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Abstract

Jane Darke's 1979 article "The Primary Generator and the Design Process" appeared in the very first issue of *Design Studies*. In the four decades of design research that followed, the article became a classic. In the article's revaluation of the role subjectivity plays in design, Darke posits a construct called the "the primary generator" — a limited set of (typically subjective) constraints — as a way for architects to engage with design tasks characterized by complexity. The primary generator acts as a random starting point, located within a subset of constraints, which is iteratively adjusted as the design process takes place. It may be construed as a subjectively valued organizing principle driving the design process. It may also be read as either a liberating force of subjective creative freedom, or as a subjective source of bias and fixation that the architect may be unwilling or unable to later escape. Darke herself held both these positions over time. Her ideas on the malleability of the design space and the very initiation of the creative design process by imposition of constraints have been critical in the evolution of constraint research, which represents a rich strand of interdisciplinary design research.

1   Jane Darke, "The Primary Generator and the Design Process," *Design Studies* 1, no. 1 (1979): 36–44, DOI: https://doi.org/10.1016/0142-694X(79)90027-9.

2   Bo T. Christensen and Linden J. Ball, "Building a Discipline: Indicators of Expansion, Integration and Consolidation in Design Research Across Four Decades," *Design Studies* 65 (November 2019): 18–34, DOI: https://doi.org/10.1016/j.destud.2019.10.001.

3   Nigel Cross, "Designerly Ways of Knowing," *Design Studies* 3, no. 4 (1982): 221–27, DOI: https://doi.org/10.1016/0142-694x(82)90040-0.

4   Darke, "Primary Generator," 43.

5   Ibid., 37.

6   Christopher Alexander, "The Determination of Components for an Indian Village," in *Conference on Design Methods: Papers Presented at the Conference on Systematic and Intuitive Methods in Engineering, Industrial Design, Architecture and Communications*, ed. J. Christopher Jones and G. G. Thornley (New York: Macmillan, 1963), 83–114.

7   Bill Hillier, John Musgrove, and Pat O'Sullivan, "Knowledge and Design," in *Proceedings of the EDRA 3/AR 8 Conference, Environmental Design: Research and Practice* 2, ed. William J Mitchell (Los Angeles: University of California, 1972), 29.3, available at https://cdn.ymaws.com/www.edra.org/resource/resmgr/proceedings/toc/edra03-contents.pdf.

Introduction

Jane Darke's[1] eight page, 7,000-word article entitled "The Primary Generator and the Design Process," conducted as part of her PhD studies, appeared in the very first issue of the journal *Design Studies*. Over the course of the following four decades of design research, the article has become a must-read design research classic, and is now the second-most cited article from the first decade of *Design Studies* publications,[2] surpassed only by Nigel Cross's article "Designerly Ways of Knowing."[3]

In this article, we revisit Darke's 1979 work to explore how the arguments and concepts originally advanced apparently struck a nerve in the design research community, how those concepts—especially the term *primary generator*—were later used and cited in other works, and how the concepts may be read now, four decades later, in light of subsequent academic work. Our main contribution of is an interpretation of Darke's work that brings it into the present day. We will trace the path of works that explicitly make reference to her highly cited article, including Darke's reading of her own work over time, as well as academic work where the inspiration and legacy from Darke seem evident.

The Primary Generator Construct

In her 1979 article, Darke states that her objective is to "augment our understanding of the process of design as practiced by architects."[4] This revaluation of subjectivity in design, in some respects, foreshadows much design research that took place in the decades that followed, where the expert designer or architect came to be the central locus of investigation.

Darke appreciates how her aim departs from earlier design research traditions, and points to the view of design dominant in the 1960s that encompassed an analysis-synthesis model, even if details varied—by incorporating feedback loops, for example—depending on the model in question. Such models recognized that there were many factors to consider in any design problem, but the hope at the time was to quantify and explicate the "subjective ones," to potentially transmit some of the processing to computers, which was supposed to allow for fewer preconceptions and thus (perhaps) a better solution. This, it was imagined, might be done through exhaustively listing all relevant requirements and factors, and their interactions, and then setting performance limits to the factors. Only at this point should the designer engage in generating a form, starting with clusters of related factors.[5] It was hoped that the synthesis of factors and the generation of form might take place in a fairly automated fashion, with minimal need for the expression of subjective assessment, which was seen as a potential risk. Darke notes that even though such analysis-synthesis models of design were dominant, especially in engineering and industrial design, only few uses of such methods had been described, with Christopher Alexander's[6] being one exception; a method he later abandoned.

In her critique of analysis-synthesis models, Darke points to Bill Hillier, John Musgrove, and Pat O'Sullivan's[7] approach as an alternative approach. Hillier and his colleagues formulated a replacement to the analysis-synthesis

8   Hillier et al. quoted in Darke, "Primary Generator," 38.
9   Darke, "Primary Generator," 38.
10   Ibid., 43.
11   Ibid., 38, original emphasis.
12   Ibid., 38.
13   Bryan Lawson, *How Designers Think: The Design Process Demystified*, 4th ed. (Burlington: Elsevier/Architectural, 2006), 46.

model, which they saw merely as a means of reducing variety. Rather, they argued, design is essentially a matter of prestructuring problems, and they instead suggested conceptualizing design as a matter of conjecture-analysis, arguing that a vast number of design decisions cannot actually be taken before the solution is known, whereby "conjecture and problem specification proceed side-by-side rather than in sequence."[8]

Building on the above theoretical landscape, notably the one proposed by Hillier and his colleagues, Darke moves on to propose the construct of the *primary generator* as a useful way of conceptualizing a specific stage in the design process: the stage that precedes conjecture. The primary generator is thus a component of the designer's cognitive structuring. Darke makes shifting references to primary generators as being ideas, concepts, (self-imposed) constraints, major aims, or objectives. The use of the term "ideas" might lead to some confusion as to how the generator can be separate from the conjectures that follow. However, Darke clarifies that the primary generator is not the conceptualized image of a solution (i.e., the conjecture), but rather refers to the prior 'ideas'[9] that helped generate that conjecture. Darke further notes, that it may be possible for the architect to become aware of the ideas that are acting as generators, which may help the architect evaluate them and possibly widen their range if necessary. Although the empirical data presented supported the use of primary generators amongst the architects studied, Darke notes that it is not her intent to propose that all architects adhere to the generator-conjecture-analysis model; only that many seems to do so.[10]

