers, and by using "they" when addressing the team, the turn is designed with the teachers as recipients.

Cluster Supervision 2, round 1, group 2_cam_1_#07:34-8:34#

1	**TA**	ehm:: (..) let's eh:: hear from the eh: reflected team. what do you think? (..) about this	
2		(.) work going on here (..) on artificial intelligence.	
3		(12.0)	
4	**Joe**	I mean it seems that they have (.) that they have eh: very clear: (.) way of doing	
5		things? even though it's un' if it's unclear (.) where they: are heading? but I think that's	
6		just eh the way of doing things in this kind of stage. eh with (.) keep on integrating	
7		and don't know (.) where the end goal is. but- during the process of integrating you	
8		get pieces- bits of pieces of information (.) out. and so I think they're actually pretty	
9		structured for the (.) huge (.) topic.	
10	**TC**	hmm. hmm	

Extract 3. *Displaying recipiency.*

In some cases, a student changes their stance toward the team in focus midway through their turn—shifting from addressing the team as "they" to "you." In Extract 4, Nina begins by turning toward the teacher as she says, "and *you said like*." She expresses concern and forecasts a challenge, "*it's quite a drastic thing*," directed to TA (lines 1–2, Extract 4). She then changes her stance toward the team when elaborating her concern, "*then you have to find your position*" (lines 3–4), and ends with a positive evaluation of the team while smiling and using a positive tone: "*I'm sure you can*." She pauses and points to yet another challenge: how will they convince a big company to listen to them. This time her statement is directed to the team using the plural pronoun "you."

Cluster supervision 1, round 2, group 1_cam_1_#16:06-16:30#

1	**Nina**	=and you said like how are their working methods because I mean if it's (.) ehm: quite	
2		a drastic thing that they are changing (.) the whole company to be more sustainable↑ I	
3		mean then you have to also find your position and how you can actually contribute to	
4		that of co'. £I'm sure you can't just like that but£ (.) it's a it's a big company so (..) how	
5		do they actually listen to you?	

Extract 4. *Changing stance midway.*

In most cases, when students respond to TA's request to reflect upon the challenges and status of each team, the students will address those in focus using the pronoun "you." Extract 5 is an example of a turn where the recipient-design is the team in focus. Following the traditional rules of classroom interaction by raising her hand, Emma displays a willingness to answer. TA states, "*yeah, just go ahead*" (line 2, Extract 5), again marking the rules for reflective practice: hand-raising is unnecessary, and Emma can "just talk." Emma frames her contribution as a question for the team to consider and refuses to give direct advice or provide a solution to the question. The pauses indicate hesitation, and combined with "might" (line 5) and "perhaps" (line 6), the question is posed in a restrained and managed way.

Cluster Supervision 2, round 1, group 1_cam_1_#08:13-08:39#

1	**Emma**	(raises hand)	
2	**TA**	yeah, just go ahead.	
3	**Emma**	eh:: I'm a little bit curious now. it's a question but I'm >I'm not gonna answer it<. but	
4		how you define ehm: (.) sustainability (.) because you are talking a lot about how (.)	
5		the:y might (..) grasp this subject and how they define sustainability but I'm (.)- would be	
6		interesting to know if you- within your group perhaps define (.) how you (.) what you	
7		think (..) sustainability is↑ (.) in this context.	
8	**TA**	hmm.	

Extract 5. *Addressing the team with a question.*

The delivery of the measured question without an answer may be one way for Emma to demonstrate her resistance to acting as an advice-giver for the team, perhaps because she does not know the answer. As a result, she opposes accepting the role of the adviser in this situation.

Ways of "doing reflecting"

Four ways of "doing reflecting" are observable in the data: reflection as advice-giving (162 instances across the three cluster supervision sessions), reflection as challenge forecasting (75 instances), reflection as claims of comparison (28 instances), and reflection as evaluative praise (32 instances). Since the students engage in multi-unit turns when responding to the teacher's request to reflect, and the teachers also produce multi-unit turns where they respond to a student's comments, the ways of doing reflecting are often combined in a turn (e.g., a statement of a perceived challenge followed by evaluative praise).

Reflection as advice-giving is the most prevalent way of doing reflecting observed in the data. The advice may be combined with a question directed to the team in focus that, due to the rules of participation, is formatted as a hypothetical question and, consequently, does not create expectations that the team will respond. The rules of participation create an opportunity for the student posing the question to give the answer in the same turn, making the question into a proposal for future actions similar to advice-giving. In Extract 4, we saw Nina posing a question and then formatting the next part of her turn as conditional if-then advice: "*if they are changing the company to be more sustainable*" with a built-in answer, "*then you have to find your position*." In Extract 5, Emma refuses to answer the question she has posed, deviating from the norm (advice as questioning with an answer in the same turn; (ten Have, 2007, p. 38). With her declaration (she will not provide an answer), she orients her approach to doing reflection as posing hypothetical

questions, which you then answer and which other students—such as Nina in Extract 4—have done previously.

Forecasting a challenge is the second most prevalent way of doing reflection. As we saw in Extract 1, Karen anticipates a challenge for the design students in the team regarding defining their role and addressing how they can help the client. Again, we notice how Karen designs her turn by posing two questions to the team in focus as the key to solving the challenge she expects they will encounter. In Extract 3, Joe also predicts a challenge, but he begins his turn with a positive assessment before stating the challenge. In Extract 4, we saw how Nina expresses concern with how the team in focus wants to "*change the whole company to be more sustainable*," framing this challenge as "*quite a drastic thing*."

Reflecting as a comparison to one's own situation is also observable throughout the data. We see an example of comparison claims in Extract 2, where Yvonne compares the situation of the team in focus to her own. The claims of comparability may mark affiliation between the student doing the reflecting and the team members in focus. By claiming comparable situations, the students display membership in a collective that includes the members of each team (Kangasharju, 1996): they are in the same situation, they face the same challenges, and they can solve the issue together. This approach can serve to mediate critique or work as a softener while at the same time showing the teacher that the student can compare their situation to the team in focus, and by doing so, potentially learn something about their team's situation.

Positive evaluations and team praise are often employed by students who are "doing reflecting". As observed in Extract 3, Joe marks his turn with multiple units: first, he praises the team, then he notes a challenge and gives advice, ending his turn with a positive assessment of the team, stating, "*I think they are actually pretty structured*," as a way signaling praise. In contrast, in Extract 4, Nina begins her turn with a challenge, forecasting "*it's a drastic thing*," followed by advice-giving. She then softens the challenges ahead with praise, commenting, "*I'm sure you can. It's not like that*." It may be that the students, as advice-givers, deliver the advice with praise to minimize potential resistance to it, managing the inherent asymmetrical features of advice-giving (Waring, 2007b). Interestingly, the advice receiver, e.g., members of the team in focus, are not allowed to respond to the advice with acceptance or rejection, but the students nevertheless orient themselves toward the team as a receiver. Like claims of comparison, giving praise and positive

evaluations may also indicate affiliation and community between the team in focus and the student doing reflecting.

Discussion

"Doing reflecting" is a dynamic activity that is negotiated and co-constructed throughout the supervision sessions. It is also a complex and uncertain affair on which to embark. Firstly, no clear instructions or expectations of the students are given to relay how doing reflection should be enacted. Reflection is framed as a way of thinking about one's own and others' situations and the potential challenges. In this setting, reflection is built as multi-turn units where the student doing the reflecting must orientate toward two receiving parts in the conversation: the team, which is the focal point of the reflection, and the teacher, who is facilitating the session and evaluating the students' performance.

The social order is achieved through the formality of the classroom setting, where the teacher facilitates the supervision sessions. The facilitated framework creates specific rules for participation and represents a break from traditional classroom rules. The teacher articulates a clear break with the hand-raising gesture traditionally used in classrooms. The analysis points toward the "just talk" request, ignoring the hand-raising gesture as an attempt to make the student-teacher interaction less asymmetrical. However, the students continuously orient to the social order of traditional classroom interaction they speak when the teacher asks a question but await a go-ahead embodied by the raised hand before talking, and they expect evaluations from the teacher when finishing a turn. Consequently, the students and teachers co-construct a local social order, where "doing reflecting" does not necessarily have a specific format or clear-cut outcome. It is the ideal of thinking (and articulating these thoughts) on one's own or other's conduct that represents "doing reflection."

Conclusion

The analysis shows how reflective practice is co-constructed and managed in the interaction between teachers and students in the classroom. It reveals that reflection is an interactional phenomenon that unfolds in the conversational turns between teachers and students as sequences of advice-giving, challenge forecasting, claims of comparison, and evaluative praise. The study highlights how the social order of the formal classroom intersects with the locally constituted rules

of participation, which enable a less asymmetrical student-teacher interaction where students take the role of advice-givers alongside the teachers.

As few studies deal with reflection in HE as an interactional phenomenon, this paper contributes insights into how students and teachers construct and enact reflective practice *in situ*, which may challenge how reflection is conceptualized, studied, and measured. Adding empirical knowledge of the process of cluster supervision and reflection in groups, the paper also highlights the role of facilitation and supervision when teaching and learning reflective practice. These findings can assist practitioners and educators in the development of methods for teaching and learning reflection in higher education.

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15 Article five: Video-Based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions

Abstract

There is a widespread commitment to both data sharing and multidisciplinary research across the social sciences. In organizational studies, video data offer promise for data sharing given their unique qualities of permanence and density, which allow for a range of quantitative and qualitative forms of analysis. This presents the opportunity for "video collaboratories" for organizational research projects, in which teams of international researchers can interrogate a single but massively rich dataset in a variety of ways and from multiple perspectives. We argue that this vision can broaden access to organizational settings and stimulate dialogue across the organizational sciences. However, the distinctive challenges of collecting video data to share across groups and disciplines are often treated as simply technical challenges. Our article is driven by our experiences collecting and sharing a video-based dataset with 28 international research teams with diverse ontological positions. We focus on how cinematic decisions during data collection and editorial decisions in data management may be shaped to fit distinct ontological assumptions in a diverse interdisciplinary set of analyses. We conclude with recommendations for future video collaboratories in organizational research.

Introduction

The past few decades have seen an increase in video-based research across the social sciences (Goldman et al., 2014; Heath et al., 2010; Pink, 2007). Within organizational studies alone, this is evidenced by a growing number of studies using video data (Balogun et al., 2015; Hindmarsh & Pilnick, 2007; Jarzabkowski et al., 2015; LeBaron et al., 2016; Llewellyn, 2021; Yamauchi & Hiramoto, 2016), as well as articles and special issues providing wide-ranging reflections on methodological issues in video-based organizational research (Hassard et al., 2018; LeBaron et al., 2018; Rokka et al., 2018). In these and many other articles, video has proven an extraordinary resource for exploring issues of central concern to organizational researchers, including embodiment (Clarke et al., 2021), sociomateriality (Hindmarsh & Llewellyn, 2018), emotion (Liu & Maitlis, 2014), group dynamics (Mell et al., 2014) and various "elusive knowledges" (Toraldo et al., 2018).

A key advantage of video data is that the original recording allows for repeated inspection, including refocusing, time out, and playback. This makes video data well suited for a range of analytic and theoretical considerations of a qualitative or quantitative nature (Christianson, 2018; Heath et al., 2010), as a complement to other forms of research (LeBaron et al., 2018), and for sharing data among research teams (Hindmarsh, 2017; Jacobs et al., 2007). As an example of this property, consider François Cooren's (2013) collection in which every article rested on a single data source (namely the 1974 documentary film *Corporation: After Mr. Sam*). More generally, video recordings collected by one researcher for a particular purpose may be suitable for reuse by a different researcher for a different purpose (Gilmore et al., 2016), thereby addressing new questions from other (even cross-disciplinary) perspectives.

