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At the Heart of Leadership

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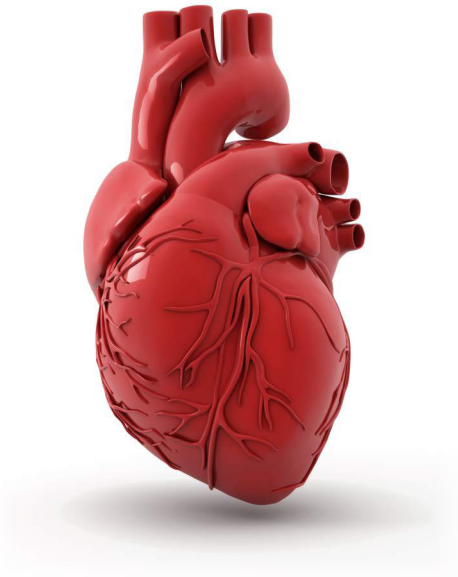

Abstract

Emotions play an important role in both relationships and decision-making processes, which are integral processes within the leadership process. The heart rate is a known indicator of emotional arousal and that is why this paper explores the relation between the heart rate dynamics and leadership related processes. This is investigated through the combination of an ethnographic study and physiological measurements acquired via biometric sensors namely, ECG, optical pulse-meter and GSR. The measurements and observations covers 4 top management team members during 2 weeks. The results of this study show that, the participants strive towards similar heart rate dynamics, hence stabilising the emotional states of the participants as well as their executive decision-making. It also indicates that similar heart rate dynamics is a desired state for relationships and leadership related processes.

Key Words: Heart Rate, Leadership, Relationships, Emotions, Decision-Making.

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1 Introduction

1.1 Background

Does the heart influence the leadership process?
It is the aim of this thesis to explore the relationship between the heart rate dynamics and the leadership process. This is investigated through combining theories stemming from leadership, psychology and neuro science. It was also explored empirically through the combination of ethnography and physiological measurements in order to deduce the influences of the heart upon the leadership process. This paper explores the relation between the heart rate dynamics of the participants within the leader-follower relationship and their executive decision-making.

The leadership process is an emotional process for both the leader and the followers yet emotions are seldom mentioned in leadership literature. Emotions are neglected and almost stigmatised in the leadership literature, due to scientific inclination towards rationality (George, 2000). The recent advances within the field of neuroscience, has shown that emotions play a crucial role in our decision-making process. Furthermore, it has through the discovery of the mirror neuron made progress in understanding the social role of emotions, such as empathy, which is the foundation for relationships (Singer, 2009). Neuroscience, have also shown the emotions elicits physiological responses and vice versa (Phelps, 2009). Leadership is a social and relational process and it is time to start accounting for the influences of emotions as they are the foundation of social interactions and relationships.

Sensative is a small technology company in Lund in the south of Sweden, which are working on “the world’s thinnest magnetic sensor”. This company is interesting to investigate from the stand point that it is a company characterised by engineers and conditioned by the belief in rationality. The employees are experienced within their fields and the CEO has a long managerial background.

This paper illuminates the relation between the emotional states of the members of the top management team and their subsequent social interactions. Because of that, this paper aims to explore the bodily, emotional and relational effects and influences upon the leadership process as well as the executive decision-making process.

1.2 Problem Statement

The purpose of the paper is to explore the relation between the heart rate dynamics of the participant within a leader-follower relationship and their executive decision-making. The paper is exploring the nature of the relation between the participants' heart rate dynamics as they engage in social interactions. The participants studied are the physically present members of the top management team and the leader-follower relationship is limited to these participants as they are the only ones wearing the biometric sensors. The individual dynamics of the heart rate is also taken into account as it is a known emotional manifestation.

1.3 Research question

The thesis strives to treat and answer the following research question:

What is the relation between the heart rate dynamics of the participants within a leader-follower relationship and their executive decision-making process?

1.4 Limitations

This thesis will only measure the heart rate, respiration and perspiration of the 4 physically attending (at the office) members of the top management team, hence excluding one member who was not physically present. This choice is due to focus of the investigation, which is on social interactions amongst individuals in a physical proximity.

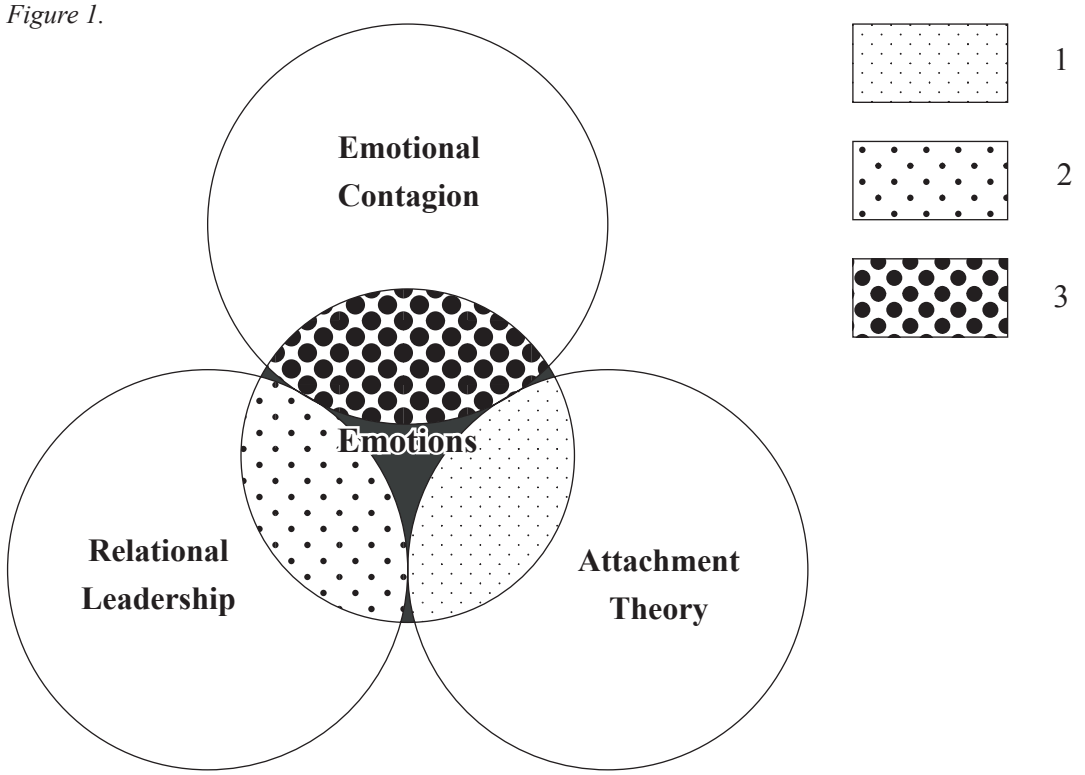
2 Theory

2.1Theory Triangulation

Theory triangulation is the notion of exploring phenomena through the perspective of different paradigms, ontologies and epistemologies (Modell, 2009). This is done in order to compare and complement the theoretical perspectives, which allows for extrapolation as well as theory building (Moisander & Valtonen, 2006). The four theories of this paper are presented in the theory section below, which are stemming from different theoretical ontologies and epistemologies. The first of these is the Leader-Follower Relationship (LFR), which stems from a positivistic ontology and based upon the attachment theory. The LFR theory is explaining the core standpoints of work related interpersonal relationship through the epistemological perspective of objectivity. The second of the theories is known as the Relational Leadership Theory (RLT) and stems from the ontology of social constructionism. The RLT is explaining the core concepts of leadership as an ongoing process, through the epistemology of subjectivity with co-created findings. The third theory is referred to as Emotions and is mainly treated from a positivistic ontology stemming from Neuroscience. The theory of emotions is central to LFR and RLT as well as the fourth and final theory, hence acting as an overlapping theory. Furthermore, it is one of the main reasons that allow the usage of theory triangulation, because emotions are not treated as positivist in the RLT whilst it is treated as positivistic in the other theories. The fourth and final theory builds upon the social nature of Emotions and is called Emotional Contagion, it also stems from a positivistic ontology. The theory of Emotional Contagion is the process of non-consciously mimicking the emotional states of others.

This paper aims to explore the relation between the heart rate and the interpersonal relationships between the leader and the followers. Moreover, it also aims to explore how the heart rates of the relationship participants affect their executive decision-making process. Because of this aim it is imperative to treat emotions as the common denominator or the overlapping theory due to the effects emotions have on the heart rate, interpersonal relationships and decision-making. Furthermore, leadership is according to RLT the interdependent process of the participants and the decision that manifests as a result of that process, hence the importance of emotions in the leadership process. The figure below illustrates the relationships of the chosen theories as well as the overlapping function of Emotions.

Figure 1.



The figure above depicts the chosen theoretical standpoints of this paper and where they are overlapping. The dotted area assigned with number 1 refers to the part of attachment theory that covers emotions often through mentalization, empathy as well as emotional contagion within attachments and relationships, which is a crucial part of the theory (Siegel, 2001). The area assigned as number 2 refers to the importance emotions play within RLT, where it affects interests, values and social interactions (Uhl-Bien, 2006). Finally, the area assigned as 3 refers to the part of theory covering emotional contagion in which emotions play an imperative role as key drivers of leadership related processes as well as relationships (Hatfreld, Cacioppo, & Rapson, 1993).

All of the theories below except Emotions have the following disposition, short introduction, defining the leader, defining the participant process and defining the relationship.

2.2 Leader-Follower Relationship

The notion of Leader-Follower Relationships (LFR) in this paper is based upon the attachment theory and the applications of attachment theory in a work situated context. The attachment theory was stipulated by John Bowlby in 1969, which states that individuals are prone to engage in interpersonal relationships in order to secure the psychological and physiological wellbeing of the relationship's participants (Hazan & Shaver, 1994). These relationships are because of that considered a biological motivation system due to its importance in the survival of the individual. Furthermore, the theory also claims that the formed relationships play a crucial role in the development of the brain (Siegel,

2001). These claims are supported by the findings that the brain adapts to stimuli provided by interpersonal relationships through the ability to create new synapses known as the brain's plasticity. The LFR is based upon two concepts from attachment theory, the first one is the attachment figure, which is related to the leader and the second one is the attachment pattern which is related to the personality of the participant. These concepts are chosen in order to explain how the individuals perceive themselves and others, which affects their behaviour towards others in a work related context, hence their behaviour as leader and/or follower (Richards & Schat, 2011).

The attachment theory claims that humans are genetically hardwired to engage in attachments, whereas the first attachment is that of the infant and its caregiver or attachment figure as they are known according to attachment theory. The attachment figure is crucial for the individual's social and emotional development (Šešo-Šimić, Sedmak, Hof, & Šimić, 2010). The role of the attachment figure is dependent on the context of the attachment, the mother can be an attachment figure in the case of the infant, whereas in a romantic relationship the partner is the attachment figure and in an organisational setting the attachment figure is the leader of the organisation (Siegel, 2001; Richards & Schat, 2011). Emotional interactions with the attachment figure are imperative in order to shape the individuals sense of self within the context (Siegel, 2001).

The infants attachment pattern which acts as the blueprint of all future attachments and interpersonal relationships are formed by the attachment figures availability and responsiveness in regards to the infant as well as the attachments figures ability to act as a secure base from where the infant can explore its surroundings (Richards & Schat, 2011). Furthermore, in adulthood this pattern represents personality traits, affective regulation and experiences which influences the individual's cognition. The notion of the self is thereof based upon the interactions and attachment with others, this interdependent process affects all concerned participant of the attachment (Lin, 2010). The attachment theory also claims that the attachment pattern can be categorised as either as secure, avoidant or anxious.

The relationships and attachments that are covered in the attachment theory are based upon the neurological rewards related to social interactions among individuals. These rewards are composed of dopaminergic projections from the midbrain to the limbic regions of the ventral striatum, the amygdaloid complex of nuclei, hippocampus and the frontal lobe, further explanation of these brain regions can be found in Appendix 1 (Šešo-Šimić, Sedmak, Hof, & Šimić, 2010). These regions of the brain are involved in among other things reward, expectancy and motivation. One implication of this is that it controls motivation of the individual to interact with other individuals when the rewards in the frontal lobe are exceeding the expected rewards of that decision or interaction (Šešo-Šimić, Sedmak, Hof, & Šimić, 2010). One such example is, Individual X (X) approaches Individual Y (Y) in order to ask questions regarding an organisational matter, such as cost of production. This happens as X

experience more benefit from knowing the answer than not knowing the answer. Hence, X is only motivated to approach Y, when the experienced reward related to the information exceeds the energy loss of approaching Y. There are also other hormones that play a crucial role in the rewards of social interactions, especially oxytocin and vasopressin. Oxytocin is known to be correlated with social interaction and the proximity of the social interaction among mammals and is claimed to be one of the most influential hormones when it comes to long lasting relationships and socially linked recognition (Šešo-Šimić, Sedmak, Hof, & Šimić, 2010). Especially strong levels of oxytocin can be found within both the infant and the mother during the lactation phase, which is important for their bonding and relationship development. The role of vasopressin in the context of bonding among humans is still in its infancy and is believed to play an important role in human bonding due to findings in other mammals such as rats and voles.

2.3 Relational Leadership Theory

The RLT states that leadership is produced by the relational processes within a specific setting and was founded by Mary Uhl-Bien in 2006 and is based upon the notion of relational constructionism, which was founded by Dian Marie Hosking 1988 and Peter Dachler in 1992 (Uhl-Bien, 2006). The relational perspective is concerned with the communicative processes and the realities that are constructed through these, such as values, interests and goals. Moreover, these communicative processes are seen as arrays of realities, where the participants' roles, actions and interactions are formed by the socio-cultural context (Uhl-Bien, 2006).

The leader of a leadership relationship is a person that is perceived to make extra salient contributions to the construction of social order of the relationship (Hosking, 1988). That is a person that is recognized by the other participants within the relation as possessing the ability to influence their needs in form of values and interests. Moreover, the influence of the person is also perceived and interpreted as aligned with their interests and values, hence towards a common goal (Uhl-Bien, 2006). The influence attained by the leader is based upon inequalities amongst the participants within the interdependent relationship, such as differences in knowledge and ability to affect resources (Hosking, 1988). One example of such inequality is when individual X (X) is considered the expert on costs related to the production. When individual Y (Y) and individual Z (Z) whom are experts in sales, talks to X about information related to X's expert knowledge, they construe that X knows more than them regarding the production, hence creating a perceived inequality of knowledge related to the production. This knowledge inequality is also perceived as influence over their interests in getting updated on the costs related to the product, which is important when negotiating in sales situations, hence affecting their interests and goals. This process is also described by Hogg (2005), "Leadership is a relational term—it identifies a relationship in which some people are able to persuade others to adopt new values, attitudes and goals, and to exert effort on behalf of those values, attitudes, and goals" (Hogg, 2005,

p. 53). Furthermore, the influence of the leader exists within the interdependence of the relationship, which implies that the other participants also influence the leader, hence the difference that the leader is considered and construed by the other participants to have more influence in the matter than the rest of the participants (Uhl-Bien, 2006).

The leadership process is action co-ordination, where all participants interact with each other in order to construct their social order (Hosking, 2015). The process is an interdependent process where the interactions of the participants construct the self and others within the specific context. Moreover, the process is also an ongoing process, hence constructing and reconstructing the self and others (Hosking, 2000). One such example is when individual X (X) addresses individual Y and Z as "Marketing", at that instance X is constructing their role, timing and action in the discussion but X is also constructing his own role as someone that does not belong to them, hence creating a "me against them" situation. The process also leads to the construction of social order through the participants' engagement in patterns of regular interactions with each other (Uhl-Bien, 2006). The regular interactions comprise meetings, documents, body language, routines and other forms of communicative means, which affects values, interests and relations. It is through changes in these patterns of regular interactions that leadership occurs and the social order is negotiated and renegotiated (Uhl-Bien, 2006). It is through social influence over these patterns that changes in attitudes, moods and goals emerges as well as changes in the self and others. Furthermore, the participants jointly strive towards development, maintenance and alignment of their relationships through alignment of these patterns of regular interactions as well as attitudes and goals (Uhl-Bien, 2006).

The leadership relationship in RLT consists of multiple meanings since it is produced by the participants within a multitude of interdependent contexts. The relationship is defined by the coevolution of multiple realities of self and others as it is interdependently constructed in relation to these (Uhl-Bien, 2006). An example of this is, individual X (X) is interpreted by the individual Y (Y), individual Z (Z) and the X's self-interpretation and Y is interpreted by each of X's and Z's as well as the Y's interpretation of self. All of these interpretations and interactions as well as the additional ones regarding the Z are contained within the relationship and furthermore are constructing the relationship. Moreover, the relationships are dynamical in nature and changes are dependent upon the interactions of the participants within the relationship. The relationship is motivated via by instrumental or affective drivers, such as influence, values and interests (Uhl-Bien, 2006). Furthermore, once the relationship is formed it provides the context for behaviours, norms and expectations. The relationships also contain bonds and connections between different participants, such as individuals, groups and organisations (Uhl-Bien, 2006). Sometime these connections and bond emerges from interactions amongst participants and sometime they do not.