Darke links the primary generator to the *objective(s)* (or *concepts*) that generate(s) the solution, noting that the greatest variety reduction, or narrowing down of a range of solutions, occurs early on in the process, with a conjecture. "These objectives form a starting point for the architect, a *way in* to the problem; he [sic] does not start by listing all the constraints. Any particular primary generator may be *capable* of justification on rational grounds, but at the point when it enters the design process it is usually more of an article of faith on the part of the architect, a designer-imposed constraint, not necessarily explicit."[11]

Evident in the above quote is an important contrast: trying to fully and explicitly list all possible factors to be considered prior to designing (design research in the 1960s), and finding a way into the problem that reduces the variety of potential solutions to a cognitively manageable set in an (as yet) imperfectly understood problem. This primary generator "way" into the problem often entails focusing on a particular (small set of) objective(s) that is usually strongly subjectively valued and self-imposed. By combining the primary generator concept with Hillier and colleagues' proposed conception of design processes, the model then becomes generator–conjecture–analysis. While this model may appear somewhat linear, Darke stresses its iterative, spiral nature.[12] In an attempt to explain Darke's model in plain language, Bryan Lawson says, "you decide what you think might be an important aspect of the problem, develop a crude design on this basis, and then examine it to see what else you can discover about the problem."[13]

14 Darke, "Primary Generator," 36.

15 Jane Darke, "Architects and User Requirements in Public-Sector Housing: 3. Towards an Adequate Understanding of User Requirements in Housing," *Environment and Planning B: Planning and Design* 11, no. 4 (1984): 422–24, DOI: https://doi.org/10.1068/b110417.

16 Allen Newell and Herbert A. Simon, *Human Problem Solving* (Englewood Cliffs, NJ: Prentice-Hall, 1972).

17 Herbert A. Simon, *The Sciences of the Artificial*, 3rd ed. (1969; Cambridge, MA: MIT Press, 1996).

18 Donald A. Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983).

19 Kees Dorst, *Frame Innovation: Create New Thinking by Design* (Cambridge, MA: MIT Press, 2015).

20 Kees Dorst and Nigel Cross, "Creativity in the Design Process: Co-evolution of Problem-Solution," *Design Studies* 22, no. 5 (2001): 425–37, DOI: https://doi.org/10.1016/s0142-694x(01)00009-6.

Methodologically, Darke undertook a series of seven interviews with British architects (from the architectural firms Borough Architects, Neylan & Ungless, Douglas Stephen & Partners, Darbourne & Darke, and Alison & Peter Smithson) each of whom was designing a distinct public housing estate in London. The interviews were retrospective—they took place in 1975, a few years after the buildings had been designed. Darke notes that the architects were generally very willing to discuss their completed projects, noting that at times it was almost as if they were talking about a favorite child.[14] In her analysis of the interviews, Darke highlights her inductive approach and notes that the article that emerged was very different from the research project she had envisioned prior to beginning the interviews.

The architects Drake interviewed pointed to a variety of objectives that (apparently) serve as primary generators. Among these were "to express the unique quality of the site;" to maintain social patterns; and to provide for—and in some respects recreate—a particular relationship between a dwelling and its surroundings. Another example of a primary generator, Darke notes later,[15] could be the wish to utilize "some good trees around the edge of the site." Darke states in a footnote that her usage of the term "generator" actually stems from that particular interview; the architect had made use of the term without prompting. Darke says that some primary generators are constraints explicitly imposed by the architects on themselves, which do not stem from the multiple, distinct sets of requirements that the building also has to live up to.

In retrospect, it might seem surprising that such a brief theoretical position piece focusing on the advancement of a single concept—the primary generator—ended up attracting so much design research attention. Despite the brevity of Darke's theoretical development, the article exists as a concise, sharply focused contribution that not only mirrored important developments in design research at the time, but also foreshadowed theoretical developments that would drive the design field forward over the decades to come.

In a later section of this article, we review current theorizing related to the primary generator concept. At the time of the 1979 article, a focus on cognitive manageability resonated well with works by Herbert Simon, who had already made landmark contributions to cognitive science[16] and design research[17] by introducing the idea that a scarcity of cognitive resources directly impacted design behavior and human problem solving. While Darke does not quote Simon in her article, Simon's legacy is evident in the way she addresses the issue of how designers can approach problems that are too complex to cognitively manage in their entirety.

But Darke also seems to move beyond Simon by asserting the value of focusing on architects' subjective judgments and choices, especially in the early phases of a design process. Her insight, in some respects, intimates the heavy emphasis on reflection[18] and framing[19] found in later design research. Furthermore, the notion that much of designing involves an iterative back-and-forth between (self-imposed) constraint setting and conjecture foreshadows later work expounding on the co-evolution of problem and solution.[20] In that brief piece of theorizing, Darke managed to establish a unique position that anticipated changes in perspective in design research

21   Jane Darke, "Architects and User Requirements in Public-Sector Housing:
     1. Architects' Assumptions about the
     Users," *Environment and Planning B:
     Planning and Design* 11, no. 4 (1984):
     389–404, DOI: https://doi.org/10.1068/
     b110389.

22   Jane Darke, "Architects and User Requirements in Public-Sector Housing: 2. The
     Sources for Architects' Assumptions,"
     *Environment and Planning B: Planning
     and Design* 11, no. 4 (1984): 405–16, DOI:
     https://doi.org/10.1068/b110405.

23   Darke, "Towards an Adequate Understanding," 417–33.

24   Darke, "Architects' Assumptions,"
     389–404.

25   Darke, "The Sources for Architects'
     Assumptions."

26   Darke, "Towards an Adequate
     Understanding."

27   Darke, "Primary Generator," 43.

28   Darke, "Towards an Adequate Understanding," 425.

that would come only later. That eventual emergence probably explains the
enormous impact of the article.