Meanwhile, data sharing opportunities across the sciences are increasingly supported by national and international initiatives for collecting, safely storing, sharing, and interrogating research data.[6] This research agenda, coupled with ongoing technological advances and researcher commitment to data reuse (Corti et al., 2014), has resulted in more opportunities for data sharing across research fields. It has also given rise to the vision for a research collaboratory: "…a center without walls, in which researchers can perform their research without regard to physical location—interacting with colleagues…sharing data and computational resources" (Wulf, 1989, p. 19).

Despite the growing interest in video, the methodological flexibility it offers, and the widespread commitment to data sharing, video data sharing remains surprisingly rare in organizational research and beyond (Corti & Thompson, 2011; Gilmore et al., 2016). In this paper, we argue for the value of the "video collaboratory" (Baecker et al., 2014; Pea & Lindgren, 2008) in organizational research. In particular, we explore some of the work needed to sustain it. To do so, we draw on our experiences from the 11th Design Thinking Research Symposium (henceforth DTRS11), in which 28 international research teams comprising 143 researchers all worked on a single dataset: a collection with video as the primary data, augmented by interviews, documents, and field notes. All DTRS11 research teams analyzed the dataset from their distinct disciplinary perspectives and based on their research questions, applying various quantitative and qualitative analyses with various ontological assumptions. This resulted in 28 symposium proceedings papers, a 30-chapter edited book (Christensen et al., 2017b), and two journal special issues (Ball & Christensen, 2018; Christensen et al., 2017b; Halskov & Christensen, 2018). The topics covered

[6] See, e.g., CLARIN, Databrary, Dryad, EUDAT, Figshare, GÈANT, Zenodo.

in these papers are all highly relevant to organizational and design research, with individual articles examining decision-making (Awomolo et al., 2017), leadership (C.-C. Chen et al., 2017), cultural knowledge in creative work (Clemmensen et al., 2017), team cognition (Christensen & Ball, 2017; Dove et al., 2018), communication and/or conflict in teams (Menning et al., 2017; Paletz et al., 2017), and idea generation (Shroyer et al., 2017). The uniqueness of the DTRS11 data sharing experience allowed us to gain a rich understanding of the benefits, challenges, and limitations inherent in using video data for sharing across a variety of disciplinary boundaries and ontological assumptions.

To reflect on the opportunities and challenges of this kind of video collaboratory, we focus on the issues that arise when collecting and managing video data intended for sharing across multidisciplinary teams of researchers. In particular, we consider how "cinematic" (LeBaron et al., 2018) and "editorial" decisions impact video-based data sharing and make recommendations for their application. Cinematic decisions refer to technical choices and equipment, such as who controls the camera; camera location; number of cameras in use; the use of fixed versus mobile cameras; and choices of angles, framing, and distance (LeBaron et al., 2018). Editorial decisions refer to data editing and management choices, such as when and where to cut video files, what to exclude versus include in the selected data, how to present and format the data, how to share the data, and what additional information to include in the data-set, and how to mediate the relationship between the organizational setting being recorded and the research teams conducting the analyses. In addition, we reflect more broadly on the issues that arose in relation to intellectual property, confidentiality, technical feasibility, and ethical concerns, as well as the labor involved in data curation. To conclude, we offer a set of methodological reflections and recommendations regarding the advantages of video collaboratories for organizational research, as well as guidance on which cinematic and editorial decisions can support their success.

Collecting and sharing video as data

Changes in the funding and organization of contemporary research have led to increasingly multidisciplinary, multi-organizational, and multinational research projects (Cummings & Kiesler, 2005). There has also been greater technological innovation to support collaborative research through the eScience, eResearch, and eSocial Science movements (Halfpenny & Procter, 2010; Jirotka et al., 2013). This has brought about significant investment in technical infrastructures to support distributed collaborative research and promoted the potential for

research collaboratories wherein teams of researchers share data and work together on common concerns. While collaboratories range in form from simple shared databases to more systematic communities of practice, an agreed-upon overarching definition from the Science of Collaboratories project describes a collaboratory as "an organizational entity that spans distance, supports rich and recurring human interaction oriented to a common research area, and fosters contact between researchers who are both known and unknown to each other, and provides access to data sources, artifacts, and tools required to accomplish research tasks" (Bos et al., 2007, p. 656). Collaboratories are well suited to tackle grand challenges that require "a commensurate 'grand programme' of interconnected research" (Armitage et al., 2021, p. 11). They are relevant to endeavors across the sciences and social sciences, but the qualities of video data present notable opportunities for "video collaboratories" in which multiple, organizational research teams can access and develop analyses of shared video datasets. Indeed, there are multiple benefits of this kind of video collaboratory that address standard challenges in organizational research (see Table 4).

Table 4: *Solutions that video collaboratories offer to key challenges in organizational research.*

Challenges for organizational research	**Solutions offered by video collaboratories**
1. A difficult and time-consuming process in research projects relates to the challenges of negotiating access to collect primary data in companies and other organizations.	Access is negotiated to a small number of organizations that can provide data for multiple research teams.
2. Research projects often collect data for one purpose. Broader data sharing and secondary analysis in the (qualitative) social sciences have not been as successful as expected.	The dataset is designed to be shared widely among groups of interested scholars, allowing for multiple topics and approaches to a single dataset.
3. Early-career or otherwise marginalized researchers often struggle to secure access to more exclusionary organizations if they do not have access to the relevant social networks.	Access to exclusive organizational sites and sophisticated datasets can be offered to early-career and otherwise marginalized researchers.
4. The host organization may demand consultancy input on topics that are not well aligned with the research team's interests.	The involvement of multiple research teams exploring a wide range of issues and themes offers the host organization a suite of reports or themes to select from.
5. To understand new research papers, academic audiences often need to be led through significant material (in presentations and papers) to become familiar with the organizational case and setting.	The collaboratory can form a field reference point for an academic community, where knowledge of the setting is shared widely across the community through papers and presentations, building opportunities for more advanced debate and discussion.

It is perhaps unsurprising that others have explored the potential for video collaboratories (Baecker et al., 2014; Hindmarsh, 2017; Pea & Lindgren, 2008). However, those researchers have focused on issues and challenges in building technological infrastructures to make video data and researchers' interpretations of those data universally accessible. We believe that they miss more

fundamental concerns for the video collaboratory—one that relates to the challenge of collecting and compiling video data so that they are amenable to multiple researchers, perspectives, and interests.

In this regard, video data can be deceptive. Video seemingly enables anyone to view and review recordings with ease. As such, video data may initially appear to avoid some of the methodological issues involved in secondary analysis of other data types—for example, relying on another researcher's annotation system (e.g., field notes as data) or data collected for a distinct purpose (e.g., interviews as data). However, research projects with video data conceal a range of decisions that one may not immediately anticipate in relation to data collection (number of cameras, choice of angle, cuts, focus) and data management (editing, selection, retrieval). They also hold an extraordinary level of detail (or "density", Grimshaw, 1982) that enables a variety of analytical opportunities (Knoblauch et al., 2006; Luff & Heath, 2012) while at the same time being limited by recording and editing choices (e.g., when to start or stop the recording, camera angle). Thus, the camera should not be treated as a "neutral" recording device (Toraldo et al., 2018), and data sharing should not be treated as "simple."

Interestingly, concerning cinematic decisions (i.e., how to plan for and execute data collection), it is rare for empirical studies using video to discuss how their theoretical assumptions underpin their camera placement and similar elements (Christianson, 2018). However, all "researchers make theoretical decisions when they locate, point, and begin recording with a camera…even the most basic cinematic decisions have fundamental and ontological consequences" (LeBaron et al., 2018, p. 243). Indeed, in relation to data sharing, LeBaron et al. (2018, p. 243) warn that "with secondary data…the past intentions of the operator may be imposed upon the present researcher who is unaware." Therefore, projects with *shared* video data add to the complexity of using video as data. In traditional video-based research designs, data are collected with a purpose or based on an interest in a given topic, where the researcher collecting the data is most often the same person (or part of the same research project) analyzing the data. However, when collecting video data with the aim of sharing those data with a wider team, a displacement between the researcher collecting the data and the researcher analyzing the data arises, making it harder to argue for a well-designed quality fit between the data collection decisions and the analyses conducted. Collecting data that are suitable for multiple unknown types of ontological stances, research questions, and analytical approaches thus poses new challenges for data collection and data management. Namely, how can researchers select appropriate situations to record that will be

analyzable from multiple perspectives, and how can they make cinematic decisions that will be appropriate to many different types and levels of analysis? Video data that will be shared thus must be collected with sharing in mind.

Beyond data collection, the process of data sharing involves additional editorial decisions related to how best to select, edit, prepare, document, manage and make available the dataset. These editorial decisions demand a balance between the requirements of different research perspectives, on the one hand, and practical and resource constraints on the work of data curation, on the other. These editorial decisions relate to concerns such as how to select which parts of the data are collected to allow for a broad range of approaches to video analysis; which technologies are required to securely share materials with diverse groups of researchers; and what additional forms of data are required to augment the principal video dataset.

Aside from cinematic and editorial decisions, this kind of video collaboratory demands additional labor and mediation work. For instance, most video recordings of everyday work practice contain personally identifiable information (e.g., faces, voices, spoken names, interiors) that cannot be removed without severely diminishing the value of the data for reuse and, further, placing costs on the data-sharer. Legal issues related to data protection regulations necessitate careful attention to the possibility of sharing data in the process of planning data collection (when filing for ethical approval and drafting consent forms) (Gilmore et al., 2018). While the legal, ethical, and technical aspects of data are not the focus of this article (for an analysis of this area, see Christensen & Abildgaard, 2017), we reflect on how these issues bear upon our cinematic and editorial decisions and the work of coordination necessary to support our video collaboratory.

The organizational sciences lack evidence-based methodological discussions of the issues, limitations, opportunities, and benefits involved in sharing video data. Therefore, we focus on the methodological questions of how the decisions made during data collection affect video data and how they can and will be (re)used. As such, this article extends the line of organizational and social research primarily based on video data (e.g., Christianson 2018; Harris 2016; Heath et al. 2010; Knoblauch et al. 2014; Mengis, Nicolini, and Gorli 2018; Pink 2007; Shrum and Scott 2018) by examining how to design and conduct video-based data collection with the purpose of data sharing. In line with scholars in management and organization studies (Hindmarsh & Llewellyn, 2018; LeBaron et al., 2018; Mengis et al., 2018), we argue that methods for collaboratively

collecting, sharing, and analyzing video need to be developed and refined to better utilize the rich analytical potential in video data and its reuse.

The DTRS11 case: Collecting video data with sharing in mind

The DTRS11 case allows us to illustrate the cinematic and editorial decisions to be made in video-based data sharing and the impact they have on the analytical outputs. The DTRS series has used shared video data of varying format, length, and size on several occasions (Adams & Siddiqui, 2015; Christensen et al., 2017b; Cross et al., 1996; McDonnell & Lloyd, 2009a). For DTRS11, 150 hours of in-field video recordings of a professional design team working on a design task within the automotive industry were collected over the course of four months. The video data were edited and packed as a dataset, along with additional forms of data (Abildgaard & Christensen, 2017a). As such, the DTRS11 case can be classed as a "community data system" in Bos et al.'s (2007) typology of collaboratories.