2.4 Emotions

Emotions, moods and feelings are processes integral to human behaviour, relationships and decision-making. Emotions are considered to be an individual's bodily response to a presented stimulus before the involvement of consciousness related processes (Ramsøy, 2014). Emotions have a tendency to involve bodily movements or physical manifestations as an outcome of the presented stimulus. These physical manifestations tend to happen at the same instance in time as the individual becomes aware of the emotional response to the stimulus, hence the tendency to only exist during a short time interval (Ramsøy, 2014). Moreover, the emotional response has a tendency to elicit hormonal responses as well as behavioural patterns (Phelps, 2009). The primary function of emotions is to act as a process in order to assess the relevance of the presented stimulus without involving the consciousness of the individual, hence playing a crucial role in decision-making processes (Singer, 2009). Feelings on the other hand are the conscious experience of an individual's specific emotional state (Ramsøy, 2014; Phelps, 2009). An example of an emotion is fear; when an individual is presented with a stimulus that is inducing fear, such as person or animal appearing through an unexpected way, hence causing the individual to react via a motion of withdrawal from that stimulus. During the first and non-conscious part of the emotional process, the non-conscious and automatic parts of the brain; parasympathetic nervous system, evaluate whether to react or not react to the presented stimulus. Until the stage of the conducted movement the emotional process is still a non-conscious process, whilst at the time of the movement the process becomes a conscious process which is referred to as a feeling and in this case fear. Moods are affective expressions that are of a conscious nature that are less intense than emotions. Moreover, moods tends to be more temporal enduring than emotions and feelings and can be elicited from appraisal of the presence of a stimulus or emerge seemingly without cause (Phelps, 2009). Moods have the propensity to affect individual's behaviours and decision-making processes even though they may lack a present stimulus or apparent cause to emerge. One example of a mood that is related to fear as mentioned in the former example is anxiety; an individual can experience anxiety over a stimulus that is not currently present such as going bankrupt if not achieving their goals, hence feeling a less intense version of fear. In the case of anxiety, the process is conscious and does not necessary involve physical reactions related to its presence. Another difference between emotions and moods is that moods have a conscious appraisal process whether emotions have a non-conscious appraisal process (Phelps, 2009).

There are three dominant approaches to assess emotions; the first one is defined by Paul Ekman as the 6 universal emotions model (6 emotions model), the second is known as the Circumflex model and finally the Approach and withdrawal model (A&W model). The 6 emotions model states that there are only 6 basic emotions that are universal and independent of cultural influences (Phelps, 2009). The 6 universal emotions in this model are listed below.

- Happiness
- Sadness
- Fear
- Anger
- Disgust
- Surprise

The 6 emotions model is based upon observations, where the emotional response is experienced by oneself or observed by others (Phelps, 2009). These basic emotions can then be further facetted towards cultural constructs such as frustration, guilt, envy etc. For example, when describing an emotional event that is experience or observed, it is depicted through the use of categorised emotional states such as happiness or even a derivative of that emotional state such as bliss.

The Circumflex model on the other hand assesses emotional states through the two different dimensions of arousal and valence. The model is based upon measuring the level of arousal; emotional intensity through the heart rate or perspiration and placing it on the Y-axis. The valence is measured in whether the emotion is perceived as positive or negative, often through self-reports or observations and is placed on the X-axis (Ramsøy, 2014). The measurement hence creates a set of coordinates, which states the emotional and affective experience of the present stimulus. One such example is the increase in heart rate and an experienced positive feeling, hence indicating an increase in arousal and a positive valence.

The A&W model is measuring the whether the response to the present stimuli is to approach or to avoid it. These behaviours are the physical manifestations of a neurological notion known as frontal asymmetry, which states that an asymmetrical activation between the left and right hemispheres of the frontal cortex induces approach behaviour (Ramsøy, 2014). The A&W model is known as a motivational measurement instead of a valence measurement, hence not able to tell whether an emotional response is linked to a positive or negative feeling but rather if approach or avoidance is induces (Price & Harmon-Jones, 2011). One example of this is in the case of anger; anger is considered an emotion with negative valence but with approach behaviour (Harmon-Jones, 2003). The A&W model is often combined with arousal measurements in order to construct the arousal-motivational index (Ramsøy, 2014). The differences between motivation and valence is the inherent propensity of motivation cause action, hence a related and predictive measurement to emotions (Ramsøy, 2014).

2.5 Emotional Contagion

The notion of emotional contagion is based upon an individual's ability to get into isomorphic mental states of others through the mirroring of physiological manifestations of emotions. The theory was established by Elaine Hatfield, John Cacioppo and Richard Rapson in 1993, even though there had been a prior use of the terminology before them. Emotional contagion is based upon the concept that emotions elicit physical manifestations as well as an identical physical expression in others, which will elicit an isomorphic emotional state. For example, when individual X sees that individual Y smiles towards him/her; if individual X is simulating a smile back he/she will feel a bit happier. In the case of the smile when mimicking the muscle activation in the face that is related to a smile, it will start release neuropeptides in the brain such as dopamine in order to elicit the emotional response to the muscle activation. The theory got further support by the discovery of the mirror neurons, which states that observed stimulus such as a hand movement activated parts in the brain corresponding both to the observation as well as an isomorphic movement within the brain, whether or not the movement was executed. The ability to mirror the physical expression of other individuals is fundamental for coordination of behaviour, hence the source for all social interactions (Iacoboni, 2009; Bartel and Saavedra, 2000). Furthermore, the coordination of behaviour amongst humans is dependent upon socio-neural processes such as empathy, mentalization and emotional contagion, which will be elaborated upon in the final paragraph of this section (Singer, 2009).

The leader is according to the theory of emotional contagion defined as the emitter of an emotional state, hence influencing others to adopt a similar emotional state. According to the emotional contagion theory the leader is not dependent upon which hierarchical role the individual possess but rather the ability to influence the emotional states of other individuals through physical communicative means such as facial expressions, postures and vocalisations (Hatfreld, Cacioppo, & Rapson, 1993). The leader is because of that based upon the possession of certain social attributes rather than a hierarchical role. The social attributes are those of extraversion, the possession of an emotional expressive language as well as expressive faces, which are all traits related to a charismatic leadership (Bono & Ilies, 2006). These claims are further supported by correlates between emotional contagion and the psychological markers of Openness to Experience and Extraversion in the Big Five personality traits (NEO IP) (Bono & Ilies, 2006). Moreover, social norms and relationships are known to further affect the influence of emotional contagion; hence the ability to affect these implies that the hierarchical role within an organisation might affect the emotional contagion (Bartel & Saavedra, 2000).

According to emotional contagion theory, the followers are those individuals who are influenced to change their emotional state to that of another, through the means of physical expressions. The process is an exchange process in which the collective emotional state is negotiated and influenced by the participation individuals (Bartel & Saavedra, 2000). The leader is therefore characterized as the

individual in which emotional state the other participants' are able to relate to. The emotional and physical synchronisations of individuals are the interdependent process in which exchange, learning and development take place (Hatfreld, Cacioppo, & Rapson, 1993). Moreover, it is the foundation in which emotional attachment between individuals are formed and maintained, which will be expanded upon in the paragraph below.

Relationships are emotional attachments between individuals, which are formed, maintained and ended via socio-neural processes. There are three socio-neural processes covered in this paper in which emotional exchanges occur and they are empathy, mentalization and emotional contagion. Empathy is defined as a conscious process in which the affective state of individual X is similar to the perceived or imagined affective state of individual Y and where individual X knows that individual Y's affective state is the source for his/her affective state (Singer, 2009). Mentalization on the other hand is a conscious process where an individual is able to cognitively represent emotional and affective states of others without experiencing the affective state (Singer, 2009). It is therefore difficult for an empathetic individual to harm others, whilst a person who can understand other affective states without feeling them such as mentalizing have no problems in harming others, which is a common trait amongst psychopaths. Finally emotional contagion is a non-conscious process in which an emotional state of another individual is picked up and experienced without necessarily knowing the emotional source (Singer, 2009). That is in the case of emotional contagion, an isometric feeling in various degrees of intensity is experienced, due to personal differences, in multiple individuals at the same time (Barsade, 2002). Moreover, an emotional attachment between individuals is dependent upon the ability to empathise and therefore also to emit and receive emotionally states to/from others, because emotional contagion occurs before empathy. Furthermore, the synchronicity of actions and emotional states increases the affiliation between individuals as well as dopaminergic rewards (Hove and Risen, 2009; Singer, 2009).

2.6 Theoretical Framework

The theoretical standpoint of this paper is that leadership is a relational process that is influenced by the emotional states of the participants and their contexts. That is why this paper has chosen to explore the relation between the heart rate of the participants within Leader-Follower relationships and their executive decision-making. Furthermore, the chosen setting is a technology company mainly consisting of engineers and a prominent conviction in rationality that permeates the company. The chosen theories of this paper and their specific theoretical combination allows for an exploration of leadership as an emotional and relational process that is unprecedented. This paper chose to combine theoretical perspectives stemming from different ontologies and epistemologies, as in this case realist positivism and relativistic constructionism in order to explore the social interactions within the setting in a more theoretically open manner. Furthermore, this is because of the inherent strengths and

limitations of the different theoretical perspectives. The inherent strength of positivistic perspective is the ability to provide general explanations to internal processes which is taken into account in this paper and on the other hand the limitation is that it does not take contextual factors into account. It is through the rejection of objectivity that the relativistic constructionist perspective thrives and is able to provide insights on a micro, meso and macro level that is in relation to the specific context or setting. This paper has chosen to combine these theoretical perspectives because they can complement each other in order to explore and understand social process in a new way, which leads to new theoretical underpinnings hence theoretical creation. Moreover, this permits new insights in regards to work situated attachments and relationships and their effects on executive decision-making. According to the attachment theory the attachment figure does not change within the attachment or relationship (Siegel, 2001). Moreover, the attachment figure is also corresponding to the hierarchical position in a work related attachment, despite the existence of informal leaders. The attachment theory is in spite of that a prominent relationship theory that is widely adopted and applied.

The 6 emotions model is limited to the ability of the observer in regards to the categorisations and faceting of these but also in regards to interpretative ability in ways that the circumflex model and A&W model are not (Ramsøy, 2014). The combination of the Circumflex model and the A&W model allows for additional information but still lacks an appropriate way to assess the emotional valence, which is far easier through the observations and participation in affectional exchanges. It is through the combination of these models that this paper investigates the influence of emotions in real life leadership situations and decision-making.

Figure 1, above also illustrates that emotions represented in RLT is done so through descriptions of emotional states through a qualitative methodology that is congruent with the Ekman model, whereas the emotions in emotional contagion as well as attachment theory is quantitatively measured through the Circumflex model and Approach and Withdrawal model.

3 Method

3.1 Data and Material

The aggregated data for this text is gathered during two weeks, namely between the dates 2015-02-23 and 2015-03-06. The data consists of various types of information, the first type is observations and interactions whereas the second type is consisting of interviews and questions and the final type is measured physiological data. The different types of data are overlapping, hence contributing with different parts of the final synthesis and are only divided during the analysis of the material. The different types of information and its respective composition are shown in the table below.

Table 1.

Type of data classification	Information, content
Observations and interactions	Written and interpreted observations
Documents	
Audio recordings	
Participating in duties within the company	
Photographs	
Interviews and questions	NEO- PI personality test (Big 5 Domains)
Physical measurements	Heart rate (Optical sensor, ECG-sensor)
Respiration (ECG-sensor)	
Perspiration (GSR-sensor)	
Skin-temperature (Thermometer)	
Motion (3D-accelerometer)	

The data categorised as Observations and interaction in the table above was gathered through the ethnographical study within the company. The ethnography encompasses the working days of the CEO, hence only including observation during time spent in the office. The CEO's amount of office hours varied from 7 to 15 hours a day, which were covered by the study. The study also generated 11,5 hours of audio recordings as well as field notes related to observations of their social interactions and behaviour. Moreover, ethnographical study was chosen as the method for gathering data regarding their social processes and interactions and it is related to RLT and the constructionist method of inquiry. The data related to the ethnography is of a qualitative nature, which is aligned with the relativistic ontology as well as the relational emphasis is aligned with the epistemology of constructionism.

The data named Interviews and questions in the table above refers to a standardised personality test that is known as NEO-PI. It was applied as mean to show the personality traits of the participants as well as personality variation, which makes up the group dynamics. Moreover, it may reveal personal inclinations, which can facilitate the explanations of certain choices. Furthermore, because it is a

self-report psychometric test it facilitates the understanding of how the different participants actually perceives themselves, which is of importance in order to discern the multiple interpretations of reality. This data analysed through both the positivistic and the constructionist perspectives in mind, hence extracting different kinds of data based upon the ontology and epistemology.

The final data categorisation in the table above is named Physiological measurements, which consists of the data gathered through the worn biometric sensors. This data was gathered through two different devices, the sensors of the devices and specific types of data are listed in the table below.

Table 2.

Device 1: Polar FT7	Physical measurement
Electrocardiography sensor (ECG)	Heart Rate, Respiration

Device 2: Basis Peak	
Optical heart rate sensor	Heart rate
Galvanic Skin Response sensor (GSR)	Perspiration
Thermometer	Skin temperature
3 dimensional accelerometer	Movement of the device; Body movement

As can be discerned from the table above, the first device measures the heart rate and respiration whilst the second device measures the heart rate, perspiration, skin temperature and body movement. The two devices both measures the heart rate but in different temporal resolutions and through different means of gathering the data, the differences will be further elaborated upon in the methodology section below, namely in the heart rate part under Physiological measurements. The first device was only worn during the office hours because of the inconvenience of the chest strap electrodes for the ECG, slightly uncomfortable at times. The second device was worn by the participants 24 hours a day and was just a wrist unit replacing their watch. The main reasons for wearing the second device outside of office hours were to collect data that could be used as a control variable for the emotions measured during office hours as well as letting the participant getting used to wearing the device. The collected data covers physiological measurements such as heart rate, respiration and perspiration that are known indicators of arousal and emotional intensity, hence providing information about the participants experienced emotional states, which is integral in order to discern the influence emotions have on executive decision-making. Moreover, it also plays an important role in order to investigate the emotional exchange processes covered in the Emotional contagion theory. Furthermore, the additional measurements of skin temperature and body movements are important in order to discern whether it is an emotional reaction or not. For example, the heart rate, respiration and perspiration increases, which can indicate a physical manifestation of emotions. These bodily processes, will also increase in correlation with movements or straining external factors such as cold, hence the impor-

tance of incorporating these measurements in order to discern whether it is an emotional response. Moreover, these emotional processes play an integral part in the forming and maintenance of attachments and relationships as well as the process of social construction of the context through the influence on interpreted interests and values (Siegel, 2001).

The two devices are compatible with each other, that is they are not interfering with each other because Device 1 is transmitting its information from the ECG chest strap unit to the corresponding wrist unit through 5 kHz coded transmission whilst Device 2 sends its information via Bluetooth to the participants paired mobile unit. Even though there were no interferences between the devices there were occasional disruptions in the data collection. In Device 1 these disruptions were due to lack of conducting moisture between the skin and the chest strap electrode, and in regards to Device 2 it was due to wrong distance between the device and the arm, often caused by the unit slipping towards the hand when moving violently. All the collected data have the time interval of one minute, which is the minimum level of detail required the measure emotions in regards to both heart rate and perspiration. Because most emotional states don't lasts more than 5 minutes the gathered data is not detailed enough to be statistically verified at a one minute level but it still indicates the direction of the heart rate and perspiration that is whether it is increasing or decreasing as the measured unit is a moving average.

The gathered data covers two weeks, during the first week 4 out of 5 members of the Top Management Team (TMT) were studied and during the last week the 2 out of 5 TMT members where studied as well as the researcher himself. The specific durations are covered in the table below.

Table 3.

Role of the participant	Start date	End date
CEO	2015-02-24	2015-03-06
International Sales Manager (ISM)	2015-02-25	2015-02-27
National Sales Manager (NSM)	2015-02-24	2015-03-06
Technical Process Manager (TPM)	2015-02-24	2015-02-27
Surveyor (Kristian Axelsson)	2015-02-28	2015-03-06

In the table above it is possible to discern the different participants of the study. Moreover, it is possible to see that the NSM and TPM is only surveyed during the first week, because they were away on business related trips during the final week. Furthermore, it is possible to discern that the researcher is studying his influence on the remaining 2 participant of the TMT during the final week. The researcher also accounts for his increased participation during this time, while wearing an isomorphic setup

of sensors as the remaining TMT members. During both of the weeks 2/3 of the shareholders were present and the final shareholder and final member of TMT is not located in the office space during the time of the study.

The participants of the study were under the impression that the researcher where there to measure stress levels in relation to the company's TMT. At the end of the study the true nature of the study was revealed to the participants. The main reason for misleading the participants was in order to have an influence on their emotional interactions between each other. The participants will be influenced by whichever reason the researcher provides them with; in this case it was an attempt to let the participants bond with the researcher without restraining their emotional engagement with him. Their bonding with the researcher lets the researcher tap in to and share their emotional states, which is important to understand the emotional influences of their social interactions and relationships.