Darke's Later Works

After the publication of her 1979 article, Darke further analyzed the interviews for her PhD dissertation, paying special attention to the visions the
architects had of their users, and how those impacted the architects' designs.
In 1984, several large portions of her thesis were published as three separate
articles in *Environment and Planning B*, covering the architects' assumptions
about the users,[21] the sources of the architects' assumptions,[22] and the users'
perspective.[23]

Darke[24] examines the architects' assumptions about the users. She concludes that the architects ought to be criticized for three reasons: their lack
of reflection about whether their role is to meet social goals or not; their
limited perspective on the nature of (then) everyday life at home, including
a distinct lack of understanding about the increasing variety in types of
households; and their very imprecise images of the users for whom they
were designing. Darke[25] explores the source of the architects' assumptions,
stressing that they were relying heavily on personal experience to gauge
the needs of others without analyzing their presuppositions and assumptions. She further finds the architects to be unsystematic and uncritical in
their awareness and use of published research and user studies. None of the
architects appeared to have had much contact with the council tenants, yet
that lack of direct knowledge was not a cause for concern by the architects.
Instead, Darke concludes critically, the architects thought it acceptable, and
a normal part of the design process, to rely on their intuition and the guidance offered by their personal experience.

Darke's ongoing efforts to analyze her interviews ended up changing her
understanding of the nature of primary generators. She formally revisited
her 1979 concept five years later.[26] In that article, she explains that the
process of generator-conjecture-analysis—which relies heavily on designers'
personal experience, and requires very little authentic data on building
users—is "useful," because output value can be assessed simply by virtue
of how well it satisfies operational requirements. The implication is that
original research and systematic observation are both inconvenient and
time consuming. She had stated that the purpose of her 1979 article was to
"augment our understanding of the process of design as practiced by architects. It is not the author's intention to prescribe a single 'correct' procedure,
to criticize methods that differ from the model that has been proposed, or to
provide a recipe for 'good' design."[27] She explicitly modifies this descriptive
aim in the article published in 1984. "Although it is, presumably, tempting
to start to 'design' (that is, to consider solutions) on the basis of a few simple
objectives and a partial or mistaken perception of requirements, this temptation ought to be resisted until an adequately complex view of the users exist
in the architect's mind."[28] Darke concludes that it is necessary for architects
to recognize the importance of having an adequately complex view or image
of their users prior to any attempt at developing a solution. In a book chapter

29 Jane Darke, "Women, Architects, and Feminism," in *Making Space: Women and the Man-Made Movement (Matrix)* (London: Pluto Press, Ltd., 1984), 11, available at https://monoskop.org/images/9/90/Matrix_Making_Space_Women_and_the_Man-Made_Environment_1984.pdf.

30 Ibid., 24.

31 Darke, "Primary Generator," 36.

32 Darke, "Towards an Adequate Understanding," 425.

33 For example, see Linden J. Ball, Louise Maskill, and Thomas C. Ormerod, "Satisficing in Engineering Design: Causes, Consequences and Implications for Design Support," *Automation in Construction* 7, no. 2-3 (1998): 213–27, DOI: https://doi.org/10.1016/s0926-5805(97)00055-1; Nigel Cross, "The Nature and Nurture of Design Ability," *Design Studies* 11, no. 3 (1990): 127–40, DOI: https://doi.org/10.1016/0142-694X(90)90002-T.

from the same year, Darke goes even further by advancing a scathing feminist critique of architecture. "My argument is that architects are out of touch with those who use their buildings, and that their professional training is part of the process that removes them from many of the people they design for."[29] She goes on, "Feminist consciousness among architects would produce a change in their approach to design, as women designers came to identify with women using the built environment."[30] One might argue that Darke's rereading of her own primary generator concept again foreshadowed movements that would surface decades later—the movement towards emphasizing the importance in architecture of focusing on, and empowering, the building user. However, as we shall see below, the finding most prominently cited in later design research is Darke's (re)evaluation of the role played by subjectivity in architecture,[31] rather than her critical stance towards architects who are limited by incomplete, biased images of building users.[32]

Citing Darke

As of December 2020, Darke's 1979 article has been cited a total of 787 times—a number that has exponentially increased as the decades have passed. The number of citations between 1979 and 1989 was 33; from 1989 to 1999 that number rose to 109; from 1999 to 2009 it increased to 189; and between 2009 and 2020 the tally has reached 441. This illustrates that Darke's work—and the primary generator concept—have not yet reached their peak in terms of domain impact.

We began by using SCOPUS to identify journal articles that cite Darke's 1979 article. Our goal was to attempt to identify the reason why the authors' chose Darke's ideas to support their research. We categorized the primary reference arguments put forth in the paragraphs containing the references and quotations; the categories were extracted from an iterative sorting of the quoting paragraphs. The second author and a student coder then coded each citation by category. As might be expected, Darke is often cited (approx. 24% of the total number) for her important contribution to design research, or for having proposed a now classic model of the design process (generator-conjecture-analysis). In addition, the general methodology she employed (interviews; empirical studies of practicing designers) also inspired a fair amount of citations (approx. 15%). The remaining 61% of citations pertained to aspects of the primary generator concept. Different authors, however, stressed different aspects of it. For example, some citing authors stress the need to focus on a limited number of constraints early on in the design process, while other citing authors emphasize the subjective or idiosyncratic nature of the constraints initially generated. To explore which aspects of Darke's primary generator arguments attracted the most scholarly attention as time went on, we classified the citations according to the core argument they intended to highlight. The results may be summarized as follows (percentage of citations in parentheses):

- In the face of complex design problems, designers actively either need to focus on a limited/manageable number of objectives (13%),[33] or chose to focus on a self-imposed subjective set of objectives (18%). The subjective

34 For example, see Robert Grover, Stephen Emmitt, and Alexander Copping, "The Typological Learning Framework: The Application of Structured Precedent Design Knowledge in the Architectural Design Studio," *International Journal of Technology and Design Education* 28, no. 4 (2018): 1019–38, DOI: https://doi.org/10.1007/s10798-017-9421-4; John S. Gero and Michael A. Rosenman, "A Conceptual Framework for Knowledge-Based Design Research at Sydney University's Design Computing Unit," *Artificial Intelligence in Engineering* 5, no. 2 (1990): 65–77, DOI: https://doi.org/10.1016/0954-1810(90)90003-m.

35 Darke, "Primary Generator."

36 Darke, "Towards an Adequate Understanding."

37 For example, see Michael Mose Biskjaer et al., "How Task Constraints Affect Inspiration Search Strategies," *International Journal of Technology and Design Education* 30 (2019): 101–25, DOI: https://doi.org/10.1007/s10798-019-09496-7; Andy Dong, Massimo Garbuio, and Dan Lovallo, "Generative Sensing in Design Evaluation," *Design Studies* 45 (July 2016): 68–91, DOI: https://doi.org/10.1016/j.destud.2016.01.003.