For DTRS11, we wanted to capture naturally occurring behavior and interactions in a professional design team engaged in a design project as it unfolds longitudinally in an organizational context with multiple and culturally diverse stakeholders. We began the fieldwork 14 months before the DTRS11 event and collected the data over four months. Our intention was to compile a dataset that afforded the possibility of applying a multitude of distinct research methods to the analysis of the design team's everyday work and organizing (Abildgaard & Christensen, 2017a; Ball & Christensen, 2018). Our one-to-many aim was to collect and compile a video-based dataset, which allowed for multi-method analyses in the pursuit of answering a range of research questions of interest to the design research community (e.g., pertaining to design processes, roles, language, interaction with materials, and thinking patterns as well as design management, stakeholder interaction, and cultural phenomena). Thus, the dataset should be rich *and* thick—that is, ethnographically collected with sufficient contextual complexity to enable the researchers to study the "how" and "why" of the work of the designers in question (Bornakke & Due, 2018). Finally, our case entailed a deadline (i.e., the DTRS11 symposium event), which forced us to consider how much time the participating researchers needed to produce quality research and write conference papers based on the shared dataset.

Ethical issues with shared video data

Gaining access, establishing trust, securing participant consent, managing who has access to the data, and ensuring appropriate levels of anonymization and confidentiality are of particular ethical

concern when conducting video-based research (Heath et al., 2010). When negotiating access, it is necessary to address and explain the proposed research project while discussing any concerns with sensitivity. Here, it is central to establish a trusting relationship in the context of the research project to negotiate access and confidentiality and to obtain written consent from participants and organizational representatives. Moreover, it is essential to clarify and agree on the level of anonymization and how to treat any sensitive information in publications resulting from the project.

Working with shared data poses additional layers of complexity in comparison to video data collected by and for a single research team. In collecting video data for data sharing, some researchers are effectively placed in a mediating role between the empirical context and the research teams that will analyze the data. The data collection team has a key role in negotiating access on behalf of a wider set of (potentially unknown) researchers and needs to act responsibly in ensuring that both sides (empirical context and research teams) understand the type of trusting relationship that has been established and is to be maintained by all. It is important to clarify to all parties which and how many individuals will have access to the data, for how long they will have access, who has the legal rights to the data, and how the data may be disseminated. This helps establish trust with the participants early on and makes it possible to undertake the video recordings. Moreover, when sharing the data, the involved research teams may gain access to non-anonymized video files in which names, places, and specific company details are visible and audible. Here, it is essential to create clear guidelines for the involved research teams regarding how to deal with ethical issues of anonymity and confidentiality in a consistent manner when working with the dataset and disseminating results for publication.

Therefore, we found it important to create a "coordination team" dedicated to managing data collection and mediating relationships between the site and the collaboratory. A designated coordination team can ensure a consistent application of the data use agreement across the network of analyzing research teams, introduce new researchers to the conditions of data use, and maintain the function of screening all outgoing publications to ensure that anonymity and confidentiality are handled appropriately. The latter is particularly important, given that a multitude of publications may result from a single dataset. Many empirical details may therefore aggregate across the corpus of publications, which could jeopardize anonymity. This situation calls for the coordination team to screen all outgoing publications for information that may jeopardize anonymity or confidentiality. The dedicated coordination team dealt with ethically challenging

issues, such as sensitive company information caught on camera (here, sessions with extensive amounts of sensitive data were not selected for distribution). To ensure consistent anonymity, we provided the research teams with an anonymization key that standardized the pseudonyms for all resulting publications. In the transcriptions of the videos provided as additional data in the dataset, we used the standardized pseudonyms and removed any secret company information.

Cinematic and editorial decisions

As is the case in any research endeavor, capturing and sharing every aspect of the interaction was not an option. However, we aimed to collect a video-based dataset that would allow for *variability* in analyses (in terms of disciplinary approaches, research questions, research topics, and methods), where the data allowed each analysis to be of high *quality* (e.g., in terms of data thickness and richness, sufficient data points) and *feasible* (i.e., within a given timeframe, with an appropriate level of effort and resource expenditure). In many respects, feasibility, variability, and quality tend to pull cinematic and editorial decisions in opposing directions. Data that allow for analytical variability may lead to a tendency to attempt to capture an unwieldy amount of data that is not possible, feasible, or likely to lead to quality data for individual analysis types. Meanwhile, a dataset that allows for feasible analyses may enable specific promising types of analyses but may also lead all analysts down the same narrow path. Despite the paradoxical relationships between these research dataset qualities, we aimed for the shared dataset to be moldable to the individual research aims. To achieve an appropriate dataset of potentially high quality for the intended analysis and its associated ontological assumptions, it should be possible to gain an overview of the data; identify and select appropriate parts of the data; refocus, slow down or speed up, and zoom in for the intended analytical level and timescale; and apply additional preparatory data steps, such as editing, coding, and annotation.

Cinematic decisions

When designing video-based data collection, cinematic decisions imply a set of ontological assumptions that influence the resulting data and analytical options (LeBaron et al., 2018). When recording videos of organizational practice, cinematic decisions are made partly in the pre-planning for data collection stage (e.g., where the camera should be located, where the camera should be pointed, who should control the camera, how the shot should be framed, whether more than one camera should be used) and partly in the recording situation (whether the recorder should stay with the camera or leave the room, whether the direction of the camera should be changed,

whether the camera's location should be fixed or mobile when the recording should be turned on and off) (LeBaron et al., 2018).

Pre-planning for video-based data sharing

Given that cinematic decisions influence how the dataset may later be molded and provide a quality fit with individual analyses, it is essential to consider *who* is to analyze the data, *what* their research interests are, and *how* they are likely to analyze the data in terms of methods and analytical frameworks. We aimed to collect and share video data for DTRS11. This involved an open call for participation from design researchers from different disciplines with distinct research interests and a variety of analytical approaches and methodologies. In this initial phase of designing the data collection process, we examined how to make early cinematic decisions for our data collection when the data are shared for analysis using (potentially unknown) ontological assumptions. Given that we did not a priori know *who* would be analyzing the data, *what* specifically they would find interesting, or *how* they would approach the analysis, we relied instead on our knowledge of the research field when attempting to estimate and cater to likely participants, typical design research topics, and common analytical frameworks.

Before beginning to record, we planned to organize our process to suit two of the dominant methods in the design field that rely on verbal data: protocol analysis and conversation analysis. The field of design research has a long history of studying design practice mainly by focusing on staged experiments, with some naturalistic exceptions wherein the researcher sets an artificial task for a team of designers (or, more often, design students) to solve within a specific time limit (Matthews & Heinemann, 2012). These approaches to studying design practice often include methods with think-aloud instructions analyzed through verbal protocol analysis of design cognition (Christensen et al., 2017a; Christensen & Ball, 2019). Like many other disciplines in the social sciences, the field of design research has also taken a "social turn" away from the objective perspective toward a more relativist approach influenced by pragmatism and social constructivism (Lloyd, 2019). The field of design research includes studies of design activity that are both theoretical and empirical, general and particular, and where design is approached as a complex human activity. The discipline has also come to include empirical studies of non-forced, naturally occurring professional practices in design (Christensen & Ball, 2014; Due, 2018; Lloyd, 2019; Luck, 2012a; Matthews & Heinemann, 2012). Today, the design discipline includes a variety of qualitative and quantitative methodological approaches. The field's eclectic nature makes it a good candidate for illustrating the potential in sharing a single video-based dataset with

many different researchers who have varying ontological assumptions and methodological approaches to analysis.

Through mapping the common analytical approaches in design research, we found that the dataset needed to be moldable along several dimensions. First, the dataset needed to allow for analyses assuming that the data were naturally and spontaneously occurring design processes as well as analyses assuming that the data were constructed in negotiation between researcher and informant. Second, the dataset should allow for both quantitative and qualitative analyses. Third, the dataset should allow for the analysis of both micro- and macro-level timescales to allow for both brief episodic interactions and longitudinal developments across many interactions. Fourth, given that the longitudinal dataset should allow for topical research questions, we needed to sample a string of distinct design interaction types (e.g., dialogue, gesture, material interaction) tied to individual stages of a design process (e.g., framing, concept formation, user studies, stakeholder interaction, prototyping). These multidimensional dataset aims led to a series of cinematic principles that drove our data collection.

We designed the data collection so that we could shadow the design team in their naturalistic context, documenting their planned and spontaneous meetings and interactions. We also aimed to reflect upon, detail, and document our data collection decisions for the sake of transparency regarding how the dataset was constructed. We aimed to document each episode using multiple cameras and audio recorders to capture rich and thick data that were analyzable from many angles while simultaneously tracing the development of the design across many stages of a design process. This was intended to allow for both qualitative and quantitative analyses at both short and long timescales and topically focused on distinct design stages or interaction types.

In considering how these dataset principles could best be met in the context of the empirical case in question, we opted for a setup where we could record planned and spontaneous activity in the design team across time in their *in situ* natural organizational contexts. Design team meetings were crucial opportunities to capture dialogue and were recorded as much as possible. As we aimed to capture naturally occurring and spontaneous dialogue, we decided that the camera operator would enter the design team as a participating observer (Hong & Duff, 2002). This ensured a continuous presence on the team, thus allowing for the situated quick and spontaneous capture of meetings set up with short notice and mitigating the problem of participant reactivity, or response to the research act (Heath et al., 2010). The participant-as-observer followed the

design team in their day-to-day office working routines over the course of four months, including on international trips for design sessions with lead users. This proved critical in deciding when and how to record, where to position the equipment, and how to deal with practical problems such as securing a clear visual image and good-quality sound.

Capturing natural occurring interactions on video necessitates knowledge of and experience with camera equipment before fieldwork (Goodwin, 1993; Shrum & Scott, 2018). Based on the knowledge of the design team's working environment and routines, we developed a technical plan for the recording equipment. We chose a camera setup that could be easily mounted on walls or whiteboards in a few minutes, was cordless, and used a wide-angle lens to capture as much as possible of the interactions in narrow rooms. A multi-camera setup with four small and easily mountable action cameras and voice recorders allowed for a 15-minute installation in a given location and captured high-quality audiovisual recordings of a meeting from a variety of shot frames and angles.

To maximize broad coverage of the interaction taking place, we used two to four cameras to collect data to record much of the actions and interactions of all participants involved in the recorded session (Heath & Luff, 2013). We found action cameras useful because they are small and fitting for both fixed and flexible setups with additional clamps and mounts. Gaffer tape was used to keep wires, external power banks, and microphones in place and for quickly mounting, adapting, and removing the cameras. As battery consumption is a common issue with GoPro cameras, we used external power banks, given that the recordings usually lasted more than the 30–60 minutes that standard batteries offer. Power banks allowed us to record for up to eight hours, exceeding the storage capacity of 64 GB SD cards. SD cards thus eventually had to be changed during a full-day recording. The video and audio specifications are shown in Table 5, and the camera setup is presented in Figure 1.