3.2 Triangulation

The notion of triangulation is based upon the combination of theories, methodologies or data stemming from different paradigms. The purpose of combining theories, methodologies and data is to compare the finding in order to find commonalities between these. The application of triangulation is argued to be a validity and reliability process that is common in qualitative methodology whilst some argue that it is an alternative to the validation process (Atkinson & Hammersley, 2007; Denzin, 2012). In this paper triangulation is applied in order to get a deeper understanding for the study and its findings through comparing different ontological and epistemological perspectives (Modell, 2009). Moreover, this paper is dependent upon triangulation in order to treat its research question, because the heart rate is a positivistic approach whereas relational leadership is a constructionist approach. Furthermore, the paper is because of that also dependent upon different methodologies and data sources in order to meet the chosen research question. There are four different kinds of triangulation defined by Denzin in the 1970, which are listed below.

- Theory Triangulation
- Respondent Triangulation
- Methodical Triangulation
- Researcher Triangulation

This paper applies three of the triangulation methods mentioned above, namely the theory, respondent and methodical triangulations. The researcher triangulation is in the case of this study not possible because there is only one researcher (Denzin, 2012). The theory triangulation is a method where theories from different ontological and epistemological standpoints are combined in order to explain coexisting phenomena from alternate theoretical perspectives (Modell, 2009). One example in this

paper is the concept of leader, which according to RLT is an extra salient person within a specific context, whereas according to Emotional contagion theory it is the emitter of emotions. Methodical triangulation and respondent triangulation will be expanded upon in the following sections.

3.2.1 Methodical Triangulation

The notion of methodical triangulations is the combination of different methodologies in order to assess a phenomenon. The methodologies often stem from different ontological and epistemological backgrounds, such as quantitative methods which stems from the realist ontology and qualitative which stems from the relativist ontology. According to followers of the incompatibility thesis the triangulation of quantitative and qualitative method is considered impossible due to the inherent incompatibility of the methodological differences between the underlying paradigms (Denzin, 2012). This perspective would leads to scientific stagnation as it leaves many questions unanswered, hence hindering the evolution of scientific method. Moreover, as mentioned above the addressed research question of this paper can't be answered or explored without the combination of quantitative and qualitative methods, hence the choice of methodical triangulation (Fielding, 2012). For example, this paper uses the quantitative measures of heart rate in order to investigate emotions as well as qualitative inquiry such as observations to also investigate the same emotions. Through complementing the observed emotional states with the heart rate measurements this paper was able to explore internal processes that could not be seen with the naked eye but still affected the executive decision-making. An example of this is given in the cross validation section of this paper.

Table 4.

Methodology:	Data:
Ethnography	6 Emotions
	Personality test: The perception of self
Physiological Measurements:	Circumflex
	A&W model
	Personality test: participant personality variation

3.2.2 Respondent Triangulation

The respondent triangulation is the corroborative approach, where the observed individuals are asked about the experience and the interpretation of the researcher in order to discern a representative description and understanding by the researcher (Atkinson & Hammersley, 2007). Due to the integrative and emancipatory nature of the respondent triangulation, it is seemingly isomorphic to the concept of reflexivity, where the researcher interacts and takes these interactions into account when analysing and conveying the findings (Atkinson & Hammersley, 2007). It is also a crucial part in order to discern the effects of the researcher, hence a mean for understanding the influence of the researcher's presence (McKeganey & Bloor, 1981).

This paper has chosen to apply the respondent triangulation in instances where the interpretation of the researcher needed confirmation. This was done in a covert manner, in the role of the participant within the setting. One such example is when the researcher askes one of the participants if a certain person had previous ties with him/her, based upon the way they addressed each other. The researcher further investigated his influence during the final week as his participation within the TMT increased, as mentioned in the Data and material section above. Through asking confirming questions regarding persons or events the participants was influenced by reflection on information which otherwise would not be the case, hence the importance of a reflexive approach to the ethnographic study, which accounts for changes related to the participation and presence of the researcher upon the researched.

3.3 Ethnography

An ethnographic study is a method to explore social phenomena through the observing and participating within the chosen setting and the people who belong to that setting. Moreover, an ethnographic study lasts over a specific time interval, often an extended period of time such as weeks, months or even years. Furthermore the ethnography can be performed in either an overt or a covert manner, which will facilitate different kinds of inquiry and results. The ethnographic study often entails collecting various forms of data from the setting that is relevant to the researched social phenomena. This data gathering process is described by Atkinson and Hammersley (2007) as "watching what happens, listening to what is said, and/or asking questions through informal and formal interviews, collecting documents and artefacts – in fact, gathering whatever data are available to throw light on the issues that are the emerging focus of inquiry" (Atkinson & Hammersley, 2007, p. 3). The access to the data is negotiated with the participants of the setting and often facilitated through the role of a gatekeeper, which is a person or artefact that enables access to otherwise restricted phenomena or parts of the setting. Finally, the data collection is an unstructured process, where data is collected during the ethnography whilst categorised and interpreted during the analysis, in order to describe the setting through the actual observations and experiences of the researcher rather than framing researcher via preconceptions of what the setting ought to be like. The analysis of data involves interpretations of processes, meanings, interactions and consequences of those interactions and processes (Atkinson & Hammersley, 2007).

The ethnography covered in this paper refers to a two week study of a Swedish technology company's TMT. The chosen setting for this papers ethnographical study was a sensor company called Sensative and the chosen group of this inquiry consisted of members of the TMT located with the chosen setting of their office; the chosen setting will be expanded upon in the Setting section below as well as the participants of the TMT in the section with the same name. The researcher had approved access to the setting and the chosen group during a time period of two weeks. The study was done in an overt manner, because the participants had to wear biometric sensors as a part of the study, in order

to be able to answer the chosen research question. The gathered data of the ethnography consists of observations which were written down as they happened and audio recordings of meetings and some photographs of the office space, the photographs are appended in Appendix II. The access to the company was negotiated trough one gatekeeper named Fredrik Westman (NSM), whilst the access to the information and the participation of the TMT was via another gatekeeper named Mats Pettersson (CEO). Moreover, the researcher participated in all meetings held at the office space in which the CEO participated and mainly contributed with information related to economics, spot prices on commodities, valuations and calculations; the participation of the researcher is expanded upon in the section below named Participation. Furthermore, the researcher had an observational inclination towards the body language of the studied participants during social interactions and processes. During the analysis of the material the social interactions, processes and relations were interpreted by the participants' means of communication such as body language, emotional states, verbal expressions, reoccurring patterns of behaviour and meanings, which is phenomenon of inquiry in theories of RLT and emotional contagion. Moreover, these phenomena's of inquiry is also imperative in order to discern the relations between the different participants within the LFR, which is addressed by the scientific question of this paper. The ethnography is chosen as a method of inquiry due to the implication of the addressed scientific question.

3.3.1 Reflexivity

TThe notion of reflexivity used in this paper is bases upon the defining traits of reflexivity as an interdependent process between the researcher and the world that is researched (Reeves, Kuper and Hodges, 2008; Atkinson and Hammersley, 2007). Reflexivity is prominent in most social science research and is considered an integral part of ethnographical research, due the role of the ethnographer, which always to varying degree of participation will influence the world that is entered as well as the world will influence the researcher (Reeves, Kuper, & Hodges, 2008; Atkinson & Hammersley, 2007; Moisander & Valtonen, 2006). Hence, the research methods of a reflexive nature is often scrutinized and criticized to be biased through the participation with the researched world but it is through the reflexive process that it is possible for the researcher to be involved in the co-creation and co-interpretation of knowledge and social processes (Atkinson & Hammersley, 2007; Moisander & Valtonen, 2006). This form of criticism mainly stems from positivistic and naturalistic views, which are mainly concerned about the objective truth whereas the ethnography in this paper springs from a social constructionist view, hence focusing on the co-creation of the specific social world that is researched and thereof not focused on the generalized or objective truth. That is the reflexivity of this papers ethnographic study is not concerned with the subjectivity but rather embraces it as a mean to understand the social process experienced by the participants of the setting (Moisander & Valtonen, 2006). The personal relationship between the researcher and the different TMT members are explained further in respective persons section and description.

3.3.2 Observations

The observations of the ethnographical study, is based upon following the CEO and three other participants of the TMT as they interact with each other within their office space. The main purpose of observations as a mean of inquiry is to enter the social world of the participants, hence observing, experiencing and relating to their social interactions. These observations were facilitated by the gatekeepers previously mentioned, especially the CEO. The CEO granted the researcher access to the ongoing processes and interactions of the participants within the office space. Because the CEO accredited the researcher as a person that belonged within the group and that could be trusted. One implication of this trust was that the CEO answered the researcher's questions, which in some instances were kept secret from the other participants of the TMT, stakeholders and shareholders. Moreover, the other participants within the setting also answered the researcher's questions as a result of the CEO's trust in the researcher. There are known dilemmas, which can occur when dealing with gatekeepers such as the gatekeeper is trying to help the researcher, hence inducing a faulty representation of the studied social processes. This is often the case when the gatekeeper selects or orchestrates persons or information in order to help the researcher, there are no indications that this phenomenon occurred in the case of this study.

The observations were written down as field notes, especially focusing on depicting the actions, social interactions and conversations of the TMT, whether it was amongst members of the TMT, other employees or other forms of stakeholders. Moreover, the observations emphasised the depiction of body language, emotional states, and vocal expressions, which emerged from interactions or generated interactions between participants. Furthermore, the time at which observations took place was written down as a part of the field note, hence denoting the start and end of the interaction as well as certain physical reactions such as changes in emotional states. If the observed TMT members started to mirror each other's body language, emotional states or speech patterns this observation was dedicated a separate time as well. The main reason why the detailed accounts of the observations were limited to the members of the TMT, is because they were the only ones wearing the bio sensors, hence of particular interest for this study due to the focus on heart rate in relation to these interactions and relationships. During the meetings the field notes and observations were complemented by audio recordings, in order to follow up, eventual details, task and process that otherwise is easy to miss. Furthermore, the audio recording also acts a source of evidence upon which extracts and transcripts can be produced.

3.3.3 Participation

The researcher has in various ways participated in social interactions that took place within the setting and duration of the ethnographical study. The researchers role and degree of contribution was defined by his area of knowledge, which is the defining the role of the employees within Sensative as well. The occasions when the researcher possessed a contributing role were quite frugal, due to the tech-

nical inclination of the chosen company. The researcher contributed to members of the TMT through activities such as helping out with finding spot prices on commodities, calculations, valuations as well as some soldering of components. Furthermore, these activities have mainly involved answering questions of an economic nature as well as the physical application of soldering components during a couple of hours in a day when only the CEO and researcher were present at the office space. These activities or interactions were based upon the former experience and education of the researcher. Moreover, the possibilities to contribute to the company facilitated the forming of relationships and trust with the researched, which allowed the researcher to emerge in their reality, hence allowing the researcher to experience and share their realities. The interactions between the researcher and the researched is a way to improve the relationships with members of the TMT and according to Moisander and Valtonen, good relationships produce good knowledge (Moisander & Valtonen, 2006). Furthermore, the researcher is likely to influence both the setting and the knowledge produced by the setting, hence bringing up the notion of reflexivity, which is explained in the section above.

3.3.4 Ethical Considerations

During the ethnographical study, the researcher got access to sensitive information about the members of the TMT, the company as well as the product. The personal information includes attitudes, mental states and relationships towards themselves and others, which they told the researcher in a private manner. The researcher was also exposed to organisational information, which has clear legal, competitive and strategic ramifications. The product information also included information regarding the progress, the patent and production of the product. These are different sources of sensitive information, which have implication on which information is selected as well as to which degree of detail the information is conveyed throughout the text. Moreover, due to the chosen limitations and purpose of this paper the emphasis lay in the interactions between the participants, the focus is not on what is said but rather the meaning and context regarding the emotional states and interactions of participants. To be able to give a representative description of these emotional states and interactions of the participants some events is slightly altered in order not to violate terms of confidentiality. Furthermore, the names of partner companies and competitors are altered in order not to risk improper use of intellectual content. Employees within Sensative that does not belong to the TMT, have their names replaced by a numerical entry, because they are not within the chosen scope of this paper. Because of the sensitive nature of the recorded information it will only be provided to the examiners and censors of this paper, due to confidentiality agreements. The decision not to keep this paper confidential is because of an agreement between the company and the researcher not to anonymise the studied members of the TMT and has so forth been approved by a majority of their shareholders as well. The members who participated in this study will be mentioned by their real name and current position within the company and there is a written approval of this in Appendix III. Finally, these actions and considerations are taken in order to maintain the integrity of this study whilst not jeopardising the trust between the researcher and the participants.

3.4 Personality Test

The personality test used in this paper is a self-report questionnaire with the purpose of deducing a personality representation through certain personal traits (Domains). The chosen personality test is known as NEO-PI and consists of 5 domains and 20 items per domain. Each set of 20 items is further divided into 2 subsets; the first subset contains items that have a positive correlation with the specific domain, whilst the second subset contains items that have a negative correlation to the domain. Moreover, the NEO PI stands for the Neuroticism-Extraversion-Openness Personality Inventory, which is also known as the Five Factor Model, the five factors (Domains) are listed below (Costa & McCrae, 1992).

- Openness to Experience (also known as Intellect)
- Conscientiousness
- Extraversion
- Agreeableness
- Neuroticism (also known as Emotional Stability)

The items used in this study was retrieved from the International Personality Item Pool and written into a google form, where the order of the Items was randomised and mandatory (www.ipip.ori.org). A Likert scale from 1 to 5 was used, where 1 was “Very inaccurate” and 5 were “Very accurate”. The chosen language of the items was English as it is the main language spoken within the organisation as well as two of the participants originates from the US. The questionnaire is appended in Appendix IV.

The test is standardised and stems from a realistic ontology, but in this paper it is applied via both a realistic and relativistic ontology. That is the personality test acts as an inquiry, which reveals how the participants of the study see themselves. This is important to comprehend in order to discern how they relate to others according to RLT and attachment theory as mentioned in the theory section. Moreover, from the perspective of the realistic ontology the personality test also provide information regarding the dynamics of the group, which is important to comprehend in order to discern the data relations upon which the statistics is calculated.

3.5 Physiological Measurements

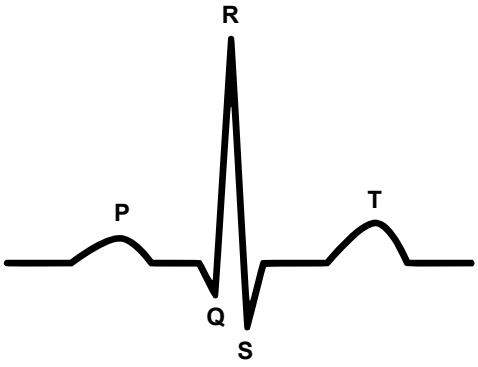
The physiological measurements of this paper consist of the heart rate, respiratory rate and perspiration (GSR), which is further elaborated upon in the following sections. All of the different measurements mentioned in this paper are measurements of arousal, which is emotional intensity (Ramsøy, 2014). The physiological measurements are then combined with the observed and interpreted valence of a social interaction or event from the field notes in order to form a variation of the Circumflex model (Phelps, 2009). Moreover, the measurements are indicating an increased or decreased activity of a

physiological process, which in some instances are known to be physical manifestations of emotional states and in other instances it is other forms of physiological stress such as movement, cold or heat, etc. That is why it is important to measure the movement and skin temperature of the participant, in order to discern whether it is a manifestation of emotional states or not. All of the measurements are affected by the bodily movement of the participant; high levels of movement cause increases in heart rate, respiratory rate and perspiration, whereas the skin temperature is mainly a control variable related to perspiration. Furthermore, the physiological measurements of this paper are necessary in order to answer chosen scientific question. The heart rate measurement is central to the investigation of this paper as it is the relation between the heart rates of different participants within a LFR, which is the purpose of the paper. The scientific question also addresses how this relation influences the executive decision-making of the participants. The respiratory rate is relevant due to the interdependency between it and the heart rate as well as the explanatory factor on how an individual may influence the heart rate of others (Codrons, Bernardi, Vandoni, & Bernardi, 2014). The GSR on the other hand is mainly used as a confirmatory variable that it is an emotional state that is manifested within the individual.

3.5.1 Heart Rate

The heart rate of an individual is the quantitative measurement of heartbeats during the timeframe of one minute. A heart beat is consisting of three peaks and two valleys as shown in the figure below. The different waves and the functions of these are further explained in Appendix V. In the figure below it is possible to see different waves, where the peaks are due to electric signals to the heart hence inducing contractions of the heart. The contraction which is central to this paper is the R wave, which is known as the heartbeat. The amount of beats during the timeframe is dictating whether the heart rate is considered high or low, where higher amounts of heartbeats infers a high heart rate and a low amount of heartbeats infers a low heart rate. Another way to measure heart rate is through the variability of the heart rate, which is derived from the time interval between two R waves (Lane, McRae, Reiman, Chen, Ahern, & Thayer, 2009). The longer the time interval between two R waves the higher the heart rate variability, hence the lower the heart rate and respectively. The different waves in the figure below are measured via an Electrocardiograph (ECG), which is measuring the amplitude and temporality between the electric signals going to the heart; this is elaborated upon in the section below. This paper also measures the heart rate through an Optical Pulse-Meter (OPM), which is not measuring the heart rate through the induce electrical signal but rather through changes in skin contrast, which will be further elaborated upon in the section named Optical Pulse-Meter. Both the term heart rate (HR) and heart rate variability (HRV) will be used interchangeably throughout the paper due to their mathematical relation as well as the convertibility. One such example is, the HR of an individual is 60 beats per minute, which equals a 1 second time interval between two R waves. The result is deduced from 60 beats divided by the time in seconds, hence 60/60 = 1.