38 For example, see Cross, "Designerly Ways"; Nigel Cross, "Design as a Discipline," in *Designerly Ways of Knowing* (London: Springer-Verlag, 2006), 95–103.

39 For example, see Peter G. Rowe, *Design Thinking* (Cambridge, MA: MIT Press, 1987); Peter Lloyd, Bryan Lawson, and Peter Scott, "Can Concurrent Verbalization Reveal Design Cognition?," *Design Studies* 16, no. 2 (1995): 237–59, DOI: https://doi.org/10.1016/0142-694x(94)00011-2.

40 For example, see Kees Dorst, "Design beyond Design," *She Ji: The Journal of Design, Economics, and Innovation* 5, no. 2 (2019): 117–27, DOI: https://doi.org/10.1016/j.sheji.2019.05.001; Nathan Crilly and Carlos Cardoso, "Where Next for Research on Fixation, Inspiration, and Creativity in Design?," *Design Studies* 50 (May 2017): 1–38, https://doi.org/10.1016/j.destud.2017.02.001.

41 Walter R. Reitman, "Heuristic Decision Procedures, Open Constraints, and the Structure of Ill-Defined Problems," in *Human Judgments and Optimality*, ed. Maynard W. Shelley and Glenn L. Bryan (New York: Wiley, 1964), 282–315; Walter R. Reitman, *Cognition and Thought: An Information Processing Approach* (Oxford: Wiley, 1965).

constraints are cited using labels such as idiosyncratic, self-set, articles of faith, prejudice, personal interest, preconceptions, value judgment, self-imposed, and postulations.[34]

- The subjectivity of the imposed constraints is the most frequent theoretical reference argument put forth when citing Darke; however, as the labels illustrate, this subjectivity may be conceptualized with either negative or positive connotations. In many readings of Darke,[35] subjectivity serves as a liberation of the practicing architect from "optimal and complete" constraint handling. In other readings (such as Darke's re-reading[36] of her own prior primary generator concept), subjectivity entails a biased design approach (e.g., gender-biased, or failing to account for the diversity of housing users). It is noteworthy that a substantial number of quotes do not emphasize the subjective nature of constraint setting, but rather focus on (through arguments mirroring Herbert Simon) the need to work with a more manageable set of constraints when limited cognitive capacity faces complex problems. Both approaches enable a way into the problem (13%)[37] that may provide suggestions for solutions (6%),[38] or serve as an organizing principle (9%)[39] throughout the design process.

- But working with generators also has a possible flipside: the designers may try to make their initial framing work at all costs, possibly causing design fixation (3%).[40] As might be interpreted from these numbers, the enabling qualities of primary generators for conjecturing and organizing the design process have received more subsequent research attention than the possible flipside of the coin (such as biases and fixation).

Darke in the Present Day

When her article was published in *Design Studies*, Darke was employed at the Department of Architecture at the University of Sheffield. Her study was grounded in architecture, but the implications of her work branch well beyond the discipline. The offshoots of her novel conceptualization of the primary generator seem most clearly discernable in what some might call *constraint research*—a rich, interdisciplinary strand of design research. In her article, Darke uses the term "constraint" just nine times. This is noteworthy, not only because constraints are pivotal to the neologism she proposes, but also because that specific perspective on constraints is somehow woven into the understanding of design processes expressed in much of the design research that came after. Before examining these ramifications to position Darke's work in the current landscape of design research, we will take a small step back to look at the emergence of constraint research. Constraint research was a theoretical precursor to the design process perspective that Darke's work ushered in.

Although Darke's 1979 article never cites him, Walter Reitman's[41] body of enquiry into the ontology of problems is, arguably, one of the first major contributions to constraint research. Working on problem analysis in order to improve computer programming languages, Reitman argues for a continuum between well-defined and ill-defined problems. Reitman finds the

42 Reitman, "Heuristic Decision Procedures," 292.

43 Ibid., 300–301.

44 Ibid., 292–93.

45 Darke, "Primary Generator," 38, original emphasis.

46 Charles M. Eastman, "Cognitive Processes and Ill-Defined Problems: A Case Study from Design," in *IJCAI 69: Proceedings of the 1st International Joint Conference on Artificial Intelligence* (San Francisco: Morgan Kaufmann Publishers Inc., 1969), 669–90, available at https://www.ijcai.org/Proceedings/69/Papers/061.pdf.

47 Herbert A. Simon, "The Structure of Ill Structured Problems," *Artificial Intelligence* 4, no. 3-4 (1973): 189, DOI: https://doi.org/10.1016/0004-3702(73)90011-8.

48 Simon, *The Sciences of the Artificial*, 124.

49 Balakrishnan Chandrasekaran, "Design Problem Solving: A Task Analysis," *AI Magazine* 11, no. 4 (1990): 65, DOI: https://doi.org/10.1609/aimag.v11i4.857.

50 Reitman, "Heuristic Decision Procedures."

51 *Sketches of Frank Gehry*, directed by Sydney Pollack (Culver City: Sony Pictures Home Entertainment, 2006), DVD.

52 Darke, "Primary Generator."

53 Ibid., 43, original emphasis.

54 Ibid., 36, emphasis added.

latter "perhaps the most interesting,"[42] using the composition of a fugue as a recurrent example.[43] Ill-defined problems are based on what Reitman calls constraints with "open attributes," or simply "open constraints," "whose definition includes one or more parameters the value of which are left unspecified…. Open constraints are ubiquitous … [they] provide definitional slack. They allow the problem solver to take a new tack on his problem, not by violating his constraints—though he [sic] may of course do that too—but by adjusting those parameters of the constraint that are open to him."[44] Since no clear-cut solution path—or obvious *"way in* to the problem," as Darke phrases it[45]—is available to the problem solver, another creative approach must be explored and adopted. Charles Eastman[46] sees the potential in this way of thinking about the nature of problems, and shortly thereafter builds upon Reitman's ideas.