Table 5: *Recording and storage specifications.*

Video specifications
Total cameras: 4 (GoPro 3+ Black Edition) Recording quality: 1080 p/30 fps/wide angle Time lapse: Pictures taken every 10 s
Audio specifications
Total audio recorders: 4 (Zoom H1) Recording quality: 24 bit/48 kHz .wav file
Storage
64 GB SD cards (for cameras) 8 GB SD cards (for audio recorders) 1 TB HDDs (for in-field storage of data)

Figure 1: *Camera setup with power bank and audio recorder.*

Situational decision-making

When recording organizational practice in naturalistic contexts, it is not possible to pre-plan for all cinematic decisions. However, a series of situated "on-the-spot" decisions influence later analytical options. Given our aim of non-obtrusiveness, we decided to set up the cameras mainly toward the beginning of a session and tried to avoid moving them mid-session, which risked interrupting the participants. The presence of the participant-observer camera operator proved critical in terms of creating strategies to make appropriate choices regarding when to record, where to place the cameras, and how to capture all participants and materials while securing a clear image and quality audio. Given the interest in bodily and verbal conduct, some cameras were placed at a personal distance (capturing normal perspective, usually from the waist up) and some at a social distance (capturing full-body postures of the interacting group) (Derry et al., 2010; Shrum & Scott, 2018) with angles that enabled us to see objects, faces, and bodies. Figure 2 illustrates a work context in China where three cameras and audio recorders are placed at different locations to capture interactions as they unfold in the space. Figure 3 and 4 show overviews of the layout and video views of a meeting.

Figure 2: *Camera and audio setup example from a workshop in China; three cameras and audio recorders in use.*

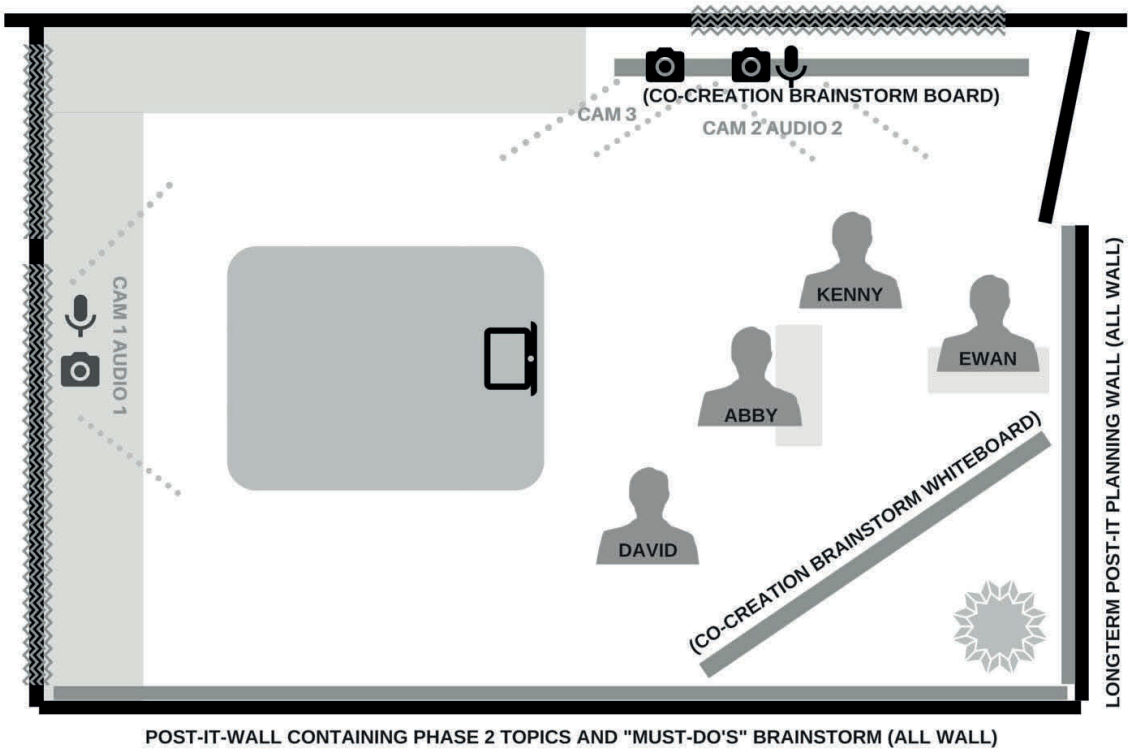

Figure 3: *Overview of camera and audio setup, participants, and materials.*

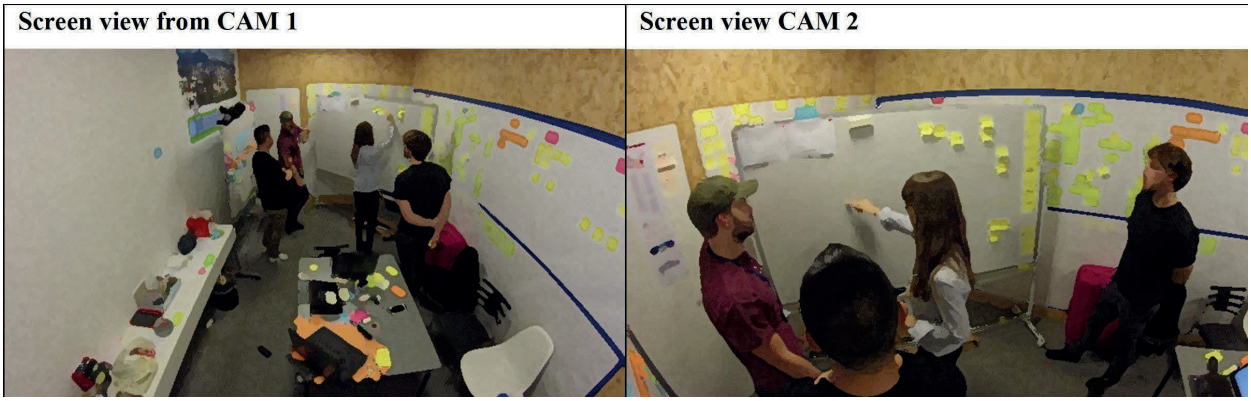

Figure 4: *Capturing interactions at different distances; screen views from camera 1 and camera 2.*

To compensate for a lack of close-up recordings of details regarding the materials in use, we took high-quality photographs of most of the material produced (e.g., sticky notes, posters, and writing on whiteboards after each recorded session; for an example, see Figure 5).

Figure 5: *Photograph from a workshop showing the details of sticky notes on a poster board.*

Given that we were recording for data sharing purposes, where the proximity of analytical interests may vary between researchers, we chose to use several cameras with different positionings to maximize the likelihood that the recordings would be of interest to the research teams across cameras. We used wide-angle settings on each camera because such settings are well suited for recording in narrow rooms like offices and homes (Goodwin, 1993). Although wide-angle lenses allow activity to be captured at a 150-degree angle, the tradeoff is the "fish-eye view," which may make specific analyses difficult (e.g., eye gaze or facial expressions). Again, using several cameras counteracted the distortion of the view by allowing for cross-checking between camera views and qualifying analytical claims (such as the relevance of eye gaze or direction of a given gesture).

Editorial decisions

Each choice in the process of editing, transcribing, and sampling the dataset impacts the data and any subsequent analytical steps (Heath & Luff, 2018). Given the aim of data sharing for feasible, variable, and quality analyses, editorial decisions required careful consideration.

What should be included in the dataset?

Preparing the final dataset required editorial sampling decisions, as we had more than 150 hours of raw video data. These data needed to be reduced before sharing for several reasons. First, the data needed to be manageable for the research teams, who were to conduct independent analyses

and write manuscripts in less than six months. Second, the size of the dataset also needed to be manageable for the coordination team (including time-consuming transcription and video editing). Finally, the dataset needed to be sufficiently comprehensive to allow for full-scale quality analysis from a variety of disciplinary perspectives and methodological approaches, analytical levels and timescales, research topics, and kinds of interactions. With these considerations and inevitable tradeoffs in mind, we planned to share 10–15 hours of video with supplementary data such as audio, pictures, transcripts, and documents produced by the design team. The overall dataset size was partly influenced by key learnings from past DTRS data-sharing events (Adams & Siddiqui, 2015; Cross et al., 1996; McDonnell & Lloyd, 2009b), where small datasets have led to an overly restrictive set of analytical options and extensive datasets have proven infeasible given the timeframe of analysis.

Several criteria guided our sampling decisions. First, the data needed to allow for analysis of a design process as it developed over time "in the wild" (Ball & Christensen, 2018), both in the short and long term. Second, the data needed to entail a range of design activities performed by the same design team in order to allow for the analysis of distinct design research topics. Third, as we followed the design team over time, we noted that certain elements that dominated our dataset offered opportunities for novel analyses that were not well described in the current literature. For example, the data were characterized by co-creation with lead users and involved multiple cross-cultural design interactions. This led us to coin the theme of "cross-cultural co-creation" as a potentially interesting topic of analysis, which further guided which videos we eventually selected (e.g., we included videos involving activities before, during, and after specific co-creation sessions). Finally, the data needed to illustrate the nature of the design teams' working routines and practices.

We included all available camera angles and audio recordings in the selected data to allow for analyses with ontological assumptions of pure observation and avoided highly cinematic or edited compositions. Deciding when an activity begins and ends in recording is primarily a theoretical discussion and is challenging in practice (Laurier & Philo, 2006). Nonetheless, as analytic interests vary, it is inevitable that research teams will find their units of analysis dispersed through different sections of the recorded data and may prefer that recordings start earlier or stop later. To enable as full a range of analytical options as possible, we decided to distribute full-length videos and thus chose to avoid cutting any recording in the middle. Nevertheless, some activities began before the camera operator could mount the cameras and begin to record, took place outside the

meeting rooms where the cameras were mounted, occurred after the cameras stopped recording, and so on. The one exception to the choice of full-length video sessions was the inclusion of time-lapse videos of cross-cultural co-creation workshops. Initially, we wanted to share these recordings in full. However, since the sessions were in a noisy environment that involved multiple simultaneous conversations in different languages, it proved impossible to feasibly transcribe, translate, and anonymize the data. We included the time lapse to allow the research teams to gain a sense of the activities undertaken in the workshop, since we anticipated that the workshops would be of interest to some teams.

Reviewing the large corpus of data was challenging. However, with field notes, we determined which chunks of video to select for detailed assessment. We eliminated recordings that contained many conversations concerning secret company information as well as recordings of primarily individual work (e.g., a team member working in silence on their computer). After balancing our objectives, the final dataset included recordings of stakeholder meetings, meetings with external consultants, core-team meetings, workshops, sprint sessions, brainstorming sessions, spontaneous idea generation sessions, and briefing sessions (Christensen & Abildgaard, 2017, p. 23). The final selection of recordings included 20 full-length video sessions of design activity ranging from 30 to 90 minutes in length.

How should the dataset be prepared and shared?

Receiving data for analysis that have been collected by another party may cause issues with obtaining an overview of the design process, understanding the personal relations within the design team, and understanding the organizational context, even before determining what might be of analytical interest. This is not only a matter of avoiding inundating researchers with 15 hours of video data from an unknown design team with a complex working process; it also involves sharing the methodological choices underpinning data collection. Describing, contextualizing, and documenting the data contributes to the quality of the data and the subsequent analyses when dealing with shared data and secondary analysis (Corti et al., 2014).