Figure 2.



The purpose of the paper is to explore the relation between different participants within a LFR and their HR, which is based upon the knowledge that HR is a known measurement of arousal; that is emotional intensity (Ramsøy, 2014). Increases in HR that is not caused by movements are known effects of emotional arousal and that is why the HR measurements of this paper take movements into accounts via a 3 dimensional accelerometer, which measures and register movements of the participant. Moreover, the arousal level measured via the HR is together with the valence the fundamentals of the Circumflex model (Ramsøy, 2014). In this paper the HR acts as the main level of arousal and is combined with the valence that can be discerned from the field notes, hence using a form of the Circumflex model. Furthermore, it is also the fundamental measurement of the arousal-motivational index, explained in the theory section of this paper.

The collected HR data is treated statistically in order to discern occurring correlations between the HR of different participants at certain social interactions or decisions. The Social interactions and decisions are defined by the observed interactions covered in the field notes. The statistical expression for calculating the correlations coefficient between two variables in a dyadic relationship is given by the expression below. The correlations coefficient ranges from -1 to 1 and is considered a measurement of the relationships strength (Gujarati & Porter, 2010). When the correlation coefficient is 1 within a stationary time series of oscillating around zero, the movement is isomorphic and tend to be identical whilst if the coefficient is -1 the movement is the opposite between the two data sets. The correlations between the participants HR acts as an indicator for emotional contagion in instances where mimicked body language between the participants was observed.

Equation 1.

$$\rho_{x,y} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \sum_{i=1}^{n} (y_i - \bar{y})^2}}$$

3.5.1.1 ECG

The electrocardiograph (ECG) is a sensor that is based upon the concept of electrodes that is placed upon the body of the individual in order to assess the thoracic impedance (de Geus, Willemsen, Klaver, & van Doornen, 1995). Through the thoracic impedance it is possible to retrieve the different peaks and valleys of each heartbeat, hence measuring the temporal distance between the R-peaks in order to discern the heart rate (HR) and HRV (de Geus, Willemsen, Klaver, & van Doornen, 1995). The ECG used in this study was a HR-sensor that was attached to a synthetic chest-strap with an electrode-surface against the skin. The chest-strap was placed in a manner so that it was horizontally aligned somewhere between the fifth and sixth rib of the ribcage. The HR-sensor has its own built-in software that converts the R-waves into a measurement of HR, which is displayed on the wrist unit. The HR on the wrist unit display is updated at least 3 times per second and due to the good temporal resolution it is possible to observe more detailed HR information as well as changes in HRV, which makes it possible to discern the respiration rate as well, further explained in the section below. The ECG was transmitting its information on 5 kHz encoded transmission whilst the OPM is sending its information via Bluetooth and thereby low possibilities of interference (polar.com, 2010). The ECG units where mainly used as a validation tool for the OPM-measurements in order to increase both the validity and reliability of the measurement as well as a control measurement for respiration.

3.5.1.2 Optical Pulse-Monitor

The optical pulse-meter (OPM) is a sensor that is able to sense the HR through the skin of humans. The sensor consists of a light source, which in this specific case is an infrared LED, and a phototransistor that is able to distinguish the heart beats of the wearer as a result of the small changes in skin contrast (Woodward, 1997). The sensor used in this study were a wrist unit that looks like a watch, that needed to be strapped on to the arm in a tight manner but not too tight, due to the risk of exerting too much pressure at the wearers skin, hence flattening the surface capillaries of the skin and thereby suppressing the pulsation effect (Woodward, 1997). The wrist unit were used in order to gather the HR of the wearer every minute and storing it either in the watch or in the wearer's application located on their phone and through the application stored on their internet account. The OPM is a more sluggish sensor compared to the ECG sensor, which only updates the HR information two times every second on the display and once every minute towards the application, and due to the distance from the actual heart as well as the technical approach of detecting the HR through the capillaries it is also considered a less reliable measurement than the ECG. Non the less it is the main source of HR data for this paper due to its ability to store vast amounts of HR information on the wrist unit. On the other hand the chosen scope of the study was to examine the physiological effects on a timeframe based upon one minute, mainly due to the unobtrusive nature of the chosen instruments.

3.5.2 Respiration

The respiratory rate is the quantitative measure of respiration within a timeframe of one minute. Respiration consists of two processes, the first one is inhalation and the second one is exhalation. The two processes involved in respiration is closely linked to the HR of the individual because both of them is regulated and induced via electrical signals sent from the brain to the heart and pulmonary system through the Vagus nerve, which is part of the parasympathetic nervous system. It is through the parasympathetic nervous system that the electrical signals of the automatic brain known as Medulla Oblongata is emitted and received (Yasuma & Hayano, 2004; Butler, Wilhelm, & Gross, 2006). It is therefore possible to discern and measure the respiratory rate (RR) via HR measurements gathered through an ECG. This is possible to discern from the indicative patterns that occurs as a result of the inhalation and respiration processes; the inhalation process invokes an increase in HR whilst the exhalation process invokes a decrease in HR (Yasuma & Hayano, 2004). Because of the strong interdependency between the heart and respiratory system it is important to consider the RR as an interdependent parameter when assessing the HR (Dishman, Nakamura, Garcia, Thompson, Dunn, & Blair, 2000; Codrons, Bernardi, Vandoni, & Bernardi, 2014). This paper only takes the RR in account even though the respiratory process involves additional information, which can be of significance in emotional processes, such as the respiratory volume.

The RR is also a known emotional indicator but even a process known to affect social interactions. This paper investigates the synchronicity of breathing between individuals in social interactions, as an emotional exchange process, which occurs as the individuals mirror each other's movement, posture and breathing (Codrons, Bernardi, Vandoni, & Bernardi, 2014). The synchronisations of RR and HR between individuals are related to prosocial behaviours, which strives towards achieving equilibrium and steady states. This is described by Kugler, Kelso and Turvey as, "free interplay of forces and mutual influences among components tending toward equilibrium or steady states" (Kugler, Kelso, & Turvey, 1980, p. 6). The synchronisation is because of that a reciprocal process in which the participant are attempting to meet in the middle. One such example is, the RR of individual X is increasing whilst the RR of individual Y is decreasing in order to establish a new steady state or equilibrium. Moreover, the synchrony of RR also leads to the synchrony of HR (Codrons, Bernardi, Vandoni, & Bernardi, 2014).

In this study the synchronicity of RR between individuals is mainly investigated through observations, which were confirmed by changes in HR due to the respiration process. The ECG used in this study was not able to record HR in a temporal resolution detailed enough to discern the RR of the participant. The ECG was despite of that able to show the HR in a temporal resolution detailed enough for an observer to observe and write down the HR changes invoked by the RR. The HR measured by the ECG was received by the wrist unit which allowed an observer to clearly discern the changes

in HR caused by the respirator process. These observations were used to discern the participants RR when talking or engaging in other social interactions, which made observing the bowel movement related to breathing difficult.

3.5.3 GSR

The galvanic skin response (GSR) is a measurement of an individual's perspiration level, which is a measurement of arousal (Ramsøy, 2014). The measurement is based upon the natural ability of the human skin to act as a resistor to electricity, hence when the skin is presented with a regulated current and a regulated voltage, there are a certain resistance as outcome of the skin and when the resistance is decreasing during ceteris paribus it infers perspiration because of the conductance of salty water (Villarejo, Zapirain, & Zorrilla, 2012). The GSR-sensor used in this study where located on the wrist of the wearer, which is not considered an optimal location due to the insensitivity in regards to perspiration as an emotional response, especially compared to locations such as the palms of the hands, the armpits or the soles of the feet's (Ramsøy, 2014). Moreover, the GSR is also sensitive to the age, weight and fitness level of the wearer, which is imperative to take into consideration in order to get a fair understanding of the measurement. The measurement consists of the difference between the measured galvanic skin conductance (Ohm) and the galvanic skin rest potential (Voltage), where the conductance has the inverse relationship to the resistance, hence the lower the voltage and the lower the resistance the higher the conductivity, the relationship of the variables is expressed below.

Equation 2.

$$G = \frac{1}{R} = \frac{I}{V}$$

4 Findings and Analysis

4.1 The Setting

The company was founded as a result of an open innovation competition at Ideon Science Park in Lund. The two founders are still involved in the company, one is the National Sales Manager (NSM) and the other is a serial entrepreneur who has the position of the CTO in this company. During the first year they recruited the CEO, who also became the final share holder in the company, up to date. As the company grew the CEO and the NSM recruited more people, where a majority of the employees where former co-workers with the CEO, from a former international mobile company. The company is today a small technology company, which have 13 employees in varying types of employment. The company have a patent for a technical solution within perimeter control and plans to expand adjacent services and solutions. The company is today located at an office building at the outskirts of Lund who is a project owned by Lund's University called MAPCI and have an inclination towards development companies and research within the mobile industry. The office space is an open office landscape, where the company rent a certain amount of office space. In this space the employees and the CEO develops and tests the physical product before the upcoming planed market launch at the end of this summer. The company is at the current time divided into two divisions based upon area of expertise, the first of this is related to the physical product where the second is related to software development as to the physical product. Even though the company have two different development areas, the different developers are all sitting amongst each other and the only one who have an apparent understanding of the two parallel development processes are the CEO and to a certain degree the CTO. Around 10 of the employees are situated in the rented office space at a daily basis and nobody have their own office and meetings are held in one out of two meeting rooms differentiated by their size. The main meetings for the different divisions are always held in the big meeting room that also fills the purpose of server room. The company owns a whiteboard on wheels that they have standing in their allocated area, which acts as the progress and task list, where each of the division have their own side and that is rolled back and forth to meetings with the different development teams.

4.2 The Participants of TMT

The participatory TMT members of Sensative are depicted in the following section and it consists of two tables, where the first table is containing physiological information and the second table is containing personality test results. In the sections beneath the tables each participants is described, first via their brief historical description and then the interpreted perspectives on themselves conveyed by the personality test. The participants are covered in the following order, Mats the CEO, Neal the International Sales Manager (ISM), Fredrik the National Sales Manager (NSM) and Jeff the Technical Production Manager (TPM).

Table 5.

	Physical Information			
Physical Attributes	**CEO**	**ISM**	**NSM**	**TPM**
Gender:	Male	Male	Male	Male
Age:	51 Years	49 Years	27 Years	45 Years
Height:	1,72 m	1,92 m	1,85 m	1,80 m
Weight:	83 kg	129 kg	85 kg	80 kg
Average Heart Rate:	77 bpm	75 bpm	67 bpm	84 bpm

Table 6.

	Percentage of Representative Items			
Factor	**CEO**	**ISM**	**NSM**	**TPM**
Neuroticism:	33%	36%	67%	32%
Extraversion:	65%	74%	45%	61%
Openness to Experience:	65%	83%	87%	75%
Agreeableness:	67%	87%	69%	79%
Conscientiousness:	90%	79%	66%	66%

4.2.1 The CEO

The CEO of Sensative is named Mats. Mats were put in contact with the two founders at a very early stage through a mutual acquaintance. At the time of entering the company as CEO, he was already operating his own consultancy business within his area of expertise, which is process management within the mobile industry. That area of expertise where accumulated through approximately 20 years of different management positions within Ericsson and Sony Ericsson. Today, Mats owns a third of the company. He is also the only person that is able to fully comprehend both the hardware and software development.

I first met Mats through Fredrik, during the time we were all located in the same office complex. Before the study I had met and talked to Mats a couple of times and even participated in one of their company gatherings, a crayfish party at Fredrik's place and throughout that evening I was sitting next to Mats.

Interpretation of self

Through the results presented above there is a distinct inclination towards being dependable, goal orientated and dutiful as the Conscientious score is at 90%. It is also possible to discern a balance in the Extraversion, Openness and Agreeableness as their scores are respectively 65%, 65% and 67%. The Extraversion score tells of a talkative person that enjoys meeting new people but don't crave being in the spotlight, whilst the openness score describes someone whom is open for new and slightly chal-

lenging as long as they are not too radical. It is also possible to discern that the person values getting along as well as avoiding conflicts yet not afraid of conflicts. Finally the neuroticism score; the person is emotionally stable, that is not easily stressed or bothered.

4.2.2 The International Sales Manager (ISM)

Neal, the international sales manager is recruited through Fredrik and another employee at Sesative. He has a vast experience within sales, especially in the US, where he worked at American Express. He is also working as a motivational speaker, which started Toastmaster Lund chapter.

Neal and I have barely spoken before the start of the study; we exchanged some sentences during the crayfish party but a part from that, only greetings in the corridors of their former office location.

Interpretation of self

In the table above it is possible to see that the person have high scores on all domains except the neuroticism, which describes a positive, social and cooperative person. Where the Agreeableness score; shows that the person finds it very important to get along and to cooperate with other individuals. Through the openness score it is possible to discern that the person is curious and creative, whilst the Conscientiousness score describes an orderly and dutiful character. Moreover, the high Extraversion score tells of a person that is social and that like to be in the limelight. The person can be considered emotionally stable with a tendency towards a happy mood, due to the low score on Neuroticism.

4.2.3 The National Sales Manager (NSM)

Fredrik, who is the national sales manager at Sensative, is one of the two founders. Fredrik is a former economy student and a nurse that started Sensative at 2013 when he was still a student at Lund University. Today, he is one of the three owners of the company and he owns a third as well. Fredrik is also involved in Toastmaster together with Neal and another employee at Sensative.

Fredrik and I got to know each other through the University and at the time he was the president of an entrepreneurial student association called FENA, which I became a member of during the time he was president.

Interpretation of self

From the table above it is possible to see that this person is very curious and creative person with the highest levels of stress and feelings of vulnerability. The person is very inclined towards new experiences, ideas and adventures which can be discerned by the high scores on Openness, whilst the score on Agreeableness shows that feelings of unity and cooperation is highly prioritised. The score on Neuroticism also shows a disposition towards anxiousness and slight emotional instability. The person is orderly but still flexible towards ad hoc solutions, which is based upon the Conscientious-

ness score. Finally the person gets stimulation from time by himself and prefer to choose whom he is going to meet and when, which can be interpreted from the Extraversion score.

4.2.4 The Technical Process Manager (TPM)

The technical process manager of Sensative is called Jeff and was recruited via Mats. He had previously worked with Mats at Sony Ericsson. He is currently employed at Sensative as well as independently working as a consultant.

I had only briefly met Jeff before the study and even though he was participating in the crayfish party, we didn't talk that much through that evening.

Interpretation of self

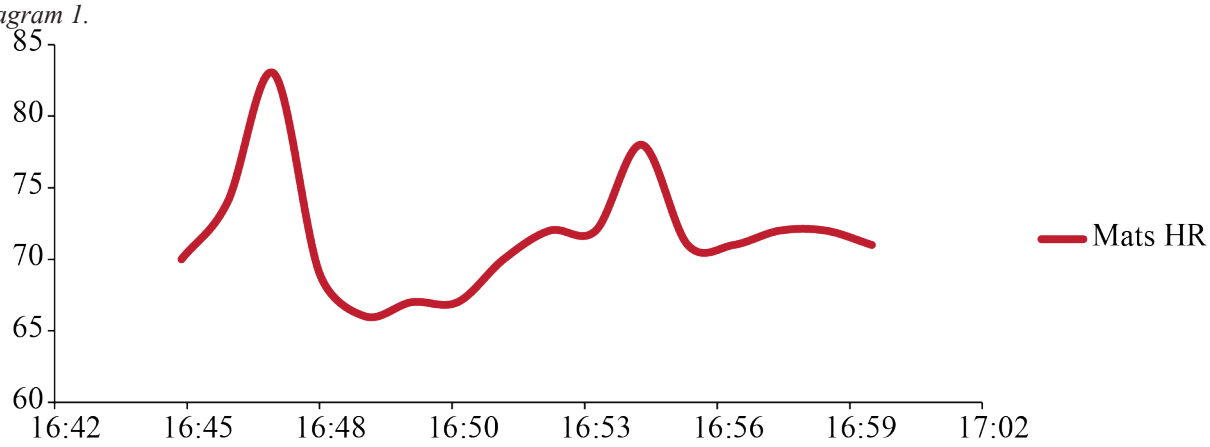
The table above shows a strong disposition towards cooperation and avoidance of conflicts whilst still open to new and unconventional ideas and perspectives. This person finds it paramount to get along with other individuals and collaborate with them, interpreted from the Agreeableness score. The person also shows a strong propensity to see other people's perspectives as well as a strong curiosity, which is discerned from the high Openness score. The Conscientiousness score shows an orderly and self-disciplined inclination, whilst the Extraversion score can be interpreted as social person whom prefer not to be in the limelight. Moreover, the Neuroticism score indicates an emotionally stable person, which is not easily stressed nor bothered.