Just six years before Darke's 1979 article, Herbert Simon expands Reitman's understanding of constraints to include "any or all of the elements that enter into a definition of a problem."[47] This understanding of constraints is mirrored in Simon's earlier thinking, according to which "design solutions are sequences of action that lead to possible worlds satisfying specified constraints."[48] The impact of Simon's rationalistic approach to working with problems cannot be overestimated. One example of that impact can be found in the work of Balakrishnan Chandrasekaran, who would posit (years later) that "formally, all design can be thought of as constraint satisfaction, and one might be tempted to propose global constraint satisfaction as a universal solution for design."[49]

From her point of departure in architecture, Darke offers an alternative to this influential, computer science-based view on how the designer can attack a problem characterized by what Reitman calls "open constraints."[50] Contending with ill-defined problems in a design process, however, is very challenging. The opening sequence of Sidney Pollack's[51] documentary *Sketches of Frank Gehry* illustrates this clearly. The director asks, "Is starting hard?" to which Gehry laconically answers, "You know it is …," and continues, "I don't know what you do when you start, but I … clean my desk. I make a lot of stupid appointments that I make sound important. Avoidance. Delay. Denial. I'm always scared that I'm not going to know what to do. It's a terrifying moment. And then, when I start—I'm always amazed. 'So, that wasn't so bad,'" Gehry's voice intones, as the camera slowly pans over the iconic Guggenheim Museum in Bilbao, inaugurated in 1997.

It is exactly this arduous *initiation* of the design process that Darke[52] focuses on. With (too) many open constraints available to the designer, the set of solution alternatives becomes equally massive. As Darke's case studies illustrate, the architect/designer must make that initiation more cognitively manageable by learning to "fix on a particular objective or small group of objectives, usually strongly valued and self-imposed…. These major aims, called here *primary* generators, then give rise to a proposed solution or conjecture."[53] This key quote captures the gist of Darke's contribution and heralds the emergence of several subsequent themes in the design literature.

It is interesting to note Darke's choice of cases in her article. In the title of the article, she refers to *the* primary generator,[54] which corresponds to

55   Ibid., 38, emphasis added.

56   Ibid., 43, original emphasis.

57   Ibid., 38.

58   Ibid., 43.

59   Kees Dorst, "Describing Design–A Comparison of Paradigms" (PhD dissertation, Delft University of Technology, Delft, 1997), http://resolver.tudelft.nl/uuid:2055acc5-bdc9-4e03-a24c-332ea4f454d2.

60   Schön, *The Reflective Practitioner*.

61   Donald A. Schön, "Designing as Reflective Conversation with the Materials of a Design Situation," *Knowledge-Based Systems* 5, no. 1 (1992): 3–14, DOI: https://doi.org/10.1016/0950-7051(92)90020-g, 11.

62   Ibid., 11, original emphasis.

63   Schön, *The Reflective Practitioner*, 40.

64   Darke, "Primary Generator."

65   Schön, *The Reflective Practitioner*.

66   Schön, The Reflective Practitioner; Mary Maher and Hsien-Hui Tang, "Co-evolution as a Computational and Cognitive Model of Design," *Research in Engineering Design* 14, no. 1 (2003): 47–64, DOI: https://doi.org/10.1007/s00163-002-0016-y; Stefan Wiltschnig, Bo T. Christensen, and Linden J Ball, "Collaborative Problem-Solution Co-evolution in Creative Design," *Design Studies* 34, no. 5 (2013): 515–42, DOI: https://doi.org/10.1016/j.destud.2013.01.002.

67   Wiltschnig et al., "Collaborative Problem-Solution Co-evolution."

68   Ibid., 515.

69   Per Liljenberg Halstrøm and Per Galle, "Design as Co-evolution of Problem, Solution, and Audience," *Artifact* 3, no. 4 (2015): 3.1–3.13, DOI: https://doi.org/10.14434/artifact.v3i4.12815.

the explicit use of the singular case in her phrase "*a* way in to the problem."[55] This seems to suggest that the designer makes a single creative decision, which demarcates their point of entry into, and thus a reduction of, the vast design space—perhaps to make it less cognitively demanding. In the article's conclusion, however, Darke refers to major *aims* and primary *generators*[56] in the plural case, which underlines that a primary generator "can in fact be a group of related concepts, rather than a single idea."[57]

At first glance, this discrepancy may seem of marginal interest. In our interpretation of Darke's article, however, the casual use of case seems to suggest two rather dissimilar approaches to understanding the very initiation of the design process. The first is built on a more radical type of creative decision making: a single, well-defined initial value aim is imposed on the design problem so that a clear-cut, organizing course of action for the designer might become apparent. The other is a more interpretative, iterative approach: the designer imposes a more flexible set of value aims on the design problem, and remains open to adjust and revise that small group of objectives[58] to sustain its generative potential throughout the design process. This distinction is relevant, because it typically leads to two quite different design processes and outcomes. We will start by looking at the latter approach.

As Kees Dorst[59] notes, Donald Schön[60] proposes an alternative to Simon's rationalistic approach to tackling the ill-defined problems that Darke's architects (for example) face at the very beginning of the design process. By emphasizing the reflective practice of design, and that each problem should be seen as unique, Schön argues that "a 'problem space' is not given in the presentation of the design task,"[61] nor by the constraints it encompasses. Rather, says Schön, 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."[62] Working with constraints in this way means reaching a unique problem-solution pairing, a process Schön understands as problem framing.[63] Although Schön, perhaps somewhat surprisingly, never quotes Darke's article[64] in his seminal *Reflective Practitioner*,[65] his emphasis on the designer's thought process while working with the constraints of an ill-defined problem seems quite in line with Darke's work four years earlier. This idea of working with—and not around—constraints becomes critical in later design research on problem-solution co-evolution.[66] A notable difference to Darke's work, however, is that her primary generator concept serves exclusively as the conceptualization of one beneficial starting point for a design process. The notion of emergent constraints—which only occur later, and thus require the designer's attention later in the design process—is not part of Darke's original definition. Nevertheless, it is central in the ensuing literature on problem-solution co-evolution. Empirical process studies illustrate that designers usually contend with considerable complexity and ambiguity,[67] which suggests that co-evolution may be the engine of creativity in collaborative design.[68] Even more recently, Per Halstrøm and Per Galle[69] have suggested that the audience of a designed artifact must be taken into account as well, which thus entails a triple co-evolution.

Although Darke's 1979 article is less frequently cited in psychology-based creativity research, there is an additional parallel with studies into the work

70 Michael D. Mumford, Roni Reiter-Palmon, and Matthew R. Redmond, "Problem Construction and Cognition: Applying Problem Representations in Ill-Defined Domains," in *Problem Finding, Problem Solving, and Creativity*, ed. Mark A. Runco (Norwood, NJ: Ablex Publishing, 1994), 3–39; Roni Reiter-Palmon, and Erika J. Robinson, "Problem Identification and Construction: What Do We Know, What Is the Future," *Psychology of Aesthetics, Creativity, and the Arts* 3, no. 1 (2009): 43–47, DOI: https://doi.org/10.1037/a0014629.