To aid in data entry, we developed a technical report for inclusion in the dataset. The report entailed detailed descriptions of the case company, background information on the design team members and central stakeholders, and a description of the design project to contextualize the video recordings as the foundation of the dataset. We also included detailed descriptions of our methodological considerations, data collection, data selection, and summaries of each of the 20

selected video recordings with five keywords (such as conceptualization, sharing experiences, workshop design, sticky notes, and evaluation). The written summaries and keywords provided a shorthand overview of each video, which enabled quick deep dives into data on topics of interest to the individual researcher. The technical report aimed to facilitate research teams' understanding of the complex and lengthy records of interaction. The report was structured chronologically according to the design process and contained material from the design project description with the expected phases and deliveries. Further, we shared the actual deliveries and project presentations developed by the designers. This choice gave the research teams access to an extensive range of materials, which we anticipated that some would find important for their analyses.

To allow for a feasible project overview and easy data entry, we conducted a semi-structured interview with the team leader before fieldwork began. The team leader was asked to explain the future project plan to obtain an overview of the upcoming four-month full-time project. The interview covered the project plan, expected deliveries, stakeholders, and design approach and allowed the team leader to explain his thoughts and reflections regarding the forthcoming project (Christensen & Abildgaard, 2017, p. 21). After the fieldwork, we conducted a follow-up interview with the same team leader. At this point in the research phase, we encouraged the DTRS11 researchers to send us tailored questions that could enrich their analyses and clarify potential uncertainties that might have occurred during their data analyses. This reduced the distance between the designers being studied, the data being collected, and the research teams analyzing the shared data.

The background and follow-up interviews with the team leader—along with supplementary materials such as slideshows, design team schedules, notes, moderation guides, and drafts of presentations for stakeholders—were also included in the dataset.

The final dataset contained the following:

- Videos of 20 sessions containing a split-view screen combining relevant camera angles, as well as a full screen for each individual camera angle;
- Full transcriptions of all video material;
- Background and follow-up interviews with the design team leader and accompanying transcriptions;
- Materials discussed in the meetings, along with any relevant background material (e.g., moderation guide, slideshow presentations, project plan); and

- A technical report covering 1) seating plans for each video session and the camera setup, 2) profiles of involved team members (with general background information at a level that did not threaten anonymity), 3) summary of the design project and process, and 4) summary of the lead-in to the current design project (completed in 2014).

The final dataset was uploaded and shared using a secure online data repository provided by the Danish e-Infrastructure Cooperation that enabled secure storing and sharing of the data in a Dropbox-like folder structure. A full discussion of how to store data securely and manage data using digital platforms is beyond the scope of this article, but the works by Louise Corti and colleagues offer thorough guidance (2000; 2014; 2020). At the roots of the folders containing the raw data, we added a welcome document with information on what to expect, what data formats the folder contained, our recommendations for where to begin, and a reminder regarding confidentiality and secure storage.

We divided the final dataset into 22 separate sessions (two interviews, 20 videos) and organized the online folder structure accordingly. Each session had a title related to its content (e.g., "Designing co-creation workshops," "Briefing with stakeholders"). We provided a chronological overview in the online database of all sessions that included numbers, title, date, and length in minutes. Each session had a corresponding folder containing subfolders with available videos in separate versions from each angle and in a split-screen version, along with a full transcript, separate audio files, and additional material, such as high-quality pictures or PowerPoints that the design team shared with us.

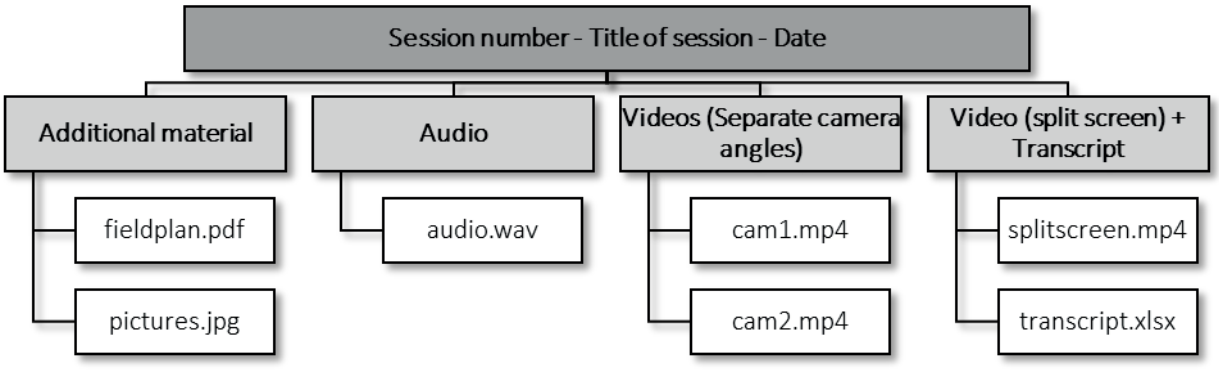

Figure 6: *Example of folder structure in the database.*

To facilitate data entry and allow for the simultaneous screening of several shot angles and types, we created a synchronized single split-screen video of each session, which we considered the first point of entry. We anticipated that the split-screen video would be enough information for most

analysis teams to conduct their initial analysis, with the remaining folders offering possibilities to explore the data in more visual, verbal, or contextual detail. An example of a split-screen video screen with four available camera angles is shown below (see Figure 7) in a blurred version for anonymity. To avoid misuse and simplify data entry, each video file included an opening frame with the data use agreement followed by a still frame of the respective plan for the camera setup (e.g., Figure 3).

Figure 7: *Split-screen video produced for sharing.*

We produced premade transcriptions of the videos with the expectation that most research teams would rely heavily on verbalizations in their analyses. Premade transcriptions were further intended to aid research collaboration and cross-referencing across the analysis teams. We were aware of the challenges of transcription practices across disciplines (Knoblauch et al., 2006); some researchers require richness and detail while others need less audiovisual information to conduct their analyses. We thus needed to reduce complexity without losing too many details that could create additional work for the research teams. For transcription, we used a simplified transcription notation system inspired by Conversation Analysis (Jefferson, 1984) to transcribe speech and relevant action sequences. Company-specific products and places were marked with "XXX" in the transcription. For some research teams, the transcripts proved sufficient to conduct their analyses, whereas others enriched (e.g., adding a more detailed transcription of selected sequences) or reduced (e.g., removing action sequence references for pure lexical analysis) the transcripts. Transcripts were provided in Excel spreadsheets and were segmented according to

turn-taking (taking overlapping speech into account). Using Excel allowed us to number each segment so that the researchers could use a standardized reference style: session number (the video) and segment number (the "turn" in the Excel sheet). Thus, (v03, 23) referred to video 03, segment 23. This reference style made it possible to locate a specific video segment across publications and also allowed researchers to discuss and collaborate on the interpretation and analysis of the same segments of data. Names were concealed using pseudonyms to ensure complete anonymity in written documents that originated from the dataset.

Impact of cinematic and editorial decisions

After we shared the DTRS11 dataset, the research teams engaged with the data, and most teams eventually submitted full papers to the symposium (Christensen et al., 2017b). Before sharing the DTRS11 data, 41 research teams were granted access to the data. The selection was based on short descriptions in the format of a research brief of the research questions they intended to address, the analyses they intended to perform, and the parts of the dataset with which they intended to engage. Comparing the initial research briefs with the final analyses offered a qualitative exploration of the impact of cinematic and editorial decisions on the analyses conducted by the research team. Below, we analyze how cinematic and editorial decisions impacted the dataset's moldability and therefore the feasibility, variability, and quality of the resulting analyses (see also table 3 for an overview).

Feasibility

Of the 41 research teams granted access, 28 produced full papers based on their analyses. Of the teams that did not finalize papers, four indicated that they lacked the time due to other priorities, one retracted their paper for personal reasons, and five referred to a lack of data fitted to their research interests, with the remaining three opting out for unknown reasons. Overall, it is noteworthy that the vast majority of research teams ended up with full analyses of various topics, with only five teams retracting with direct reference to the lack of data fitted to their specific research interests. Retractions came very early in the process, indicating that the teams decided that there was a lack of data matching their interests upon a quick screening of the final data. Two retractions related explicitly to the inability to apply existing theoretical frameworks to the data, and one team considered the dataset content outside the researchers' standard conception of design. Retractions can be expected when sharing datasets in this way, but the key is to provide

sufficient information about the dataset upfront so that researchers can decide whether to commit further without undue and unnecessary time and effort.

Data entry for shared data can be a time-consuming endeavor. We found that the technical report, background interview with the team leader, and split-screen video served as almost all teams' entries into the data and significantly eased the task of gaining an overview, identifying topics of interest, and finding relevant data sessions to examine further. Thereafter, some teams referred to the transcripts as the next analytical step, whereas others dove into specific camera angles to view select videos in more detail. For the teams performing textual analysis, the premade transcripts served to significantly abbreviate the time to analysis, although some teams had to expend effort to either add further details regarding behavior and gesture (e.g., Conversation Analysis) or remove details regarding pronunciation and pausing (e.g., Latent Semantic Analysis) before analysis could begin. Within the five-month time frame that our symposium allowed for analysis, 28 teams managed to provide full papers, but not without investing significant resources. It was clear that the teams needed to purposefully and continuously manage and scale their analysis to their resources (e.g., team size) to avoid being overwhelmed by data. As a result, the average number of co-authors grew between the initial research brief ($M = 2.55$) and the final paper ($M = 3.04$), as nine teams added additional members.

While the fixed time period could be seen as a constraint with regard to feasibility, we discovered that it offered a number of benefits. First, it ensured that the work of the coordination team could be focused on a set period, mediating between the site and researchers. A longer period would have made it more difficult to sustain the coordination team and might have restricted access to the additional information needed for specific types of analytic work. Second, it engendered research momentum: Researchers focused their efforts on generating articles within the set period, creating an impactful field reference point.

Variability

There are two key pieces of evidence that our dataset supported variability. First, the research output varied significantly in relation to the topics explored. Some analyses were related to team dynamics and conflicts in multicultural design teams, focusing on aspects related to team conflict, leadership, stakeholders, and changes in the team's conversational topics over time. Because the data traced a design team across cultural contexts, some research teams turned to study cross-cultural design processes, focusing on situated cultural practices, articulation of cross-cultural

assumptions, and cultural values. A subset of studies explored the cognitive and metacognitive processes related to design thinking, focusing on information sharing, the use of design materials such as sticky notes, and metacognitive processes related to process awareness and epistemic uncertainty. The dataset allowed for the topic of design talk to be studied with particular emphasis on design slang and jargon, design language discourse, and conversational focus shifts in turns with low topical coherence. Some research teams discussed framing as a design skill, problem structuring, planned spontaneity, and constraints in the design team. The dataset allowed some researchers to study design iterations across a more extended period as well as how themes and problems evolve during a design project. User interactions and co-creation were also studied, focusing on phenomena such as user empathy and narratives in co-creation. As such, the range of analytical topics for which the dataset allowed was significant.

Second, the research output varied significantly in relation to the adopted research approach. The data were approached using qualitative, quantitative, and mixed-methods analyses. A wide range of analytical approaches was applied, including interaction analysis, collaborative inquiry, content analysis, conversation analysis, discourse analysis, multimodal interaction analysis, network analysis, latent semantic analysis, and a variety of coding quantifications followed by statistical analysis. Some researchers utilized the longitudinal nature of the dataset and developed mixed-methods approaches to perform timeframe analyses. This diversity of analytical approaches was possible due to the moldability of the dataset. Interestingly, many of the cinematic and editorial decisions were accepted across papers and caused few issues. These decisions included the role of the camera operator as participant-observer, the situational decision-making, the choice to use multiple fixed cameras at a variety of distances from the interaction, and the choices regarding when to turn on and off the camera. For most analyses, the choice to record using multiple cameras was a crucial aspect of the ability to select and modify the data to fit the researchers' analytical purpose. Thus, despite a common data entry strategy of first viewing the split-screen shot, many visual analyses later used a selected single-angle record for their subsequent in-depth analysis.