4.3 Cross Validation and Data Integration

This paper combines theories and methodologies in order to explore the relation between the physical manifestations of emotions and the social interactions occurring within a leadership relationship. It is also exploring how these bodily expressions of emotional states influence the executive decision-making of the participants within such a relationship. The methodologies are chosen in order to gather both observational data through ethnography and physiological data through sensors. The combination of these data sources is chosen in order to create a form of Circumflex model, where the observational data provides the valence and the physiological measurements the level of arousal (Phelps, 2009). Moreover, the ethnographical observations also allows for relational and contextual data to be taken into account, such as meanings, interests and values. This Circumflex approach is chosen with the inherent limitations of the methodologies in mind (Phelps, 2009). The main inherent limitation of the physiological measurements is that it is context dependent and needs the observational information in this case in order to discern whether the emotional state was good or bad (Ramsøy, 2014). On the other hand the physiological measurements allow data to be taken into the consideration when interpreting the observations which would otherwise be concealed to the observer, hence not taken into account. One such example is when Mats received a phone call (2015-02-24 16:45-17:00) with alarming news from an important stakeholder and the written accounts of the

observation states “Mats seems unaffected about the bad news”. When looking at the HR data it was possible to see a strong emotional reaction to the information, but it was well concealed, the diagram below shows the corresponding HR data during the event.

Diagram 1.



Equation 3.

$$Y_t = \ln\left(\frac{X_t}{X_{t-1}}\right) = \ln(X_t) - \ln(X_{t-1})$$

The physiological data has been treated logarithmically, which is explained by the expression in Equation 3. The data in its collected form is not comparative because of the individual physiological conditions mentioned in the section of each participant; hence the conversion into depicting the temporal changes of the data. Moreover, it is the temporal changes that convey whether the process is striving towards a new equilibrium as explained in the Respiration section of this paper. Furthermore, the conversion also has statistical implications, such as increasing the stationarity of the variables within the time series. The variable is considered stationary when the mean and the variance of the variable are held constant, if that is not the case it will inflate the test-statics, hence leading to misleading deduction (Westerlund, 2005). The data sets have not been tested through additional statistical testing such as, neither Dickey-Fuller test of root of unity (Non-stationary variables) nor the White’s test for heteroscedasticity. The main reason why White’s test for heteroscedasticity is not applied is because the presence of heteroscedasticity is expected due to the nature of physiological data (Westerlund, 2005). Heteroscedasticity is when there exists a variation in the residuals, such as increasing or in the case of this study fluctuating. The reason that the residuals is fluctuating is because an individual have physiological and emotional processes that varies in an irregular manner. An example is; the HR might increase drastically from homeostasis when angry and decrease slightly from homeostasis as they have a causal chat. Another statistical limitation to the gathered physiological data is that most emotional states have a shorter duration than 6 minutes, which makes it hard to statistically verify the significance at a significance level of 95%. This is because of the minimum required sample size for

the significance calculation is 6. The expression used for testing the significance of the correlation coefficient can be seen below. Moreover, another problem with small sample sizes is the small sample bias, which states that the small number sample has a tendency to inflate the results.

The group dynamics discerned from the personality tests indicates that the members of the group are rather similar to each other. The correlations of the personality test scores between the different members are listed in the table below.

Table 7.

Participants of the TMT:	**Correlation coefficient:**
Mats and Fredrik	-0,01818
Mats and Neal	0,811375
Mats and Jeff	0,729224
Fredrik and Neal	0,161978
Fredrik and Jeff	0,282957
Neal and Jeff	0,986268

The table above shows how similar the test scores are between different participants of the TMT. It is possible to see that Fredrik have the most deviant scores from the other participants, which can be interpreted as a basis for conflicts due to the low correlation with the rest of the participants. Furthermore, it is also possible to see that Neal and Jeff are most similar in their scores whereas Mats and Neal are more likely to get along than Mats and Jeff. Furthermore, theses correlation coefficients are only purposed to illustrate the differences between the participants of the TMT and is not statistically significant. Moreover, the indications from the table above are not represented in the physiological data of this paper. One such example is that Neal and Fredrik tend to work a lot together without a lot of conflicts and the same is observed with Mats and Fredrik. This implies that the similarities of the test scores are not affecting the data gathered through the physiological measurements. Hence, indicating that the observed mimicking between the participants is not affected by the similarities of these test scores but rather other means of influence such as emotions.

4.4 Analysis

The purpose of this study is to explore the influences emotional states has within the leadership process and how these influence the executive decisions of the participants. The exploration is focused on the LFR and the social interactions of its participants. The following analysis has merged the physiological measurements with the corresponding observations in order to emphasise the interdependence between the bodily and visceral processes. These processes are interdependent to such a degree that their influence on the context are of equal importance, hence ought not to be separated. Such an example is given in the passage below.

(2015-02-23)
Mats the CEO is using a joke to influence the external consultant both his voice and body in order to convey his message. When he makes the joke his voice transfers the words and to a certain degree the meaning that is supposed to be funny but it is the tone, the strength and the pace of his voice that conveys context that this is a joke. Moreover, the facial expressions, breathing and posture of Mats body are also indicators that this is meant to be a joke and aimed at the external consultant as well as when the joke is supposed to be funny. The timing is emphasised by the speech and the breathing along with a smile on Mats face.

The passage above relies on the information regarding the context and the social interactions of the participants, which is ethnographic information, whilst the bodily and neurological process that is involved in emotional expressions relies on information from the physical measurements. This analysis has because of that been divided into thematically sections based upon the findings instead of methodical enquiry. These thematically divided sections are Emotional Influence, The Role of the Leader, Relationships Dynamics, which are aligned with the scientific question of this paper, hence derived in order to address it. Moreover, each of the sections will have the following internal disposition, presentation of the findings, the findings theoretical support and the findings theoretical deviations. This internal disposition is chosen in order to allow for a more holistic perspective of the specific finding, which is crucial in order to comprehend relations between different instances. Moreover, it also permits the influences of and upon social processes to be demonstrated as well as a detailed level of the social interactions that shapes these social processes.

In the following sections the conversations are transcribed in such a manner that statements in regular font is what is said, statements that marked as bold is of important to the analysis and statements within brackets are observations linked to the body language of the specific social interaction. The statements within brackets are observed and interpreted as the social interaction was unfolding, hence written down in the field notes. Moreover, the findings below are chosen in order to provide the examiners of this paper with the best possible evidence and that is why the chosen findings takes place during the first days of the study, due to the possibility to provide audio recording. The main reason for this is that two of the participants of the study where not present during the final week and Sensative only have one meeting a week where everybody is present.

4.4.1 Emotional Influence

Emotions tend to influence the decisions of both leader and follower to a degree that exceeds reason and rationality. This section shows an instance where this was the case within Sensative and where the eventual ramifications of these emotional influences could have been costly for Senstaive. The findings below shows that the CEO is aware of what is considered the rational choice and even what is the proper decision according to the other participants of the discussion. Even though the CEO is

aware of this he proceeds with the decision that is emotionally founded, in this case of stubbornness and pride.

Excerpt 1. (13:05)

1. Neal: And right now we are just amongst us, right? So… if I had to ask you what do you feel confident and comfortable with? Because I, I mean Fredrik and I talk all the time that we don't want to be the kind of sales guys that go out and promise things, that you guys say why the hell are you guys promising this we can't deliver that, you know so that means open lines communication from both ways…
2. Mats: Yes
3. Neal: Right… and I certainly don't wanna go out and tell somebody I'm gonna send them to you in July and then in August they'r saying where the hell is my sensor Neal?
4. Mats: Mmm
5. Neal: Right? So I would rather give…
6. Mats: Should we discuss?
7. Neal: …them a realistic picture
8. Mats: Yep… Should we discuss risks then? And… Risk number one, which is ehh… Which I certainly hope that we would get around and that is a software problem that we are having right now ehh… mainly related to current consumption, because I hope now when we have the stability basically in control ehm… [Cough] We have been struggling with this for quite a long time ehh… I'm still… optimistic in believing that we will solve it now in a few days…
9. Neal: Mmm
10. Mats: …maybe a week…
11. Neal: Mmm
12. Mats: …ehm… but there is always a risk ehm… if we then move forward I think on this list up here, the list… the risk there is not so much whether we can meet the time or not, it is more about what functionality do we have now, how good does vibration work and temperature and so forth, and there is that what we deliver here [pointing at the white board]and what we certify with this aggressive plan, we will be limited in functionality, then we need to do as thin on that and add functionality.
13. Neal: Is it better then to go a little slower and be more certain of the functionality?
14. Mats: That is a good question ehh… **general rule I think is go for the money. Don't try to overdo everything and make everything perfect until you will start to sell**, because then we will never start selling.
15. Neal: Agree, we can't wait until we have a perfect product, right? But then if you look at the risk of that, what is the risk of sending a product out there that customers might not be happy with?

16. Mats: The functionality that I'm a little bit concerned about is the is basically the vibration and how that should work.

The excerpt above is showing the start of a discussion regarding risks with an eventual product launch, where marketing wants to know at what time they can expect to be able to promise a delivery to eventual customers. At point 8, the discussion takes another turn toward the current risks, where Mats emphasise a software problem related to the power consumption as the main risk. As Mats mentions in point 8, the software problem is something that he, 1 and 2 have been working on for many weeks, without solving it. At point 14, Mats is saying that they should aim for a product to launch as soon as possible, it is important to remember that it has gone over two years without direct cash flow only some governmental support and the private investments of the shareholders.

At this point Mats also states that "Don't try to overdo everything and make everything perfect until you will start to sell".

Excerpt 2. (13:07)

1. Mats: The biggest risk here! That will really hit this plan that is if v4 layout for some reason fails, then we have easily 4-5 weeks delay and that is why we need to…
2. 1: Yeah…
3. Mats: …be sure we have all the rubber bands…
4. 1: Yeah…
5. Mats: …and things available
6. 1: But you have to understand one thing here, if I'm going to get the rubber bands, we have to generate a completely new layout from scratch, which will take much more time than modify what you have but we that it works, I'm not convinced that this rubber band thing is the most important issue actually, because we have the version 3…
7. Mats: Do you remember how long time it took for us to review…
8. 1: …But this is reviewed now, the version 3 is reviewed, there are small changes…
9. Mats: …then we need to be very conscious about the changes we do…
10. 1: …of course we do…
11. Mats: …**then I'm not so sure that we should change the voltage regulator anymore**…

The excerpt above is depicting a later part of the same discussion mentioned earlier regarding risks and the launch of the product. At point 1, Mats is at this point in time mentioning another risk that he perceives as the biggest one. At point 6, Mats is actually advised by 1 not to go through with that due to the risks of failure as well as the time needed. Moreover, 1 is also implying that it is better to

stick to V3 in order to "go for the money" as Mats mentioned in Excerpt 13:05, Point 14 above. At point 11, Mats is saying that they shouldn't continue with the voltage regulator and maybe that is the wrong priority.

Excerpt 3. (13:09)

1. 1: If it is absolutely necessary to do rubber band I can do it but the risk is that it takes longer time.
2. Mats: I'm just so nervous…
3. 1: Because…
4. Mats: …that we do a minor mistake and we lose 4-5 weeks.
5. 1: But we will not, we will not. We have not solved that problem yet with the rubber bands on 4010, me and 4 has started looking but it was just the other evening… yesterday evening we started, so give us a day or two and we will solve it.
6. Mats: Because with the old iterations we did, with the old reviews we did…
7. 1: Yeah, but…
8. Mats: [Raises his voice slightly] I think we were extremely LUCKY that we didn't have any errors in V3…

The excerpt above is continuing the same discussion as before. At point 4, Mats is explaining the implications of continuing with V4 and at point 8 he really emphasises his impression that they were "LUCKY" with V3 and shouldn't push their luck because just a minor error will send them back 4-5 weeks.

Excerpt 4. (13:10)

1. Neal: Can I ask a stupid question?
2. 1: Sure
3. Neal: If? Do we then to get a product out for sale, do we need to go to V4? Over V3? Does it have to be? Because I agree with you, let's get something out there as long as we feel… certainly a magnetic connection works the way we really want it to work, right?...
4. Mats: Mmm
5. Neal: …And we haven't even start… we haven't mentioned the vibration and stuff yet…
6. Mats: Mmm
7. Neal: right? It's just, we take it of the kickstarter, we don't even talk about it yet…
8. Mats: Mmm
9. Neal: …because that is also something, being in marketing and communications, we can use to spin up more excitement in the fall, if that's when we feel… comfortable with that.
10. Mats: Mmm

11. Neal: Like I said, this could be a stupid question and you'll say no Neal the V3 won't work, but not being a technical person and listening to you, we need to get something out there, which I agree with, will V3 be enough?
12. Mats: Mmm…
13. 1: [deep sigh] Move on…
14. Neal: [Laughing] Sorry
15. Mats: …**it is all about the voltage regulator I think**…
16. 1: …there are a couple of things right now to consider

The excerpt above is still continuing on the same discussion at the previous Excerpts. At point 3, Neal is trying to get a clear answer whether they are planning to go with V3 or V4 for the product launch. At point 11, Neal is asking the same question once more and in point 12 Mats is ambiguously confirming that V3 is enough. Once more, Mats is mentioning the voltage regulator, which he proposed not to change anymore, in Excerpt 13:07, Point 11.

Excerpt 5. (13:12)

1. 1: So we replace what we think is more necessary, with throwing out things we don't need
2. Neal: So…So… so, it means certainly sounds…
3. Mats: Your question is…
4. Neal: …like we need V4 for the vibration.
5. Mats: Your question is very relevant, and… and… [Deep sigh] **It is all about the voltage regulator**…

At point 1 in the excerpt above, 1 is wrapping up his technical explanation regarding what is important to prioritise, which started at Excerpt 13:10, Point 16. At point 5, Mats is once again denoting the voltage regulator as the main problem even tough 1 is proposing a couple of other problems that is more important according to him.

Excerpt 6. (13:17)

1. Mats: But I agree with your question…
2. Neal: Ok?
3. Mats: …definitely and **the voltage regulator is all about squeezing out the last 10% of the battery.**
4. 1: Yeah…
5. Mats: Meaning, if we just skip that discussion instead of 10 years we might have 8 or 9 years
6. 1: Mmm
7. Mats: **Maybe that is good enough for the first… 5, 10 thousand, 20 thousand units.**

8. Neal: Well, I can tell you if it… what we heard from them at CES, was that in the security business 3 years is good, 5 years is phenomenal! So if we are talking anyway that we could say and feel comfortable 5 to 8 years I don't think we have an issue, to be honest with you…
9. Mats: Mmm

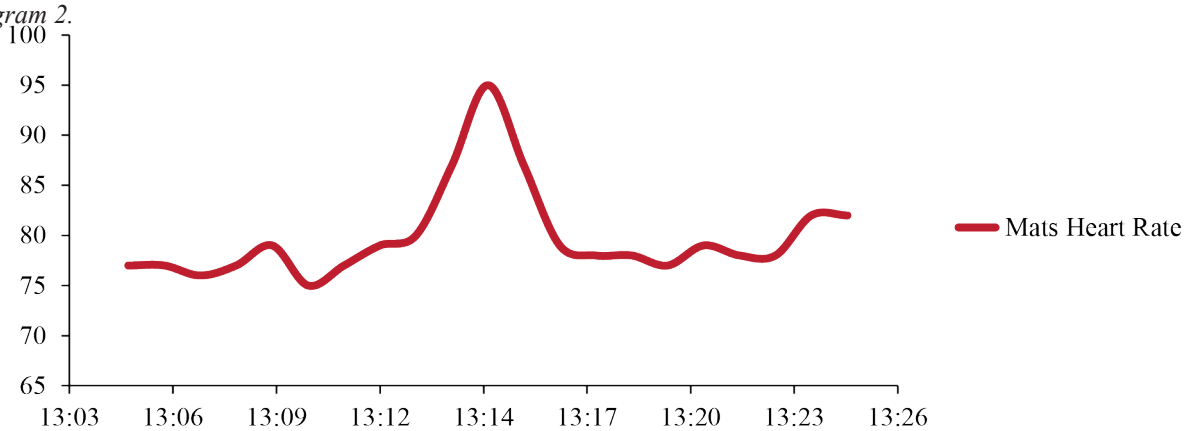
The excerpt above is a part in the same discussion but at this stage Mats is actually explaining the implications of the voltage regulator, at point 3. At point 7, Mats is mentioning a proposal that is aligned with what he proposed before to "go for the money", in Excerpt 13:05, Point 14. In this case he gets the support from Neal that the voltage regulator isn't that important as Mats seem to think, in point 8.