71 Roni Reiter-Palmon, "The Role of Problem Construction in Creative Production," *Journal of Creative Behavior* 51, no. 4 (2017): 323–26, DOI: https://doi.org/10.1002/jocb.202.

72 Ibid., 323–24.

73 Darke, "Primary Generator."

74 Reiter-Palmon, "The Role of Problem Construction."

75 Craig R. Fox, Rebecca K. Ratner, and Daniel S. Lieb, "How Subjective Grouping of Options Influences Choice and Allocation: Diversification Bias and the Phenomenon of Partition Dependence," *Journal of Experimental Psychology: General* 134, no. 4 (2005): 538, DOI: https://doi.org/10.1037/0096-3445.134.4.538.

76 Darke, "Primary Generator," 38.

77 Michael Mose Biskjaer and Kim Halskov, "Decisive Constraints as a Creative Resource in Interaction Design," *Digital Creativity* 25, no. 1 (2014): 27–61, DOI: https://doi.org/10.1080/14626268.2013.855239.

78 This idea has been recently developed in Michael Mose Biskjaer, Peter Dalsgaard, and Kim Halskov, "A Constraint-Based Understanding of Design Spaces," in *DIS '14: Proceedings of the 2014 ACM Conference on Designing Interactive Systems* (New York: ACM, 2014), 453–62, DOI: https://doi.org/10.1145/2598510.2598533.

79 Margaret A. Boden, *The Creative Mind: Myths and Mechanisms*, 2nd ed. (1990; London: Routledge, 2004), 58.

80 Philip N. Johnson-Laird, "Freedom and Constraint in Creativity," in *The Nature of Creativity: Contemporary Psychological Perspectives*, ed. Robert J. Sternberg (Cambridge, UK: Cambridge University Press, 1988), 202.

81 Reitman, "Heuristic Decision Procedures"; Reitman, *Cognition and Thought*.

82 Simon, "The Structure of Ill Structured Problems," 189; Simon, *The Sciences of the Artificial*, 124.

83 Darke, "Primary Generator," 43.

84 Ibid., 43.

on problem construction.[70] In this body of creativity research, problem representations are "knowledge structures based on problem-solving."[71] Among four given types of relevant information intrinsic to these structures, two are of particular interest in the light of Darke's work, namely "information required to define and solve the problem," and "constraints and restrictions on the problem-solving effort."[72] Although Darke's article[73] is not cited in that specific paper,[74] we would argue that this particular take on problem conceptualization implicitly draws on the novel theoretical perspective that she introduces—how constraints cannot only be mapped, but, more importantly, how they might be fruitfully managed at the very initial stage of a design process whose boundaries are ill-defined. During early-phase constraint management, Darke's primary generator concept highlights the importance of subjectivity in decision making and prioritization of constraints in creative problem construction. As opposed to general decision-making theory on options management, which has shown that in many situations people tend toward even allocation over the available options,[75] the primary generator emerges as the designer allocates more attention to specific constraints not just to minimize choice overload, but also as a means of maximizing subsequent choice possibility. We will return to this point shortly.

As mentioned, the above interpretation of Darke's article puts emphasis on her use of primary generator*s* (in the plural). But if we take the title of her article at face value, then establishing *a single* primary generator—as opposed to "a group of related concepts"[76] may reveal some unique potential. Although Darke never uses the term itself, it does seem that having a single primary generator may become decisive for the ensuing design process. The legacy from Darke is thus evident in later work looking at imposed constraints as desired turning points in a creative design process. This is most evident in Michael Mose Biskjaer and Kim Halskov's[77] notion of decisive constraints. The expression plays on the word "decisive" as it relates to the decision making process—"decisive" is to decide, in this case, as "creative" is to create—which mirrors Darke's focus on the designer's active role in the framing of the design space. It also incorporates the more traditional sense of "decisiveness"—the imposed constraints become catalysts and thus turning points that push the design process in a new, organized direction.

To us, this fundamental perspective on constraints as both instrumental to the shape of the initial design space[78] and as creative catalysts is one of the key contributions of Darke's 1979 article. As Margaret Boden said later on, "Constraints on thinking do not merely constrain, but also make certain thoughts—certain mental structures—possible."[79] This view implies the importance of understanding and assuming responsibility for the freedom of creative decision making right from the moment the design process begins. As Johnson-Laird clearly states, "to be creative is to be free to choose among alternatives."[80] The question is, however: which alternative(s)? Following Reitman[81] and Simon,[82] Darke acknowledges that constraints are a necessary part of any creative process; however, the central point she raises is that "designers do not start with a full and explicit list of factors to be considered."[83] Instead, designers "have to find a way of reducing the variety of potential solutions to the as yet imperfectly-understood problem."[84] When

85 Reitman, "Heuristic Decision Proce-
    dures"; Reitman, *Cognition and Thought*.
86 Isaiah Berlin, "Two Concepts of Liberty,"
    in *Political Philosophy*, ed. Anthony
    Quinton (Oxford, UK: Oxford University
    Press, 1967), 141–52.
87 John Irons, "A Translation of Goethe's
    Sonnet about Nature and Art," *jonirons.
    blogspot.dk* (blog), accessed December
    31, 2020, http://johnirons.blogspot.
    dk/2011/09/work-in-progress-transla-
    tion-of-goethes.html.
88 Igor Stravinsky, "Third Lesson: The Com-
    position of Music," in *Poetics of Music in
    the Form of Six Lessons (The Charles Eliot
    Norton Lectures, 1939–40)* (Cambridge,
    MA: Harvard University Press, 1970), 87.
89 Boden, *Creative Mind*, 95.
90 Janet McDonnell, "Impositions of Order:
    A Comparison between Design and Fine
    Art Practices," *Design Studies* 32, no. 6
    (2011): 559, DOI: https://doi.org/10.1016/j.
    destud.2011.07.003, emphasis added.
91 Darke, "Primary Generator," 38, 43.
92 McDonnell, "Impositions of Order," 559.

the (ill-defined) design space is characterized by many open constraints,[85] which in turn prompt numerous potential solutions, the designer faces another type of responsibility: they must embrace and translate the *enabling* potential of applying those constraints. Darke hereby points to the importance of both understanding and actualizing the creative freedom inherent in the liberating subjective reading of the concept of a primary generator.