The extent to which the full dataset was part of individual analyses also varied. Although a few teams used almost the entire dataset, the average amount of video on which the teams based their analyses included only three to four hours of select relevant data. Thus, the editorial decision to allow for topic diversity was crucial in ensuring analytical variability. The many varied and interdisciplinary analyses of a singular dataset offered significant opportunities for cross-disciplinary research analyses. While we had hoped for and anticipated such cross-disciplinary

collaborations, a key finding was that this seemed to add a new, doubly effortful analytical layer to the workloads of the research teams. As a coordination team, we significantly underestimated the time needed for research teams to inter-connect and produce joint publications. Clearly, one reason for the lack of cross-disciplinary analyses across research teams is the limited time frame of the project. However, to realize this potential in future projects, it is important to build structures to motivate cross-disciplinary work and create more explicit opportunities to examine common themes and interests, such as those outlined by Siedlock et al. (2015).

Quality

As noted above, the shared dataset supported variability in the research approach adopted by different teams. However, analyses focused on fine-grained analyses of short extracts generally experienced fewer problems, as the cinematic choices tended to allow for the appropriate analytical steps (e.g., changing angle, zooming in). The longitudinal nature of the data collection did allow for a novel type of analysis on timescales in design (Shroyer et al., 2017), which eventually won the Design Studies Award for best annual paper in the journal *Design Studies*. Nevertheless, there are issues to take into account in generating a moldable dataset where decisions by the coordination team still allow for local decision-making by different teams of researchers.

With a shared dataset of limited size and multiple topics and types of interactions, some teams struggled to find enough relevant data for their respective analyses, but rarely to the extent that they abandoned an analysis. Analyses focusing on interactions across more extended periods (e.g., across design sessions) were somewhat limited by the lack of detailed information on what took place between videos. Several publications aimed to trace activity longitudinally (Chan & Schunn, 2017; Dong & MacDonald, 2017; Menning et al., 2017), but the dispersed temporal nature of the videos selected for the dataset (snapshots over a four-month window) caused issues related to the inability to perform in-depth analyses at any one point or across time. These research teams experienced some difficulty when viewing the process as a series of video snapshots. Furthermore, one paper pointed to the constructed nature of the dataset and commented that the editorial decisions might have imposed a narrative structure onto the data (Lloyd & Oak, 2017). That paper further commented that the time lapses included in the dataset contained an error in the temporal sequence, and suggested perhaps that the time lapse had been edited with a specific purpose in mind.

Nevertheless, and as previously discussed, cinematic and editorial decisions in sharing data are inevitable. Information in the technical report proved invaluable for distinct ontological assumptions, and many research teams made extensive use of the additional materials that were collected and generated. The detailed still images taken after each session proved particularly important in exploring and understanding the nature of the materials generated during the meetings, as these stills avoid the contextual blurring that arose when pausing the in-motion video and allowed for a clear visual interpretation of context, text, and objects. The choice of camera angle and distance and the choice to start or stop the video made individual analyses somewhat challenging to conduct at times for some teams, but rarely disrupted them fully. The background project description and background interview with the team leader were used centrally by most of the research teams in their analyses. This was used to furnish a general context for papers, provide illustrative quotes to support emerging findings from the video dataset, and (rather interestingly) to generate avenues for analysis of the video dataset.

However, a key learning is that research teams' expectations should be managed so that cinematic and editorial decisions are shared as widely as possible but teams can still make decisions locally about (i) what they include in their analysis, (ii) the extent to which they make use of the technical report, and (iii) the extent to which they can request additional data. The third point presents an enduring challenge for eResearch. It is possible to treat the 15-hour dataset as a sample where, if relevant, researchers can ask for further instances and examples. However, there are some resource and technical challenges involved in offering 150 hours of data to a distributed set of research teams. For instance, significant infrastructure is needed to share such a quantity of video data in secure and efficient ways while limiting download speeds. Second, in our case, the coordination team was charged with screening the dataset for issues related to anonymity or confidential data in order to mediate the relationship between the research site and the wider team of researchers. As such, offering the full dataset for further analysis presents additional ethical and practical challenges.

Table 3: *Recommendations for cinematic and editorial decision-making in video collaboratories.*

Problem	What we did	Key learnings	Recommendations
CINEMATIC DECISIONS			
Obtaining access How to mediate a trusting relationship among a large and distributed set of stakeholders	A dedicated coordination team responsible for data collection was established. During initial meetings with the participants to be filmed, we clearly outlined the planned research process and how data were to be shared and used, highlighting that we would be mediating the relationship throughout the project. We identified research teams likely to analyze the data. Informed consent, treatment of confidential information, and anonymization were negotiated prior to recording. On the researcher side, data use agreements and NDAs were used to align formal expectations, with additional informal information communicated on the established trusting relationship with the organization and derived expectations.	The choice to establish a dedicated coordination team was significant. This team could balance and mediate the level of interaction between the empirical context and the research teams throughout the project.	Set up a dedicated coordination team responsible for data collection who can mediate the relationship between the organization and the multiple research teams. The team needs to pay careful attention to the ethical challenges inherent in establishing and maintaining trust on behalf of multiple research teams. The team needs to balance the desire to *reduce* the analytical distance between the empirical setting and the research teams (in order to improve research quality) with the need to *maintain* a trusting relationship with the coordination team (which is key to securing anonymization, confidentiality, and access). The coordination team needs to manage expectations for all stakeholders: Which and how many individuals will have access to data? How long will they have access? Who has the legal rights to the data? How will the data be disseminated?
Pre-planning How to pre-plan for collecting in situ data to be analyzed for a multitude of topical interests and analytical approaches	Taking both the empirical context and likely research team interests into account, we established a set of cinematic principles for how to approach the data collection. We then designed a technical equipment setup suitable for the present purpose (multiple cord-free action cameras with wide-angle lenses that could be easily mounted in a few minutes).	For most research teams, the choice to record using multiple cameras was critical in being able to select and mold the data to fit individual analytical purposes. Most teams succeeded in analyzing the dataset, leading to a large number of distinct topics. However, a few teams also withdrew due to the inability to analyze the data according to their research interests.	Work with the potential research teams based on their topical interests and typical analytical approaches in order to maximize the likelihood that the dataset will be useful and moldable for the research teams' individual purposes. Map across analytical approaches to identify potential cinematic tradeoffs to consider during data collection. Familiarize yourself with the empirical context. Develop a set of pre-defined cinematic principles for data collection and design the technical setup based on these principles (e.g., number of cameras, camera location, framing of the shot). Consider tradeoffs between anticipated analytical approaches and try to work around them. Make sure to capture data in sufficient thickness, richness, and quantity to enable different analytical approaches to produce a quality and feasible analysis.
Recording What to capture on camera when topical interests and analytical strategies vary across research teams	We used different camera positions to capture interactions unfolding from different angles and perspectives. The participants often worked in small meeting rooms with materials and whiteboards. One to two cameras were used to capture the full-body postures of all participants in the room as well as the materials in use—such as whiteboards, laptops, and sticky notes—and the spatial layout. Additionally, one to two cameras were used to capture the participants' behavior from a mid-waist or full-body perspective.	While we had anticipated some of the topics and approaches in the cinematic principles, more topics and analytical approaches were applied to the analysis of the data than expected. The most frequent choices aligned well with the anticipated topical interests and analytical approaches, but the unique qualities of the dataset also drove many analyses. The data were approached using a multitude of qualitative, quantitative, and mixed-methods analyses.	Make the dataset moldable for individual research teams by sometimes making doubly effortful cinematic decisions regarding how and what to record in support of distinct anticipated analytical approaches. This will enable individual research teams to select the angles, sessions, and suitable approaches for their own analysis. Simultaneously, record unique topical qualities, as they are likely to lead to original and unexpected analyses.

Situational cinematic decision-making How to make in-field recording decisions	We aimed to capture naturally occurring and spontaneous dialogue, so we decided that the camera operator would enter the design team as a participating observer, thus allowing for continual presence and situated quick and spontaneous capture of meetings set up with short notice.	Making appropriate situational cinematic decision-making requires pre-defined cinematic data collection principles but also training in applying these in the face of a dynamic and unfolding empirical context. It was particularly challenging to manage the level of intrusiveness. The camera operator sometimes compromised obtaining close-up views of the participants' facial expressions or the materials on which they were working in order not to miss the overall interaction and to avoid disturbing the interaction. To partially address this tradeoff, we took high-quality photographs of the material produced after each recorded session.	Applying the set of pre-established cinematic principles in situ can be difficult and involves tradeoffs. Therefore train the camera operator in applying situational decision-making (e.g., when to record, where to place the cameras, how to frame the shot, when to move the cameras, what additional materials to capture and collect). We recommend the use of a camera operator who is also a participant-observer. This choice allows for important ongoing situational cinematic decisions and continual empirical setting presence and did not lead to any identified analytical problems by the research teams.

Problem	What we did	Key learnings	Recommendation
EDITORIAL DECISIONS			
Selecting What to select for inclusion in the dataset	We chose to share records of coherent sessions from different stages in the design process, from different types of meetings with a variety of stakeholders, and at different locations (e.g., different offices, different countries) to provide the research teams with multiple entry points for analysis. We left out recordings that contained many conversations concerning secret company information, as well as recordings of primarily individual work. As research teams had approximately five months for their analysis, we selected 10–15 hours of video for sharing in order to make analysis feasible.	Field notes taken during data collection helped us make decisions on how to select and reduce the dataset. They provided an efficient way to identify and select different stages in a project, different types of meetings with various stakeholders, and in different contexts.	Consider the feasible timeframe for conducting a quality analysis in selecting data. There is a tradeoff between feasibility and amount of analytical options. Having more data is likely to lead to more analytical options but also requires more time for the data collectors to curate and prepare and for the research teams to obtain an overview of and select from. Finding relevant data in very large video datasets can be extremely time consuming. Consider likely topical interests and include unique empirical qualities deriving from the dataset. Use field notes to support such decision-making.
Preparing How to prepare and supplement the dataset	To facilitate data entry and provide sufficient background information on cinematic and editorial decisions, we developed a technical report for inclusion in the dataset. To provide context for the video recordings, the report contained detailed descriptions of the case company, background information on the design team members and central stakeholders, and a description of the design project. We also included detailed descriptions of our methodological considerations, data collection, data selection, and summaries of each of the 20 selected video recordings. With the expectation that most research teams would rely heavily on verbalizations in their analyses, we produced premade transcriptions of all videos. We used a simplified transcription notation system inspired by Conversation Analysis (Jefferson, 1984) to transcribe talk and relevant action sequences.	Describing, contextualizing, and documenting cinematic and editorial choices in the dataset contributed significantly to the quality of the data and the subsequent analyses. The technical report proved important for research teams. While transcription is time consuming, for some research teams the transcripts proved sufficient to conduct their analyses, whereas others would enrich (e.g., adding a more detailed transcription of selected sequences) or reduce (e.g., removing action sequence references for pure lexical analysis) the transcripts.	Preparing the data for analysis (e.g., writing a technical report; transcribing the data) is key to facilitating data entry and feasible analysis, and for producing quality analysis. However, given the diversity of analytical approaches, what is helpful for one team may be irrelevant to others. The more preparatory work that can be shifted to the coordination team, the less time it is likely to take the research teams to reach a quality analysis (easier to locate, easier to analyze). Be aware of the variance in transcription practices across disciplines (Knoblauch et al., 2006) in order to strike an appropriate balance in transcription. A split-screen video recording of four camera angles worked well for many teams as a first point of data entry. Avoid cutting recordings in the middle, but rather share full-length videos of interactions.