Excerpt 7. (13:19)

1. Neal: So are they willing to wait an extra 6,9,12 months for one that lasts 10 years instead of 8? Maybe the answer is yes for them.
2. 1: I don't think so
3. Mats: Mmm

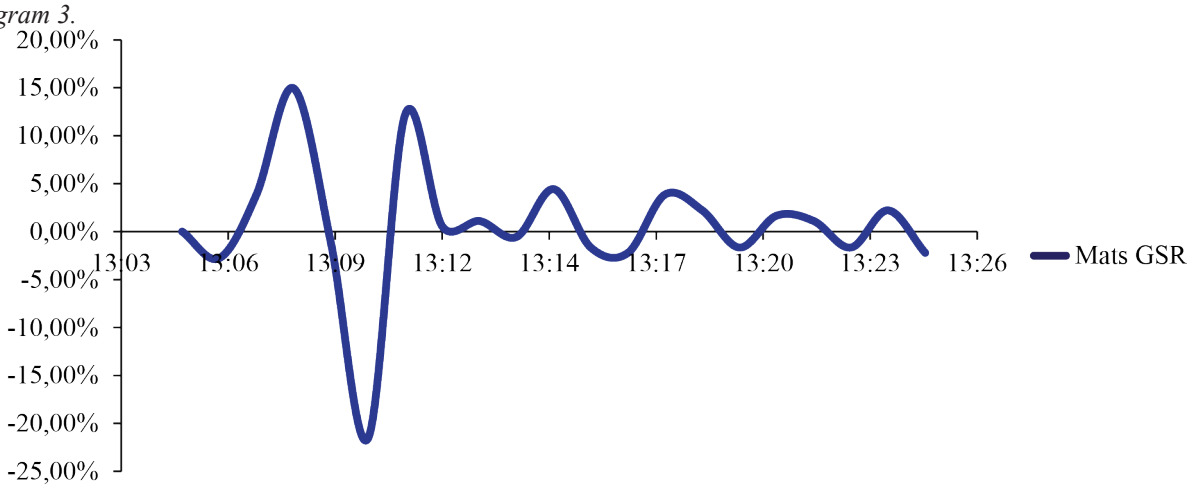
Finally, in the excerpt above Neal is highlighting the implications of continuing with the voltage regulator and risking a product launch that might be delayed between 6-12 months as a result of adding 10% of battery life. 1 expresses his doubt regarding the customers' willingness to wait that much longer in order to slightly increasing the battery life of the product, especially as the standard on the market is around 3 years and below.

Diagram 2.



In the diagram above it is possible to see Mats Heart Rate, which is notably increasing throughout the discussion treated in the excerpts above. At 13:09 it is possible to discern the first peak, which is coinciding with Mats statements about his "Nervousness" and the increase of voice as he emphasises that they were "LUCKY". Furthermore, the diagram also shows a continued heart rate increase between 13:10 and 13:15, which is taking place as Mats is treating Neal's question regarding a possible launch during V3.

Diagram 3.



The diagram above is depicting the temporal changes in Mats perspiration, during the discussion above. There is a coinciding peak in perspiration at 13:09, because the diagram is describing the temporal changes the increase leading to a peak is at 13:08 and the culmination is at 13:09 as the decrease is at 13:10, hence coinciding with the peak in Mats Heart rate. This indicates that Mats is experiencing increased levels of emotional arousal. Moreover, the diagrams below shows that there is an increased movement from Mats during 13:13 and 13:15 with a lower skin temperature, this movement was going back and forth in front of the white board as well as some writing on the whiteboard, which can be an explanation why his Heart rate increased during that time whilst the GSR was only producing small oscillations, the implications of this these diagram will be treated in the following sections.

Diagram 4.

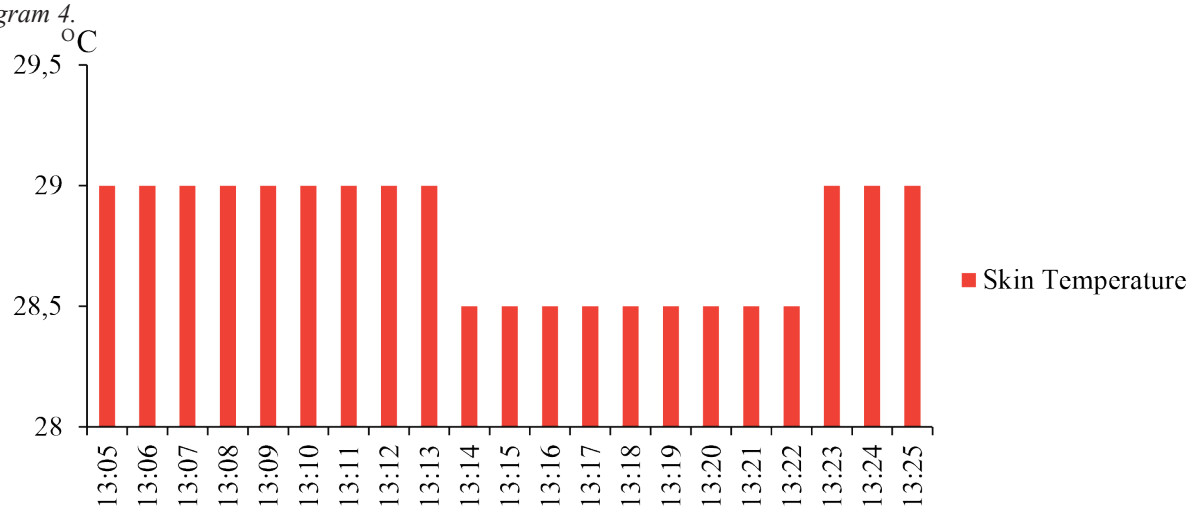
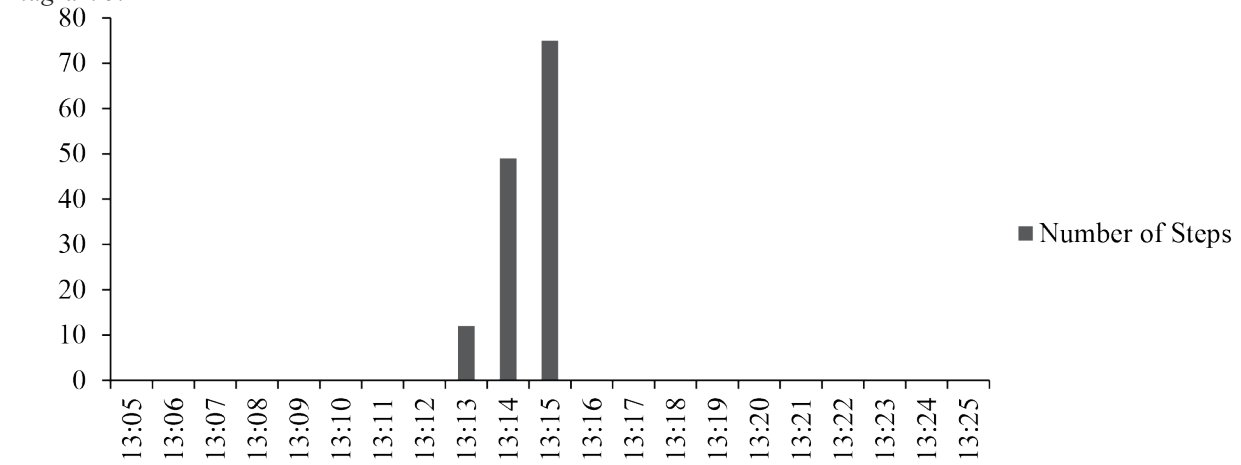


Diagram 5.



After the meeting treated above had ended Mats had a short lunch and went straight back to work on the voltage regulator, with 1 and 2. After the meeting Mats and 2 spent 20 more hours each working on the voltage regulator problem, which Neal and 1 discouraged him from doing, due to the high risks and the potentially low increase in value for the customer. Moreover, the continuance on the voltage regulator went directly against the plan to "go for the money" (Excerpt 13:05, Point 14). Furthermore, he and 2 solved the problem with the voltage regulator at 10:06 the 2015-02-26, at that point it is apparent that Mats is very proud and this could be seen through Mats gathering the involved engineers to show off the result. Mats clearly explained what was the rational way to go on with the product and still he acted directly against what he explained was the right thing; go for the money and not work on the voltage regulator (Excerpt 13:05, Point 14; Excerpt 13:07, Point 11); to do due to an emotional attachment to the problem at hand; voltage regulator.

Theoretical support

The findings described above are congruent with the theoretical foundation of the influence of emotional states upon executive decision-making (Ramsøy, 2014). The emotional process as described in the theory section is an appraisal process, which entails a non-conscious decision; whether to act or not on the presented stimuli (Phelps, 2009). In this case the presented stimulus involves the doubt of the continuance of putting more time into the voltage regulator; "**…then I'm not so sure that we should change the voltage regulator anymore…**" presented at Point 11 in Excerpt 2. Moreover, as Mats expresses his doubt, his physiological response to his experienced emotional state led to increased HR and increased perspiration (GSR) as shown in diagram 2 and 3. Furthermore, these physiological responses are not coinciding with any relevant movement of the boy nor are it coinciding with an increased skin temperature as can be discerned from diagram 4 and 5, which indicates that the physiological response was emotionally elicited. This emotional response further indicates Mats latent self-interest in the concerned matter; the goal of achieving a ten year battery life. Moreover, Mats also conveys that he is experiencing emotional states in connection with the physiological readings,

which he expresses as "**I'm just so nervous…**" at Point 2 in Excerpt 3 that is approximate 13:09. This claim is also supported by Mats expressed fixation with the voltage regulator, mentioning it as the main reason why they have not launched the product yet. Mats first expresses the fixation through these words; "**…it is all about the voltage regulator I think…**", at Point 15 in Excerpt 4. Followed by the line; "your question is very relevant, and… and… [Deep sigh] **It is all about the voltage regulator…**" expressed at Point 5 in Excerpt 5. Once again it is possible to discern that the mentioning of the voltage regulator has physiological consequences, which can be seen in Diagram 2 and 3. The diagrams show an increase of HR as well as an increase of perspiration (GSR). Furthermore, it is possible to see that the bodily response is not induced by body movements or changes in skin temperature, hence once more indicating emotional responses albeit not to the same level of arousal as before. This emotional response is followed by an escalation of HR reaching its peak at 13:15, which is matched by a small peak of the GSR. This HR escalation is accompanied by movements of the body as well as a decrease in skin temperature and even the body movement reaches its culmination at 13:15. These results are not enough to discern whether the HR and GSR are elicited by emotional processes on top of bodily responses or purely physiological responses, such as body movement. On the other hand, the physical movement is likely a physical response to stress, hence moving in order to get back to homeostasis (Phelps, 2009). This is based upon the extent of the HR escalation, rising from 80 to 95, which is an increase of 18,75% upon an already deviant HR. Moreover, other indications that supports the homeostasis likelihood is, Mats abruptly stops walking around at the same instance that the HR is decreasing, which is seen in diagram 2 and 5. If Mats were trying to get back to homeostasis, he would no longer have any incentive to move and waste energy when the stress is decreasing or being relieved.

The moments addressed in the passage above also indicate that Mats experiences a cognitive dissonance. This is discerned through the high Conscientiousness score (90%) in the personality test, which is a representation of how Mats perceives himself, namely as self-disciplined, organised and dutiful. Moreover, high level Conscientiousness scores such as the case of Mats is often an indication of perfectionism and compulsive behaviour, which is further support for Mats fixation as mentioned above as well as another potential cause of the cognitive dissonance (Carter, Guan, Maples, Williamson, & Miller, 2015). The cognitive dissonance in this case is that Mats is deviating from his own expectations and perception of himself through making executive decisions based upon affective states such as pride, instead of "going for the money", which is expected of him. Mats knows and expresses these expectations upon him, first as "**… general rule I think is go for the money. Don't try to overdo everything and make everything perfect until you will start to sell,**" at Point 14 in Excerpt 1. Mats later expresses it as "**Maybe that is good enough for the first… 5, 10 thousand, 20 thousand units**", at point 7 in Excerpt 6. This further displays support that the focus on "good enough" is not aligned with Mats vision of the product and thereby his compulsive behaviour regarding the voltage

regulator in the search of perfection. The search for perfection furthermore directly contradicts what he perceives is expected of him, namely "go for the money" and "not trying to make the product perfect". Despite of that Mats stills succumbs to his perfectionism and continues to put another two days into the voltage regulator problem before solving it. Mats choice to proceed with the voltage regulator dilemma is not congruent with neither RLT nor attachment theory, which will be explained and expanded upon in the following section.

Theoretical deviance

The choice of continuing with the voltage regulator as described in the findings above is not supported by the RTL. The main reason that the choice is not consistent with the RTL is because of Mats pursuit of his own values or self-interests despite acknowledging the values and interests of the other participants within the relationship and discussion. For instance, Neal's goal and reason for starting the whole discussion is to sell the product and through that maintaining his relationships with his potential customers and stakeholders. Moreover, Neal's main interest is to have a secure income and that is also one of the main reasons he is in Sensative, from the start and it is the same reason that 1 shares. In the case of 1, he has found a new position in another company, his main interest at the stage of the discussion is to increase the dividend from the loyalty program to his favour economically wise. Mats is on the other hand more emotionally involved in the company and for him it is not a pursuit of an income but rather a realisation of beliefs. The standpoints of 1 and Neal are not aligned with Mats choice to spend more time on the voltage regulator, hence jeopardising Neal's security and 1's future dividend. Furthermore, Mats are depriving Neal and 1 of their reason to follow or support him, through displaying that he knows that their perspectives are coherent with the established guidelines for the outcome of this choice. Because the power structure within Sensative is based upon knowledge and when Mats displays that he, 1 and Neal are equal in that regard, he has lost the power, hence the incentives for them to follow him. The leader is according to Hosking (1988) defined by the influence attained trough the inequalities amongst the participants and through equalising himself with Neal and 1; Mats is no longer a leader and has lost the influence.

Mats choice to carry on is not supported from the theoretical standpoint of attachment theory, due to the lack of reciprocity, collaboration and consideration to 1 and Neal. Mats role as an attachment figure is to provide support for 1 and especially Neal who is trying to build explore the market and through that support create a strong attachment towards him and Sensative. In working against their needs and solely focusing on his own needs, Mats are making Neal and 1 insecure about their value to Mats and thereby also Sensative. The lack of security will lead to limited commitment in the direction of Sensative and even vague feelings of alienation, hence hindering them from doing their best. Moreover, the insecurity within the attachments reduces the oxitocinergic and dopaminergic releases, hence the decreasing the feeling of belonging and the rewards associated with it.

Another consequence is that the choice leads to deviation from 1's and Neal's goals and values, which makes it harder for them to empathise with Mats (Singer, 2009). The reluctance built up towards Mats also makes it harder for them to receive eventually emitted emotional states from Mats as well. The ability to emit emotional states is imperative in order to synchronise dopaminergic responses to tasks, goals and values. That is the reward of belonging to the organisation and its goals, values and performing the tasks of the organisation. Moreover, People prefer to cooperate and when a cooperative process is violated the participants experience a need to punish the violator of the cooperation (Singer, 2009). In the case of Mats choice Neal and 1 might set up hinders for cooperation with Mats in the future especially towards goals and values that are important to him.

4.4.2 The Role of the Leader

The following observations and graphs are describing two instances where there are changes among the participants in possessing the role of the leader. The first instance portrays intraday changes of the role as leader between the different participants, which spans over different group constellations as well as contexts. This instance describes four changes in the leader role and the dependency role, the first leader is Fredrik, the second and third ones are Jeff and the final leader is Fredrik. All of the situations are displaying triadic relationships, which allow for interpretations of which participants that possess the role of leader, hence providing the physiological measurements with a context. Moreover, the first part of each section within the first instance is a short description of the observation in order to facilitate the comprehension of the social situation.

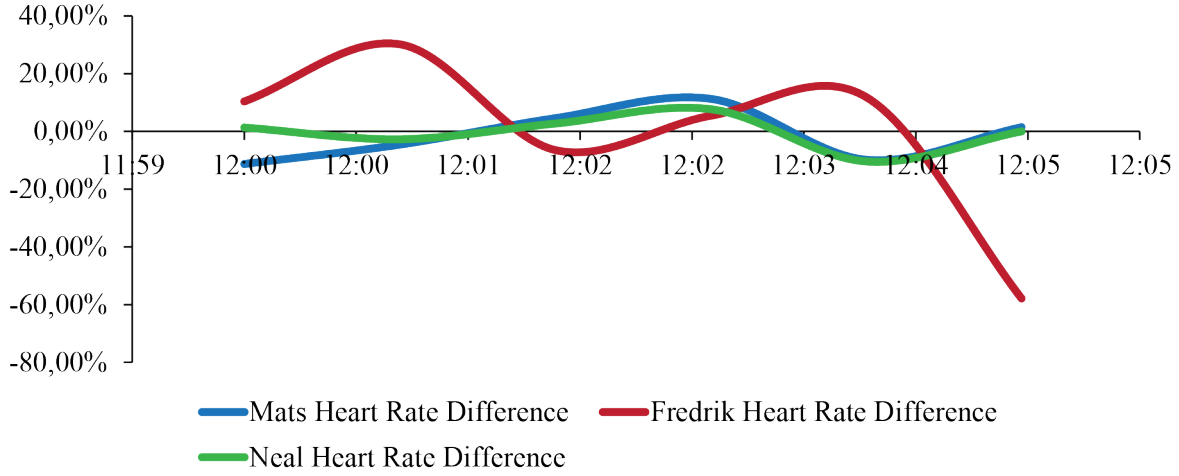
The second instance is describing a situation where Mats is the leader and where Fredrik takes charge briefly, hence displaying a situation where more than one leader exist at the same time within a context exceeding a triadic relationship context.