As Isaiah Berlin[86] famously argued in 1958, freedom can be considered either negative or positive, which more colloquially can be understood as freedom *from* versus freedom *to*, respectively. Although Berlin's proposition was a cornerstone of postwar political philosophy, that distinction between the two types of freedom resonates with the understanding of constraints in design research that Darke's novel concept ushers in. Rather than championing the idea that constraints are best worked around or avoided altogether—freedom from constraints—Darke presents the idea that working with constraints in fact entails a freedom and thus a creative potential of its own. Her primary generator captures the insight that designers necessarily also have the freedom to impose constraints and deploy them as a creative resource as they initiate a design process that already presents many open constraints. The idea that these constraints restrain, by definition, and also have the potential to enable freedom is not in itself novel; however, up until Darke's article was published, this critical insight had mainly been conveyed through artworks and anecdotes. A famous example is Goethe,[87] who in his poem, "*Natur und Kunst*" states that, "He who'd do great things must display restraint; The master shows himself first in confinement, and law alone can grant us liberation." Decades later, Igor Stravinsky arrives at a related insight when explaining his view on creative (positive) freedom and the generative potential of constraints.

> "My freedom will be so much the greater and more meaningful the more narrowly I limit my field of action and the more I surround myself with obstacles. Whatever diminishes constraint, diminishes strength. The more constraints one imposes, the more one frees one's self of the chains that shackle the spirit."[88]

Darke manages to move beyond such anecdotal evidence, fascinating as it may be, and instead introduce a simple, efficient, empirically based explanatory concept to capture this insight into the generative potential of applying constraints as a resource. The creative (positive) freedom to choose is here unavoidable, and as Boden explains, "Even someone who accepts all the current constraints without modification will have a choice at certain points—sometimes, a random choice will do."[89] More recently, Janet McDonnell has continued this line of thinking by focusing on "the relationships between the decisions that are made that can be construed as *imposing enabling constraints*, and the creative potential which is thus set in place once a regime is decided upon"[90]. While Darke remains a little vague about the ontological status of primary generators by recurrently referring to them as "objectives"[91] or "an article of faith on the part of the architect,"[92] McDonnell is more specific in her conceptualization of "enabling constraints." McDonnell defines them as "devices, arbitrary, pragmatic,

93   McDonnell, "Impositions of Order," 557.

94   Mel Rhodes, "An Analysis of Creativity," *The Phi Delta Kappan* 42, no. 7 (1961): 305–10, available at https://www.jstor.org/stable/20342603; Vlad Petre Glăveanu, "Rewriting the Language of Creativity: The Five A's Framework," *Review of General Psychology* 17, no. 1 (2012): 69–81, DOI: https://doi.org/10.1037/a0029528.

95   For example, see Caneel K. Joyce, "The Blank Page: Effects of Constraint on Creativity" (PhD dissertation, University of California, Berkeley, 2009), https://escholarship.org/uc/item/9n14h1bp; Balder Onarheim and Stefan Wiltschnig, "Opening and Constraining: Constraints and Their Role in Creative Processes," in *Desire'10: Proceedings of the First ACM Conference on Creativity and Innovation in Design* (New York: ACM, 2010), 83–89, available at https://dl.acm.org/doi/10.5555/1854969.1854984; Balder Onarheim, *Creativity under Constraints: Creativity as Balancing "Constrainedness"* (Freidricksberg: Copenhagen Business School, 2012), available at http://libsearch.cbs.dk/primo_library/libweb/action/dlDisplay.do?docId=CBS01000589242&vid=CBS&afterPDS=true; Kelsey E. Medeiros, Paul J. Partlow, and Michael D. Mumford, "Not Too Much, Not Too Little: The Influence of Constraints on Creative Problem Solving," *Psychology of Aesthetics, Creativity, and the Arts* 8, no. 2 (2014): 198–210, DOI: https://doi.org/10.1037/a0036210; Michael Mose Biskjaer, "Self-Imposed Creativity Constraints" (PhD dissertation, Aarhus University, 2013); Catrinel Haught-Tromp, "The Green Eggs and Ham Hypothesis: How Constraints Facilitate Creativity," *Psychology of Aesthetics, Creativity, and the Arts* 11, no. 1 (2017): 10–17, DOI: https://doi.org/10.1037/aca0000061.

96   Darke, "Primary Generator," 43.

97   Lawson, *How Designers Think*.

98   Ibid., 106.

99   Patricia D. Stokes, *Creativity from Constraints: The Psychology of Breakthrough* (New York: Springer, 2006).

100 Jon Elster, *Ulysses Unbound: Studies in Rationality, Precommitment, and Constraints* (Cambridge, UK: Cambridge University Press, 2000), 4.

101 Darke, "Primary Generator," 38, original emphasis.

102 McDonnell, "Impositions of Order," 557.

103 Biskjaer, "Self-Imposed Creativity Constraints."

aesthetic and other which artists or designers impose to create coherence in a work or to create a discipline for the working process."[93] This more detailed definition thus captures more of the intrinsic complexity of primary generators and brings to the fore how primary generators both affect the work (artifact) as well as the process itself as two core components of creativity.[94] McDonnell here implicitly points to the possibility of domain-specific differences in the application of such enabling constraints. Perhaps some design domains might lend themselves better to the application of a primary generator? And others might be better characterized using the concept of problem-solution co-evolution? Since Darke does not address this in her article, we will refrain from any conjecture. Instead, we will suggest it as an idea for further studies, as Darke's observation of the enabling potential of constraints in creativity continues to attract attention.[95]