Sharing How to ensure easy data entry from many perspectives; how to ensure cross-disciplinary collaboration	We divided the final dataset into separate sessions and organized the online folder structure accordingly. Each session had a corresponding folder containing subfolders with available videos in separate versions from each angle and in a split-screen version, along with a full transcript, separate audio files, and additional material such as high-quality pictures or PowerPoints. The dataset was uploaded and shared using a secure online data repository provided for secure storing and sharing of the data in a Dropbox-like folder structure. The online data repository met our demands for storage capacity, and researchers were granted individual password-protected access.	While a few teams used almost the entire dataset, the research teams on average based their analyses on three to four hours of data. Storage demands and streaming or download time can pose a problem for some research teams (see the works by Louise Corti and colleagues for a thorough guide to storing and managing shared data; 2014; 2000; 2020). Cross-disciplinary analysis takes time. Although shared video data lends itself to cross-disciplinary analyses, such analyses often needs to rest on an initial disciplinary analysis. We underestimated the time and effort needed for cross-disciplinary analyses and findings to emerge.	Share for ease of data entry (make a first point of entry), as gaining an overview of large datasets is extremely time consuming. Balance ease of entry with an openness to multiple topical interests and approaches (avoid overly narrated presentations). If the aim is to develop cross-disciplinary analyses, then plan for significant time and events in a second analytical step where disciplinary analysis can be combined and integrated.
Ethics How to ensure confidentiality and anonymity across many publications	To handle anonymization and confidentiality across all resulting publications, we provided the research teams with an anonymization key standardizing the chosen pseudonyms and instructing them on how to handle confidential information. We screened all outgoing publications for correct anonymization and level of confidentiality.	Aggregated empirical details across publications can jeopardize anonymity and confidentiality for shared datasets. Clear guidelines on how to anonymize data in publications can both assist research teams in applying appropriate levels of anonymity and allow for the tracing of data points (e.g., episodes, individuals) across the resulting publications.	Continue to mediate the relationship between organizational setting and research teams after data collection in order to maintain an appropriate ethical distance (e.g., anonymity, trust).

Conclusion

Video collaboratories offer unique benefits in the field of organizational research. In particular, sharing video data drawn from organizational life provides opportunities for field reference points that researchers can interrogate to generate a wide range of analyses and insights. While there have been attempts to consider the technical infrastructures necessary to share video data across diverse research groups, the collection and analysis of data for sharing have often been taken for granted. Indeed, video data can be deceptive, leading to the belief that sharing is an easy endeavor because anyone can view and review the recordings. However, as LeBaron et al. (2018) note, the work of analysis is fundamentally shaped by cinematic decisions made through the process of data collection. One conclusion that could be drawn from LeBaron et al. (2018) is that data collected is limited to the research questions and analytic approaches of a particular project, as those concerns affect the cinematic decisions involved in data collection. However, building on this, we argue that those questions and approaches may not be singular but rather multiple and that cinematic and editorial decisions may be designed to support a variety of quality and feasibility outcomes. Indeed, our experiences with DTRS11 reveal that it is possible to conduct data collection so that the shared video data may subsequently be molded to fit a variety of qualitative and quantitative methodological approaches. As such, it offers a path forward for similar video-based data sharing projects in organizational research.

Through the case of DTRS11, we have offered key learnings regarding some of the challenges posed in the design of data collection, the technical aspects of video, and data management with the purpose of sharing for research use across disciplinary and methodological boundaries. In this article, we have analyzed the relevance of cinematic (data collection) and editorial (data management) decisions to data sharing in video collaboratories, thereby offering key learnings for the future of video collaboratories. In this regard, we hope to contribute to the discourse of video-based research methods in organizational studies (Christianson, 2018; LeBaron et al., 2018) with detailed accounts of each step in the process of designing, collecting, managing, and sharing ethnographic video data.

Based on our experiences, and as outlined in Table 3, we recommend that future video collaboratories do the following: (1) Establish a dedicated coordination team to handle delicate ethical challenges pertaining to establishing a trusting relationship in obtaining access and ensuring appropriate levels of anonymity and confidentiality by mediating and balancing the

relationships between the organization and the research teams. (2) Reflect on the potential research teams' likely topical interests and analytical approaches and analyze potential important data collection tradeoffs. This will enable the establishment of cinematic principles that should allow for a flexible dataset where each research team may later mold the dataset to some degree to fit its analytical purposes. (3) Use multiple camera angles and viewpoints to maximize the utility of the dataset. (4) Train the camera operator to make situational cinematic decisions in the face of an unfolding empirical context that may lead to difficult recording decisions involving tradeoffs with regard to analysis. (5) When selecting data for sharing, consider the timeframe and data depth or quantity needed to conduct quality analyses from a variety of analytical approaches. (6) Prepare the dataset by both including contextual information and documenting data collection decisions. A technical report specifying the methodological approach to the data collection—choices, selections, and roles—as well as contextual information about the dataset itself (e.g., on organizations, individuals, and projects), is extremely valuable in order for the data to be useful in publications across disciplines and methods. (7) Share the data with ease of data entry in mind and make explicit efforts to support cross-disciplinary work. (8) Continue to coordinate the relationship between the empirical setting and research teams after data collection to maintain an appropriate ethical distance. At a time when Covid-19 is making video-based data collection particularly challenging due to the increasing difficulty of gaining or retaining access to empirical settings (especially for early career researchers), we hope that our recommendations may help engender the establishment more video collaboratory research projects, enabling improved video-based data sharing for interdisciplinary analysis, for the benefit of organizational researchers.

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Appendix A: Transcription conventions

All verbal utterances are transcribed as pronounced along with action following a CA-inspired transcription notation (Heath et al., 2010, pp. 70–83; Jefferson, 1984; Wagner, 2020).

Transcription symbols	
:	Indicates prolonging of sound
> word <	Indicates fast speaking
< word >	Indicates slow speaking
[ ]	Brackets shows overlapping speech
=	Indicates latched speech
wor-	Indicates interrupted speech or cut-off word
°word°	Indicates whisper or very low voice
WORD	Indicates high volume speech
ˇwordˇ or £word£	Indicates utterance said with smiling voice
.h	Audible inhalation
h	Audible exhalation
(.)	Indicates a micro pause less than 0,5 seconds
(1.8)	Indicates a pause measured in seconds
↑	Indicates local rise in intonation
↓	Indicates local fall in intonation
((move))	Text in double parenthesis describes action relevant for the analysis

Appendix B: Co-author statements

Updated: 27.11.2020

CO-AUTHOR STATEMENT

Title of paper	The Oscillation Between Individual and Social Designing in Co-Located Student Teams
Journal and date (if published)	CoDesign - International Journal of CoCreation and Design in the Arts. Published: 20 December 2018

1. Formulation/identification of the scientific problem to be investigated and its operationalization into an appropriate set of research questions to be answered through empirical research and/or conceptual development

Description of contribution:

Sille Abildgaard and Bo T. Christensen collaboratively formulated the research problem to be investigated and its operationalization, including the synthesis of the issue into a set of research questions the be answerable by carrying out the empirical study and analyses.

2. Planning of the research, including selection of methods and method development

Description of contribution:

Sille Abildgaard and Bo T. Christensen collaboratively planned the research and developed the methodology for this article.

3. Involvement in data collection and data analysis

Description of contribution:

Sille Abildgaard has to a large extent, done the data collection independently. Sille Abildgaard has been significantly involved in the data analysis, including coding and transcription of the video data. Sille Abildgaard has conducted the qualitative video analyses, where Bo T. Christensen conducted the quantitative analysis.

4. Presentation, interpretation and discussion of the analysis in the form of an article or manuscript

Description of contribution:

Sille Abildgaard has made a significant contribution to the presentation, interpretation and discussion of the analysis and results achieved in the article. Sille Abildgaard has to a large extent, independently worked on the visual presentation and analysis of the selected video fragments.

Publication
Please note that the article will be published electronically and in a limited edition in print as a part of the PhD thesis by the CBS library in connection with the PhD defence.

1. Co-author (PhD student)	Sille Julie J. Abildgaard Name
I hereby declare that the above information is correct	
28-05-2021 Date	 Signature

2. Co-author	Bo T. Christensen Name
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CO-AUTHOR STATEMENT

Title of paper	How Task Constraints Affect Inspiration Search Strategies
Journal and date (if published)	International Journal of Technology and Design Education. Published: 08 February 2019

1. Formulation/identification of the scientific problem to be investigated and its operationalization into an appropriate set of research questions to be answered through empirical research and/or conceptual development
Description of contribution: Sille Abildgaard has made some contribution in collaboration with the co-authors in formulating and identifying the basic academic issue to be investigated and answered, including the synthesis of the issue into a set of research questions the be answerable by carrying out the empirical study and analyses.
2. Planning of the research, including selection of methods and method development
Description of contribution: Sille Abildgaard has made a significant contribution in planning the study and developing the methodology in a way that the research questions posed was answered.
3. Involvement in data collection and data analysis
Description of contribution: Sille Abildgaard has made a significant contribution in collecting the data (including the collection of audio-visual data and conducting interviews) and involvement in the data analysis (including coding and qualitative analysis).
4. Presentation, interpretation and discussion of the analysis in the form of an article or manuscript
Description of contribution: Sille Abildgaard has made some contribution in collaboration with the co-authors in presenting, interpreting and discussing the analysis and results achieved in the article.

Publication
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Updated: 27.11.2020

CO-AUTHOR STATEMENT

Title of paper	Kinds of 'moving' in designing with sticky notes
Journal and date (if published)	Design Studies - The Interdisciplinary Journal of Design Research. Published: Accepted for publication

1. Formulation/identification of the scientific problem to be investigated and its operationalization into an appropriate set of research questions to be answered through empirical research and/or conceptual development

Description of contribution:

Sille Abildgaard and Bo T. Christensen collaboratively formulated the research problem to be investigated and its operationalization, including the synthesis of the issue into a set of research questions the be answerable by carrying out the empirical study and analyses.

The article builds upon another study and published article with Sille Abildgaard as the second author. Sille Abildgaard played an important role in re-framing and developing the academic issue to be addressed in the current article.

2. Planning of the research, including selection of methods and method development

Description of contribution:

Sille Abildgaard and Bo T. Christensen collaboratively planned the research, selected the data and developed the methodology for this article.

3. Involvement in data collection and data analysis

Description of contribution:

Sille Abildgaard has been significantly involved in the data collection and data analysis, including coding and transcription of the video data.

4. Presentation, interpretation and discussion of the analysis in the form of an article or manuscript

Description of contribution:

Sille Abildgaard has made a significant contribution to the presentation, interpretation and discussion of the analysis and results achieved in the article. Sille Abildgaard has to a large extent, independently worked on the visual presentation of the analysis and the analysis of the selected video fragments.