Instance 1

Fredrik As Leader

A short meeting between Mats, Fredrik and Neal regarding what is supposed to be conveyed to the costumer as well as through which channels and personal networks they are going to send out the information. The information is about the product and the upcoming crowdfunding (CF) campaign. Mats is mainly mimicking Fredrik's head movements through synchronized nodding and head shaking as well as Fredrik's breathing.

Diagram 6.



The diagram above shows the temporal and relative changes in HR for each participant, where the blue line represents Mats, the red line represents Fredrik and the green line represents Neal. The diagram also shows an interval of time that spans from 12:00 to 12:05 on the 2015-02-25, which is the first 5 minutes of a 15 minutes meeting regarding which information that is going to be sent out, when and to whom. It is observed that Fredrik is in charge of the situation through his confidence in the matter and especially as Mats and Neal mainly agrees with Fredrik's statements. Moreover, Mats is mimicking Fredrik's head movements and synchronised breathing; such as nods at the same time as Fredrik as well as increasing his breathing pace to that of Fredrik's. The Heartrate changes of Mats and Neal correlates negatively with Fredrik's, who is observed as leader in this situation. The table below displays the correlation between the different participants' temporal heart rate change and their respective significance level.

Table 8.

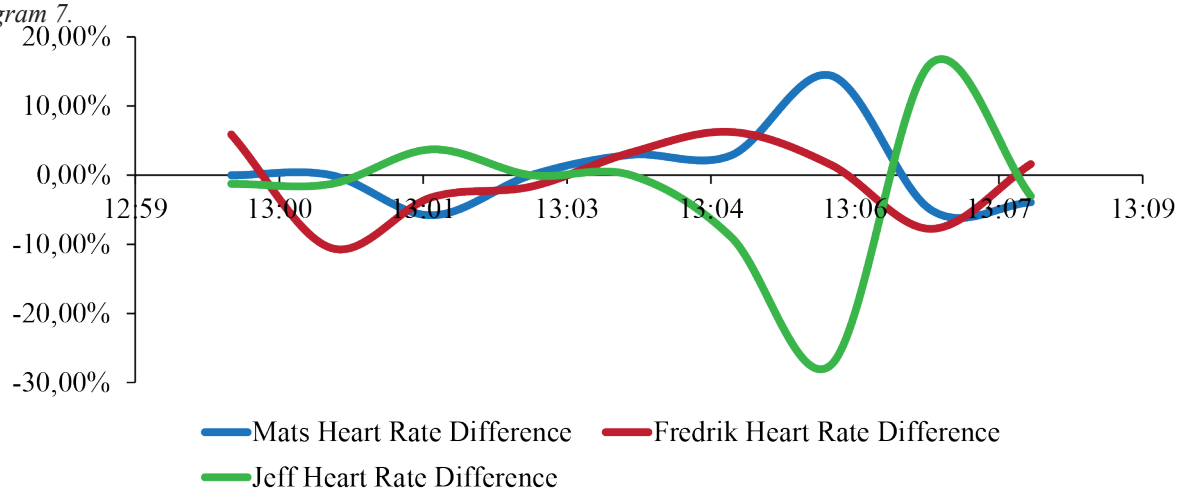
Mats & Fredrik	Fredrik & Neal	Mats & Neal
-0,32793	-0,18413	0,741035
Significance level 95%		
-0,69426	-0,37467	2,207215

The table above shows the correlations between Mats and Fredrik, Fredrik and Neal, Mats and Neal. The correlations are -0,3279, -0,1841 and 0,7410 respectively. The test statistics in the last row indicates that none of the correlations are statistically significant, because all of the presented values fit within the span of -2,776 and 2,776, which are the critical points at 4 degrees of freedom at 95% significance level. Furthermore the duration is spanning from 12:00 to 12:05.

Jeff As Leader

Jeff walks over to Mats and answers the questions Mats asked (11.02-11:07). It is information regarding the PCB:s. Fredrik also joins the informal meeting, both Fredrik and Mats are following Jeff's breathing and both of them are facing Jeff with their torso in an opened and relaxed manner.

Diagram 7.



In the diagram above it is once again possible to see the temporal changes in HR, this time between Mats as the blue line, Fredrik as the red line and Jeff as the green one. The displayed duration of the time series above stretches from 13:00 to 13:08, the 2015-02-25. Furthermore, it's possible to discern that the fluctuations of the red and the blue line are similar in their appearance, whereas the green line is fluctuating in an opposite fashion to the red and blue lines. The strength of these relationships is displayed in the table below.

Table 9.

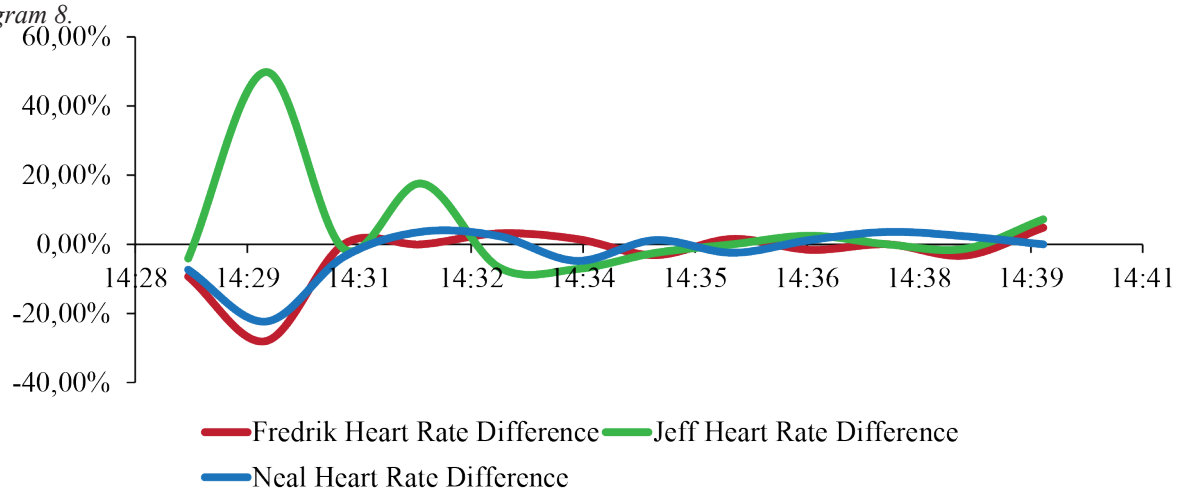
Mats & Jeff	Mats & Fredrik	Fredrik & Jeff
-0,88783	0,364966	-0,45508
Significance level 95%		
-5,10469	1,03715	-1,35214

The table above shows that the values in the second and third column aren't strong enough to be significant at a 95% confidence interval, because both 1,03715 and -1,35214 are within the sample variation limits of -2,356 and 2,356. The correlation in the first column on the other hand is strong enough to be less than -2,356, hence indicating a statistically significant relationship at a 95% significance interval.

Jeff As Leader

Fredrik, Neal, Jeff and 3 is having a meeting regarding the information that is going to be presented to the customers as well as information concerning costs of production and expected deadline for delivery. Between 14:10-14:19 everybody is agreeing with each other and is difficult to discern which one is the source of imitation but Jeff is the one who mainly talks, hence a little bit more in charge of the situation. At 14:20, the mood changes and nobody is no longer mimicking one and other; instead they are arguing for their own perspective and their own interest and the main argument is between Neal and Fredrik concerning how to formulate the information from Jeff in text. The argumentation lasts until 14:29, when Jeff takes charge over the information by proposing a way to put it that both Neal and Fredrik can agree upon; they start to mirror Jeff's breathing and once again they turn their torso's towards Jeff and focuses on what he has to say. Fredrik and Neal displays synchronised breathing and mimicked hand movements with Jeff until 41:41 when Neal starts to argue for his perspective and Jeff loses a bit of confidence, but both Fredrik and Neal continues to ha a synchronised breathing with Jeff even though it seems a little off from time to time.

Diagram 8.



In the diagram above, it is possible to see the temporal changes in HR, where the red line represents Fredrik, the green line Jeff and the blue line represents Neal. The chosen time interval is between 14:29 and 14:40, the 2015-02-25. The diagram also shows the similar appearance between the red and the blue line and where the green line has a contradictory appearance to the red and blue lines. The table below shows the correlations and respective significance score.

Table 10.

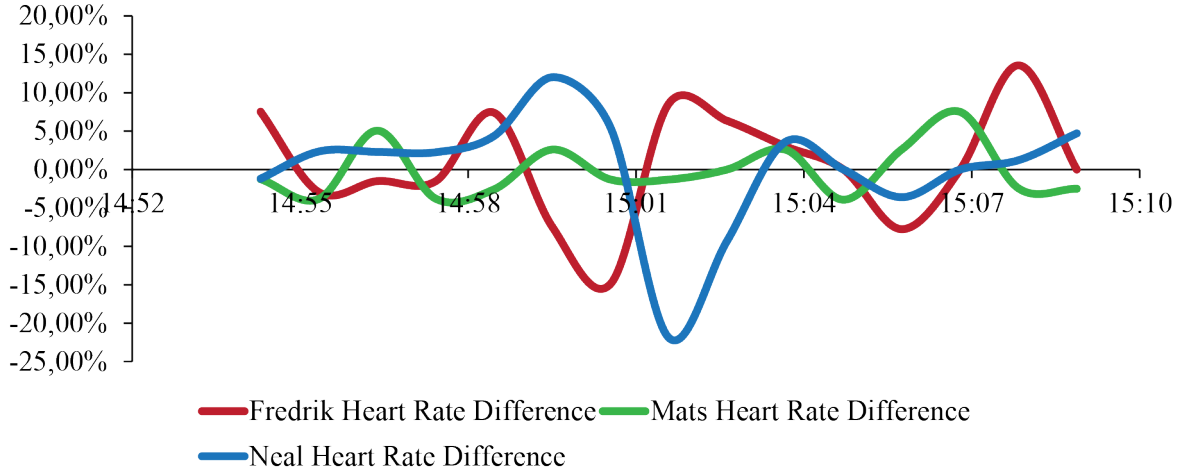
Fredrik & Neal	Fredrik & Jeff	Neal & Jeff
0,867443	-0,79036	-0,70133
Significance level 95%		
5,513353	-4,0796	-3,11124

All the values on the second row of the table above are shown to be statistically significant as explained by the values on the fourth row. All the values on the fourth row are outside of the following interval -2,228 and 2,228, hence statistically significant relationships.

Fredrik As Leader and losing power to Mats

Between 14:55 and 15:10 see Mats E7. At 15:10 Mats gets a phone call and leaves the room, even though Mats is no longer present, Neal still continues trying to persuade Fredrik of what Mats said. Both Fredrik and Neal are trying to persuade each other about their interpretation of what Mats said. There are no sign of mimicking each other but they are facing each other but in a position that is neither defensive nor offensive.

Diagram 9.



The diagram above shows each individual's HR fluctuations, where the red, green and blue line is represented by Fredrik, Mats and Neal respectively. The chosen time interval is between 14:55 and 15:09, the 2015-02-25. The diagram shows that the blue and red line is reversed in their oscillations between 14:55 and somewhere around 15:03 where all the lines intersect each other in one point and afterwards the blue and red line is similar in its movement but opposite to the green line. The correlations of this time interval are listed in the table below.

Table 11.

Mats & Fredrik	Mats & Neal	Fredrik & Neal
-0,20645	0,060274	-0,44696741
Significance level 95%		
-0,76076	0,217717	-1,80153538

None of the correlations listed in the table above is statistically significant, because all of the values of the test-statistics (-0,76076; 0,217717; -1,80153538) are within the -2,160 and 2,160 interval, hence indicating that they are not significant.

Instance 2

(12:03-12:09)

Mats is facing Fredrik and Neal, while questioning them about the market prospects for a specific version of the product. They are acting as two teams, the hardware team consisting of Mats and Jeff whilst the Marketing team consists of Fredrik and Neal. The production team is more offensive in their body language, facing the marketing team with their whole torso exposed and a firm gaze on them. Moreover, Fredrik is mimicking Mats more than Neal and even agreeing with Mats, leaving Neal to defend for himself before Neal also agrees with Mats.

The following instance describes the change from Mats as the leader or in charge of the situation to a change where Fredrik also takes charge of the situation, hence leading to a situation where there are two leaders in charge of the same situation at the same time. In the excerpts below; Mats is asking Fredrik and Neal about any news on a specific version of the product, the excerpts are starts at 12:03 and ends at 12:04.

Excerpt 8. (12:03)

1. Mats: Is there any interest, Marketing? For the 4010 solution? Or is that dying completely now? [Mats turn his body from facing Jeff to facing Fredrik and Neal who are sitting next to each other]
2. Fredrik: It has been Alpha and we have been talking… [Fredrik who is already turned toward Mats while still sitting in his chair, his confidence decreasing for a short while]
3. Mats: Yes?! [As Fredrik's confidence dips, Mats asks another question in order to stress the answer, at this stage Jeff is turning his body towards Fredrik and Neal as well]
4. Fredrik: …and then… [Fredrik doesn't succeed to build that confidence again before Jeff interrupts him]
5. Jeff: But now if you're talking with Beta, you'll be able to contact Beta, maybe we should wait and see what they say.
6. Neal: The contact with Beta that was THROUGH Gamma, so I'm pretty sure that it's going to be very Z-wave focused… [Neal turns towards Jeff and emphasises a point which undermines Jeff's question]
7. Fredrik: Mmm [Fredrik nods while looking at Mats]
8. Jeff: Ok [Neal and Jeff are still facing each other]
9. Neal: ...but on the product sheet that we create, certainly we should have the other protocols that we can… [Turning his body towards Mats]
10. Jeff: Mmm [Jeff also turns towards Mats]

11. Neal: …that we can use, so…so…so they'll see it, but… I think we have to see how we approach that
12. Mats: Yeah, because I'm to be honest, I mean you have been working with the layout… [Mats voice becomes softer, his head is hanging a little and he gives the impression of being a bit disappointed]
13. Neal: Mmm [Neals head starts to hang as well]
14. Mats: …and schematics based upon how climax was moving a while ago, but… the way you have signalled lately, I…I start to feel that when your done we should just put that on… ehh… on hold
15. Neal: Mmm
16. Fredric: And focus on the Z-wave?
17. Mats: Because I… I don't hear any… [Mats is still focusing on Neal and ignoring Fredrik's question]
18. Fredrik: No [Fredrik clearly answers]
19. Mats: …speaking from you at all… [Mats turn his head towards Fredrik]
20. Fredrik: No. Not right now. [Fredrik becomes even clearer and Mats changes his focus towards Fredrik]
21. Neal: I mean… I would say the…the… that's a good strategy, if we get into Be…Beta and they ask us for it, that they would be a potentially big enough customer, that then we come back and say can we move forward with that… [Neal seems to be a bit insecure, still with a low head looking at Mats as well as a couple of times at Fredrik]
22. Mats: Mmm [Mats is back to his open posture and head high]
23. Neal: I think it makes sense to lay off it right now, yes [Neal also opens up and seems more confident again]
24. Mats: put all the egg into Z-wave...?
25. Neal: Yeah
26. Mats: … and then when 4 is back and if there is interest then we will restart it, but I think right now it's better to… to…to back into doing Z-wave [Mats is pushing out his chin in order to do an upward nod, which is a gesture that he does a lot, he looks a bit pleased as well with a vague smile]
27. Neal: Yeah [Neal nods his head]
28. Fredrik: Mmm [Fredrik is also nodding]
29. Neal: Good then
30. Mats: Yeah [Mats does his signature nod again]

The excerpt above is describing a direct shift in focus from Jeff on the production side to Fredrik and Neal on the marketing side. Mats are directing his focus towards Fredrik and Neal and starts

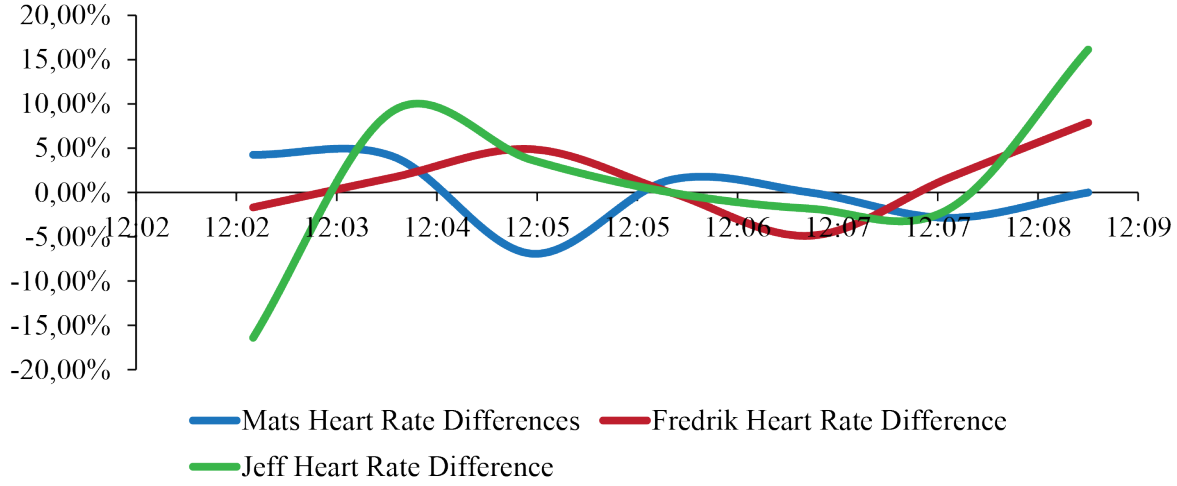
questioning their progress. Mats questioning is first mentioned at point 1 where he starts of in a more offensive manner, which can be seen how he interrupts and stresses Fredrik during moments of hesitation. Furthermore, in point 12 and 14, Mats gives the impression of being a bit disappointed on Fredrik and Jeff. Finally in point 17, Mats is not letting Fredrik in through ignoring him, while still focusing on Neal. Mats is clearly exercising his power over the situation through the ability to include or exclude participants in the discussion, which is expanded upon in the following section. Moreover, Mats include participants in the discussion that is supporting his alignment of interests and excluding participants who are not. Another example of such behaviour is further depicted in the excerpt below.