Another interesting aspect of Darke's quote cited in full above is her use of the term "self-imposed,"[96] which implicitly suggests a typology of constraints. In her article, Darke thanks her colleague, Bryan Lawson, for his advice, and she references his doctoral thesis, which had come out seven years earlier. This connection is interesting, since Lawson published his book *How Designers Think*[97]—including a novel constraint model—just a few years after Darke's article was published. Comprising thirty-two boxes, Lawson's cube-like model[98] offers a comprehensive overview of some of the key challenges (constraints) for *in vivo* architectural design problems, but notably does not really address the theme of voluntarily imposing constraints, which Darke had invoked earlier. Patricia Stokes[99] later embraces this idea of self-imposition of constraints and shows its relevance across various creative domains, but without offering an elaborate typology. The most comprehensive typology of constraints that shares a kinship with Darke's work is arguably Jon Elster's book *Ulysses Unbound*, which from its foundation in social science and political theory presents the idea of "beneficial constraints," and especially what Elster calls "essential constraints"—"constraints that an agent imposes on himself for the sake of some expected benefit to himself."[100] This leads Elster to propose a basic distinction between intrinsic, imposed, and self-imposed constraints, where the latter must be interpreted as initiatives individuals (such as designers) undertake to generate an expected benefit to themselves. This benefit could therefore be that elusive "*way in* to the problem"[101] to "create a discipline for the working process."[102] Although neither Stokes nor Elster reference Darke, the legacy of the primary generator concept seems to have spread to non-design specific disciplines. Among the most comprehensive treatments of the generative potential of self-imposed constraints across creative disciplines is the work of Biskjaer.[103]

When tracing the legacy of Darke's article, it becomes clear just how progressive the primary generator concept really was. Ironically, some of the later theorizations within and pertaining to constraint research that have the strongest kinship with Darke's way of thinking rarely reference her work explicitly. Although she never addresses this point directly, Darke does seem to suggest that whatever a designer deems comfortable—in terms of the amount of pressure from the constraints exerting an influence

104   Darke, "Primary Generator," 43.
105   Martin Stacey and Claudia Eckert, "Reshaping the Box: Creative Designing as Constraint Management," *International Journal of Product Development* 11, no. 3 (2010): 241–55, DOI: https://doi.org/10.1504/ijpd.2010.033960.
106   Balder Onarheim, "Creativity from Constraints in Engineering Design: Lessons Learned at Coloplast," *Journal of Engineering Design* 23, no. 4 (2012): 323–36, DOI: https://doi.org/10.1080/09544828.2011.631904.
107   Biskjaer, "Self-Imposed Creativity Constraints."
108   Barry Schwartz, *The Paradox of Choice: Why More Is Less* (New York: Ecco, 2005).
109   Medeiros et al., "Not Too Much"; Stacey and Eckert, "Reshaping the Box"; Biskjaer, "Self-Imposed Creativity Constraints"; Balder Onarheim, "Creativity Under Constraints: Creativity as Balancing 'Constrainedness'" (PhD dissertation, Copenhagen Business School, Denmark, 2012).
110   McDonnell, "Impositions of Order," 557–72.
111   Elster, "Ulysses Unbound," 212.
112   Karl Halvor Teigen, "Yerkes-Dodson: A Law for All Seasons," *Theory & Psychology* 4, no. 4 (1994): 525–47, DOI: https://doi.org/10.1177/0959354394044004.
113   Biskjaer et al., "How Task Constraints Affect."
114   Darke, "Primary Generator," 38.

at the initiation of a design process—is individual. In her conclusion, Darke stresses that the designer uses subjective judgment[104] to select the strongly valued, self-imposed objectives they use to inform and initiate the design process. Two decades later, Martin Stacey and Claudia Eckert[105] pick up this theme in their proposition of under-constrained versus over-constrained creative problems as a loosely defined continuum, stressing that neither extreme is conducive to creativity. Informed by Darke's work and the idea of a continuum, Balder Onarheim[106] demonstrates how industrial designers undertake various creative constraint management strategies to alleviate constraint pressure and initiate the design process. At the other end of the continuum, Biskjaer[107] has shown how artists, designers, and other creative professionals introduce constraints in order to increase constraint pressure, which, if too low—and the creative problem thus too under-constrained—might lead to the paradox of choice[108] in which even establishing a primary generator can seem nearly impossible. This idea of attaining a level of not too much, not too little constraint pressure has prompted the idea of a sweet spot of constraint pressure.[109] This theoretical proposition has been presented as an inverted U-shape, where an individual's perceived potential for creativity (y-axis) is a function of a creative problem's level of constraint pressure (x-axis). The goal for creative individuals such as designers is therefore to locate and enter into their own creative 'sweet spot' by either alleviating constraint pressure through various strategies if the creative problem at hand appears (too) over-constrained or, conversely, if it is (too) under-constrained, introduce additional constraints in the form of one or more primary generators, which serve as enabling constraints.[110] Interestingly, Elster[111] intimated the idea of such an inverted U-shape based on constraint pressure, but never followed up on this idea. As Karl Teigen[112] points out, research in psychology in particular has seen several proposals of inverted U-shapes, not all of which have been demonstrated empirically. Even so, Biskjaer and his colleagues[113] recently studied how varying levels of task constraints (as design briefs) affect inspiration search strategies as "ways into the problem,"[114] and the team found some empirical support for the idea of a sweet spot of creativity. Four decades since its introduction, Darke's primary generator concept is still attracting attention from design researchers, which is a testimony to the continued relevance and impact of this seminal contribution to the history of design research.

Conclusion

Four decades of design research later, Darke's 1979 journal article on the construct of the primary generator has become a design research classic, and it now seems clear that her work may be read through several distinct theoretical lenses. In a revaluation of subjectivity in design, Darke described the primary generator as an imposed focus on a limited set of—typically subjectively valued—constraints, and as a way into the problem for the architect. In the light of later works and developments, we have tried to illustrate how the concept of the primary generator has been read and theorized both as a more or less random starting point within a subset of task constraints to be

iteratively adjusted subsequent to conjecturing, and as a subjectively valued organizing principle that drives the design process. Darke's concept may also be read both as a liberating force of subjective creative freedom for the architect, and as a subjective source of bias and fixation that the architect may be unwilling or unable to later escape and move beyond.

Although Darke's article is rooted in architectural design, tracing its legacy through four decades of design research has shown just how influential her article was in its anticipation of the epistemic turn that design research would take up through the 1980s by moving beyond a mainly rationalistic paradigm. In this article, we have argued that Darke's thoughts on the malleability of the design space and the very initiation of the creative design process by imposition of constraints have been critical in the evolution of what we call constraint research, which denotes a rich strand of interdisciplinary design research. We have attempted to illustrate just how influential the primary generator concept, and Darke's understanding of the design process itself, has been in the design literature that came after. We have no doubt that Darke's work will continue to inspire and inform new contributions to design research in general, and constraint research in particular, and we hope that both new and existing readers will agree with us that Darke's primary generator article definitely deserves a second look.

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There are no conflicts of interest involved in this article.

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