Publication
Please note that the article will be published electronically and in a limited edition in print as a part of the PhD thesis by the CBS library in connection with the PhD defence.

1. Co-author (PhD student)	Sille Julie J. Abildgaard Name
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Updated: 27.11.2020

CO-AUTHOR STATEMENT

Title of paper	Video-based Data Sharing in Organizational Research: The Significance of Cinematic and Editorial Decisions
Journal and date (if published)	

1. Formulation/identification of the scientific problem to be investigated and its operationalization into an appropriate set of research questions to be answered through empirical research and/or conceptual development

Description of contribution:

Sille Abildgaard and Bo T. Christensen collaboratively formulated the research problem to be investigated and its operationalization, including the synthesis of the issue into a set of research questions the be answerable by carrying out the empirical study and analyses. The framing was later developed primarily through inputs, suggestions and comments from Jon Hindmarsh.

2. Planning of the research, including selection of methods and method development

Description of contribution:

Sille Abildgaard and Bo T. Christensen collaboratively planned the research and developed the methodology for this article. Sille Abildgaard has been significantly involved in the selection and development of the video-based methodology.

3. Involvement in data collection and data analysis

Description of contribution:

Sille Abildgaard has been the primary contributor in the planning of the data collection and the fieldwork (including video ethnography and qualitative interviews). Sille Abildgaard has been significantly involved in the data analysis, with important inputs from Bo T. Christensen.

4. Presentation, interpretation and discussion of the analysis in the form of an article or manuscript

Description of contribution:

Sille Abildgaard has been the main contributor to the structure and write-up of the article, with inputs from her co-authors. Sille Abildgaard has made a significant contribution to the presentation, interpretation and discussion in the article.

Publication
Please note that the article will be published electronically and in a limited edition in print as a part of the PhD thesis by the CBS library in connection with the PhD defence.

1. Co-author (PhD student)	Sille Julie J. Abildgaard Name
I hereby declare that the above information is correct	
28-05-2021 Date	Signature

2. Co-author	Bo T. Christense n Name
I hereby declare that the above information is correct	
28-05-2021 Date	Bo T. Christensen Signature

3. Co-author	Jon Hindmarsh Name
I hereby declare that the above information is correct	
28-05-2021 Date	Signature

4. Co-author	 Name
I hereby declare that the above information is correct	
 Date	Signature

Appendix C: Informed consent

Information om deltagelse i forskningsprojektet CIBIS

Hvad betyder CIBIS?
Creativity in Blended Interaction Spaces

Hvad går dette forskningsprojekt ud på?
CIBIS projektet har til formål at skabe en IT platform til understøttelse af kreative processer og undervisning i kreativitet og innovation.

Hvem står bag forskningsprojektet?
Projektet er drevet af Aarhus Universitet og Copenhagen Business School og sker i samarbejde med LEGO og Designit. Derudover vil der også blive samarbejdet med udenlandske universiteter i Paris, Eindhoven og London.

Hvem er blevet bedt om at deltage i dette forskningsprojekt?
En gruppe af designere fra Designit samt unge fra Akademiet for Talentfulde Unge, Ørestad gymnasium, Viby gymnasium og Aarhus Tech – Viby deltager i projektet.

Hvad skal der ske?
Der vil i løbet af projektet blive optaget video af eleverne i undervisningen. Det vil typisk være i forbindelse med workshops af nogle dages varighed.

Er der nogen risici forbundet med undersøgelsen?
Der er ingen umiddelbare risici, hverken fysiske eller psykiske, ved at deltage i projektet.

Hvem har adgang til videooptagelserne?
Al video opbevares i op til 5 år i overensstemmelse med Datatilsynets retningslinjer og slettes derefter. Videomaterialet vil udelukkende blive brugt til forskningsbrug blandt forskere. Det vil altså ikke blive spredt til ikke-forskere/offentliggjort. Kun forskere, der skriver under på at de har tavshedspligt, vil få adgang til materialet.

Hvem får at vide, at jeg deltager i undersøgelsen?
Alle deltagere har fuld anonymitet, hvilket vil sige at der på intet tidspunkt vil blive publiceret eller på anden måde videregivet navne eller andre personlige oplysninger på deltagere i projektet.

Er deltagelse i forskningsprojektet frivillig?
Deltagelse i forskningsprojektet er fuldstændig frivillig. Du behøver ikke deltage, og skulle du skifte mening undervejs, kan du til enhver tid trække dig fra projektet.

Hvem kan jeg kontakte hvis jeg har yderligere spørgsmål til forskningsprojektet?
Bo Christensen, lektor på Copenhagen Business School: bc.marktg@bs.dk
Den Nationale Videnskabsetiske Komité: DKetik@DKetik.dk

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Samtykkeerklæring fra forældemyndighedens indehaver til den unges deltagelse i et forskningsprojekt.

Forskningsprojektets titel: Creativity In Blended Interaction Spaces (CIBIS)

Erklæring fra indehaveren af forældremyndigheden:

Jeg har fået skriftlig information og jeg ved nok om formål, metode, fordel og ulemper til at give mit samtykke.

Jeg ved at det er frivilligt at deltage, og at jeg til hver en tid kan hive mit samtykke tilbage uden, at det går ud over min datters/søns mulighed for at deltage i undervisningen.

Jeg giver samtykke til, at _____
(den unges navn) deltager i forskningsprojektet. Jeg har fået en kopi af dette samtykke ark samt en kopi af den skriftlige information om projektet til eget brug.

Navn på forældremyndighedens indehaver:
_____

Dato: _____

Underskrift: _____

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Fax: +45 - 3815 2101
www.cbs.dk

Informeret samtykke til deltagelse i et forskningsprojekt.

Forskningsprojektets titel: Creativity in Blended Interaction Spaces (CIBIS)

Erklæring fra forsøgspersonen:

Jeg har fået skriftlig og mundtlig information og jeg ved nok om formål, metode, fordele og ulemper til at sige ja til at deltage.

Jeg ved at det er frivilligt at deltage, og at jeg til hver en tid kan hive mit samtykke tilbage uden, at det går ud over mine muligheder for at deltage i undervisningen.

Jeg giver samtykke til at deltage i forskningsprojektet. Jeg har fået en kopi af den skriftlige information om projektet til eget brug.

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Informed consent

What is this research project about?
The purpose of these studies is to gain more knowledge about human creativity. This has relevance for the study of human cognition and innovativeness.

Who has been asked to participate in this research project?
Participants in this study are students at Copenhagen Business School. Approximately 70 students will be asked to participate.

What will happen?
You will participate in a brainstorming session of 1 hour with your work/study group. This session will be videotaped and used as data material in the research project. The videos will only be used by the research team for research purposes and will not be made available to anyone else.

Are there any risks associated with the study?
There are no immediate risks, whether physical or mental, by participating in the study.

Will I receive compensation?
Hopefully, the brainstorming session will lead to good ideas in your project. There will be refreshments during the brainstorming session. You will also, at a later date, have the opportunity to take one or more creativity tests and get feedback on your creative abilities.

Who knows that I participate in this study?
All information about the participants in this study will be kept confidential. You will remain completely anonymous and will not be identified by name in any publications resulting from this study.

Is my participation in this study voluntary?
Your participation in this study is entirely voluntary. You do not need to participate, and should you change your mind along the way, you can at any time withdraw from the study.
I hereby declare that I agree to participate in this study.

Name	Date
Signature	E-mail (Please write clearly)

Declaration of informed consent and mutual confidentiality

Applicable to the research project "The Multimodal Constitution of Learning Spaces - Analyzing Student Interactions at the Studio Space" (Ph.D. project, working title) under the research project DEED (Designerly Ways of Teaching for Entrepreneurship at Higher Education) at Copenhagen Business School.

This document reflects a mutual understanding that no data, data processing and, in particular, generated and/or confidential knowledge of students in the subject "Strategic Design and Project Management" must be redistributed to other actors in pure form. This means that Sille Julie J. Abildgaard and possibly a student assistant from the Copenhagen Business School and the DEED project must film, interview and observe interactions and practices in the subject "Strategic Design and Project Management" according to the agreement with teacher Professor (MSO) Bo T Christensen.

The analyses of data are carried out by Sille Julie J. Abildgaard for the purpose of use in own projects as part of the Ph.D. project. Some observations may be used in connection with feedback to the teachers related to the course design and learning objectives.

If any results of the study are disseminated outside this context, everything and everyone will be completely anonymized, and prior approval of the degree of anonymity may be arranged.

Sille Julie J. Abildgaard at Copenhagen Business School stores data under the Ph.D. project in accordance with the CBS Research Data Management Policy and the FAIR principles. This means that the data is securely archived for up to 5 years after the project ends.

Participant Statement:
I have received written and oral information and I know enough about the purpose, method, advantages, and disadvantages to say yes to participate.

I agree that it is voluntary to participate and that I may withdraw my consent at any time without compromising my ability to participate in the course.

I consent to participate in the research project and, with my signature, approve that I may be filmed, interviewed and observed.

The participant's full name:

_____

Date: _____

Signature: _____

Source: Due, B. (2017). *Multimodal Interaktionsanalyse Med Videoetnografisk Dataindsamling.* Samfundslitteratur.

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Februar 2019

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Solbjerg Plads 3, C2.09
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Sille Julie J. Abildgaard
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sjja.marktg@cbs.dk

Information regarding participation in DTRS11

What is DTRS11?
Design Thinking Research Symposium 11. It is a conference for design researchers.

What is this research project all about?
DTRS11 is a conference where design researchers write articles about design processes based on their analysis of specific video material.

Who is organizing the research project?
The project is run by Copenhagen Business School

Who have been asked to take part in the research project?
[redacted] has been asked to participate. It is possible that one other company might partake in the project.

What will happen?
Videos of the [redacted] team at work will be captured during the project. It could possibly be video recordings of group meetings or user experience studies.

Are there any risks involved in the project?
There are no immediate dangers, neither physically nor mentally, in taking part in the project.

Who has access to the video material?
In agreement with the guideline of The Danish Data Protection Agency, all the video material will be stored for a maximum of 5 years and subsequently deleted. The video material will only be used for research purposes among researchers. The material will therefore not be made public or shared with non-researchers. Only researchers who have signed a secrecy agreement will be able to gain access to the video material.

Who will be told that I take part in this project?
Names and other personal data will not appear in any articles, publications or other public material derived from the research project.

Is participation in the research project voluntary?
Participation in the research project is completely voluntary. You are not obligated to participate. You may withdraw at any time from the research project.

Who may I contact in case of any further questions regarding the project?
Bo Christensen, associate professor at Copenhagen Business School,
bc.marktg@cbs.dk

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10. oktober 2015

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Declaration of consent:

I agree that I have obtained the necessary written and oral information about the research project - concerning its purpose, methods and general implications – in order to take part in the project.

I hereby give my consent to participate in the research project, and I acknowledge having received a copy of the written information regarding the project for my own personal use.

Name: _____

Date: _____ Signature: _____

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Appendix D: Confirmation of publication

Fra: Elsevier - Article Status
Til: Sille Julie Jøhnk Abildgaard
Emne: Track your article [JDST_101036] accepted in Design Studies
Dato: 25. juni 2021 17:45:08

Track your article!

Dear Ms. Abildgaard,

Your article *Kinds of 'moving' in designing with sticky notes* will be published in Design Studies.

To track the status of your article throughout the publication process, please use our article tracking service:

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