Excerpt 9. (12:05)

1. Jeff: One more component ehh… question, that we talked about changing the sensitivity for the Honeywell
2. Mats: Yeah [Mats signature nod]
3. Jeff: Right?
4. Mats: Yeah [Slightly tilting the head]
5. Jeff: ehh… And he hasn't confirmed the pricing or anything like that, but do we go… do you want me to go ahead and bring those in as soon as possible so we know…?
6. Mats: The more sensitive one, yes I… I… I like to have that instead…
7. Jeff: Yes
8. Mats: … since we're going for less sensitive magnets
9. Jeff: Mmm
10. Mats: Right… Adhesives? Anything?
11. Jeff: Ehhm… I'm on top of that
12. Mats: Mmm… We have the holes for the pads, but that's not a huge issue… Color of plastics any discussion there with core?

The excerpt above is taking place between 12:05 and 12:06 which is directly afterwards Excerpt 8. Jeff's question at point 1, is of a confirmatory nature, hence indicating a need for approval from Mats. Mats where not going to address this topic at this meeting, hence answering it briefly in order to move on to the next topic on the agenda, this can be seen in point 10 in the excerpt above. Mats questions at point 10 also shows that he is including Jeff in the dialogue before moving on asking questions towards Jeff and Fredrik at point 12.

Diagram 10.



In the diagram above it's possible to see the HR changes, the blue, red and green line in the times series is representing Mats, Fredrik and Jeff respectively. The time series is representing the time interval between 12:03 and 12:09, the 2015-02-24. Moreover, it's possible to see that the green and red line have similar shape whilst the blue line appears to be opposite to the fluctuations of the green and red ones. The correlations and significance of the relationships are listed in the table below.

Table 12.

Mats & Fredrik	Mats & Jeff	Fredrik & Jeff
-0,392188923	-0,21873	0,71084
Significance level 95%		
-0,953338062	-0,50123	2,259866

The first row of the table above shows the correlations, where -0,3921, -0,2187 and 0,7108 is the correlations for each of the dyadic relationships Mats and Fredrik, Mats and Jeff as well as Fredrik and Jeff. It is also possible to discern that none of values in the last row is outside of the interval, -2,571 and 2,571, hence none of the values are statistically significant.

(12:19-12:24)

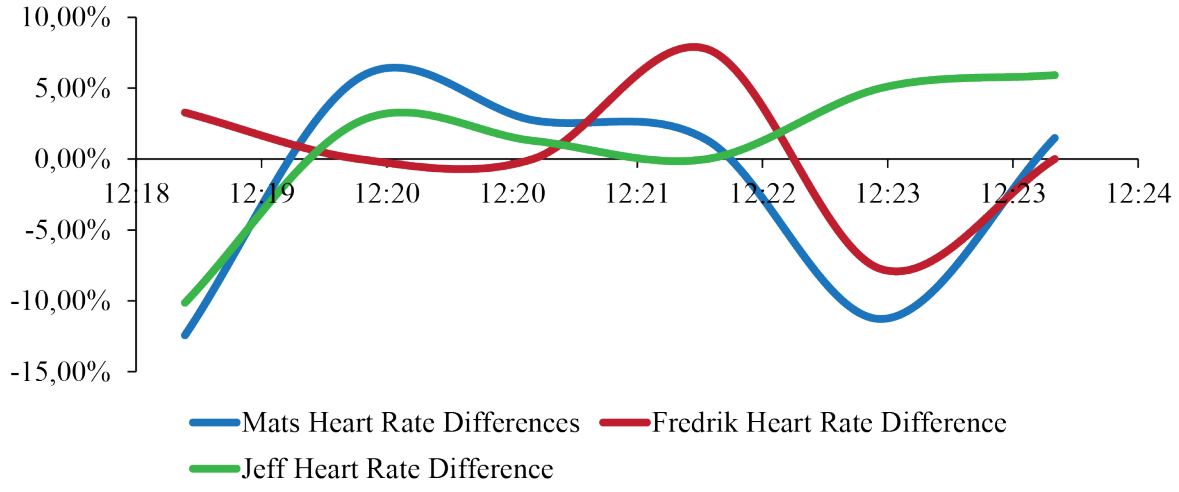
Mats ask a question regarding the design on the magnet and both Jeff and Fredrik answers but Fredrik takes the word. When this happens Jeff leans back further into his chair and Fredrik leans forward with the torso facing Mats. Mats asks a second question and Fredrik takes charge over the conversation, he displays confidence in this matter, and Mats seems to trust his judgment and confidence. The conversation continues with defining and assigning more tasks to the participants.

Excerpt 10. (12:19)

1. Mats: Are we happy with the printing on the magnets?
2. Jeff: Yes
3. Fredrik: I think it's good
4. Mats: Is it ehh… robust enough this one?
5. Fredrik: Yeah, it is much better than the last one, it goes off if you rub it… heh… really hard, but it is not like the first version
6. Mats: Ok… do we… need some kind of very simple test require… specification for this? Or?
7. Fredrik: for the mounting or? We haven't done…
8. Mats: For the printing…
9. Jeff: Bu… [Interrupted by Fredrik]
10. Fredrik: Could we get some…
11. Mats: …actually for the whole magnet probably including the printing
12. Jeff: We don't have any specs for the magnet [Smiling almost laughing]

The excerpt above takes place between 12:19-12:20, during the same meeting as previous excerpts. Mats is asking Jeff a question regarding the printing on the magnets, when Fredrik at point 3 interrupts Jeff and Mats through answering the question and thereby inviting himself into the discussion, which takes Mats of guard seen at point 4. The pattern is repeated once more at point 8. Mats actively show the focus of the discussion and when Jeff tries to answer Mats question at point 9, Fredrik quickly interrupts him at point 10. Point 10 is showing that Fredrik's answer to Mats question is once more an instance where Fredrik invites himself into the discussion without the approval of Mats, Fredrik is also closing the topic at this stage almost excluding Mats like he previously did with Jeff at point 2 and point 9. The excerpt above shows a moment where two leaders are present and dictating which participants that is included or excluded in the discussion as well as which topics or interests that is important. The implication of this event will be elaborated upon in the section below.

Diagram 11.



The diagram above shows the temporal HR changes for each of the participants; Mats, Fredrik, Jeff, where Mats is represented in blue, Fredrik in red and Jeff in green. The diagram displays the time interval of 12:19 to 12:24, the 2015-02-24. The diagram shows that the green and blue line are similar in appearance from 12:19 until it intersects the red line at approximately 12:22, from that point onwards it appears to be opposite to the red and blue line. Moreover, the red line starts off with opposite fluctuations to the green and blue and around 12:21 the blue and red lien are similar in appearance as well as the opposite of the green line. The correlations and significance scores are listen in the table below.

Table 13.

Mats & Fredrik	Fredrik & Jeff	Mats & Jeff
0,324551763	-0,50668	0,475485
Significance level 95%		
0,68625175	-1,17541	1,080986

The table above shows the respective correlation of each of the three dyadic relationships; Mats and Fredrik, Fredrik and Jeff as well as mats and Jeff. The significance scores in the last row of the table are all within the interval; -2,776 and 2,776, hence indicating that none of the correlations are significant.

Theoretical Support

The analysis concludes in a definition upon what the role of the leader is and what it consists of within LFR. The role of the leader is derived from the findings above and based upon three tenets that are also derived from the findings. The three tenets are Interdependence, Extra Salient Contributions and Power, all of the tenets will be expanded upon in each respective sections.

Interdependence

The findings presented in the section above indicate that leadership is a dynamical and ongoing process, which is under constant change and exchange. The findings above also indicate that the role of the leader is defined by the other participants of the LFR and to a certain degree the leader as well. The first instance of the findings, shows that the role of the leader can change several times depending upon who is participating. The first instance shows four different triadic social interactions within the duration of one day and the second instance shows a leadership shift during a meeting. The interactions described in instance 1 consist of different triadic constellations of participants as well as different perceived leaders within each of these. In the first interaction Fredrik is the leader and Mats and Neal is the followers. In the second interaction Jeff is the leader and Mats and Fredrik are the followers. In the third instance Jeff is once more the leader but this time it is Fredrik and Neal who are the followers. Finally, Fredrik starts out as the leader and Mats and Neal are the followers but in this interaction the role of the leader later changes to Mats, hence converting Fredrik to a follower.

These findings are consistent with the RLT, which states that the role of the leader is not a hierarchical position but rather a role possessed by and individual (Uhl-Bien, 2006). Moreover, the physiological relations conveyed in Diagram 6-9, shows a reoccurring pattern, which indicates who is the leader and who is the followers. This pattern is present in all the diagrams ranging from 6 to 11 as well as all of the tables ranging from 1 to 6. Moreover, the pattern will be expanded upon in the paragraph below, whilst the occurrence of the pattern and the significance of these patterns will be elaborated upon in the following section. The change of leader in the second instance is similar to the final interaction of the first instance. The main difference is that instance 2 allows for further detail on the shift of the role of leader, which will be elaborated upon in the paragraph below.

Throughout Excerpt 8 and 9 Mats is in charge of the situation and Fredrik and Jeff are followers. This change at Point 3 in Excerpt 10; where Fredrik interrupts Jeff's answer to Mats question, hence inviting himself into the discussion through confidently answering the question. This takes Mats of guard which can be discerned through his answer "Is it ehh… robust enough this one?" at Point 4 Excerpt 10. It is also possible to distinguish Mats inferiority towards Fredrik as he insecurely asks the following questions "Ok… do we… need some kind of very simple test require… specification for this? Or?" at Point 6 in Excerpt 10. The corresponding physiological changes in the HR can be discerned from Diagram 11, which shows that Fredrik's HR is moving in the opposite way to both Mats and Jeff's HR. Jeff and Fredrik maintains the negative correlation throughout the displayed time series, whereas Mats changes his from a positive correlation with Jeff towards a negative correlation after the first intersection at approximately 12:21. This change from a positive to a negative correlation between Mats and Jeff's HR, indicates that there was an conflicting body language at the start, which changes to a mirroring of body language in order to reach an equilibrium as described by Codrons, Bernardi, Vandoni and Bernardi (2014).

Extra Salient Contributions

The possession of the role of the leader seems to be related to the perceived saliency of the participant, hence possessed by the participant who is perceived as extra salient. One such example is when Jeff is a leader and is in a short meeting with Neal and Fredrik, between 14:29-14:40. Jeff is in charge of the situation through displaying knowledge which neither Fredrik nor Neal possesses and which they are dependent upon, furthermore Jeff is confident in his knowledge and the information that he conveys. This is congruent with Hosking (1988), which states that ability to influence others within a LFR is based upon inequalities amongst the participants and in the case of Sensative it is mainly an inequality of knowledge. Moreover, Fredrik and Neal are breathing in synchrony with Jeff during this time, which would explain the -0,79036 correlation between Fredrik's and Jeff's HR and the -0,70133 correlation between Neal's and Jeff's as well as the 0,867443 correlation between Fredrik's and Neal's HR. This implies that the Jeff and his followers (Fredrik and Neal) engage in a reciprocal

physiological exchange process due to the negative correlations between the HR of Jeff and his followers (Fredrik and Neal), which can be described as phasing out the temporal changes of the HR in order to attain a new physiological equilibrium. As both Fredrik and Neal synchronise their RR and HR with Jeff's through an interdependent exchange process, the attainment of equilibrium also results in a strong synchronisation between the Neal's and Fredrik's RR and HR, which is demonstrated through the strong positive correlation. These findings are congruent with Kuglers (1980) description of forces at mutual influence as well as Codrons, Bernardi, Vandoni and Bernardi (2014) findings described in the respiratory part of the methodology section. Furthermore, the physiological mirroring in which they engage is supported by the theory of emotional contagion, as Jeff in this case successfully invokes physiological isomorphism between Fredrik and Neal, shown by the strong positive correlation, hence indicating Jeff as the emotional source.

Power

Through the findings above it is also possible to discern the power, which is used by leaders in order to control relations. According to the findings above, power is an alternative way of affecting participants. The definition of power according this paper is the ability to include and exclude resources from the relation, which is derived from the findings above. In the findings above it is possible to discern how Mats is using his power in order to affect the discussion as well as the participants. One such example is the exclusion of Fredrik from the discussion, through ignoring Fredrik's answer through focusing on Neal's instead at Point 17 in Excerpt 8. Another example of exclusion or inclusion is when Jeff asks a question regarding a component at Point 1 in Excerpt 9, whereas Mats briefly answers the question at Point 6 and 8 in order to quickly shift the direction of the discussion to another topic at Point 10 in Excerpt 9. Another example of applying both inclusion and exclusion can be seen in Point 1 of Excerpt 8, where Mats abruptly changes his focus from questioning Jeff to questioning Fredrik and Neal. Moreover, Mats is addressing Neal and Fredrik as Marketing, hence creating a distance from Mats and at the same time including Jeff in to Production. The abrupt questioning seems to take Fredrik and Neal off guard, as Fredrik answers the question in an unprepared manner, "It has been Alpha and we have been talking…". Mats then interrupts Fredrik by saying; "Yes?!" at Point 3 and at Point 4 when Fredrik continues his reply through saying, "…and then…", then Jeff interrupts Fredrik at Point 5 by saying "But now if you're talking with Beta, you'll be able to contact Beta, maybe we should wait and see what they say.". This clearly shows that Jeff feels included and part of the Production with Mats. The final example is an instance where Fredrik includes himself into the discussion, which is covered in Excerpt 10. At Point 1 Mats is questioning Jeff about the printing on the magnets, Jeff is abruptly interrupted by Fredrik at Point 3. The question was clearly addressed to Jeff, Hence taking Mats off guard as expressed through an unprepared answer, "Is it ehh… robust enough this one?" at Point 4. These findings regarding power are supported by the attachment theory, as exclusion from relations causes a lack of oxytocinergic as well as dopaminergic rewards, hence a known punishment (Siegel, 2009; MacDonald & Leary, 2005).

Theoretical Deviance

The hierarchical position is according to RLT not relevant to the process of leadership as it is a process of interdependency amongst participants. The findings above indicate that the hierarchical position facilities the attainment and use of power. The RTL only focuses on influence and whilst that is an important process, it is still important to consider the notion of power. The ramifications of excluding participants according to social constructionism are that the participants become actors without relation to the realities created (Hosking, 2000). The notion of power or at least the discussion regarding inclusion and exclusion is because of these ramifications imperative to consider from a RLT perspective, hence even considering revising the hierarchical positions as they can facilitate exclusion and inclusion in a work related setting.

Another contiguous matter is the finding of two coexisting leaders; this state seems to be a transgressional state where a shift in the leadership occurs. Moreover, the occurrence seems to indicate a conflicting state of influences in order to get the followers. In Excerpt 10, Fredrik forces himself into the discussion by interrupting Jeff's answer. Jeff's answer to Mats question is; "Yes" at point 2, whereas Fredrik interrupts with the following answer; "I think it's good" at Point 3. In point 3, Fredrik's answer is aligned with Jeff's but more positive and confident, which shows Jeff that Fredrik and Jeff have shared attitudes and values regarding the matter and even that Fredrik are to a certain degree supporting and protecting Jeff. This pattern is occurring once more at Point 9 where Jeff is once more interrupted by Fredrik. At this time Mats is not taken off guard, which is due to the physiological adaptation that can be seen in the Diagram 11. At approximately 12:22 Mats and Fredrik is mirroring Jeff in order to win him over as a follower, hence leading to similar appearance between Mats and Fredrik's lines depicting the temporal changes in HR as well as the opposite appearance of Jeff's HR changes. The existence of a multitude of leaders within relationships is covered by neither RLT nor emotional contagion theory. Even if it is a transgressional state it is still an occurring social phenomenon with social implication. The occurrence of this phenomenon will be covered in the following section.

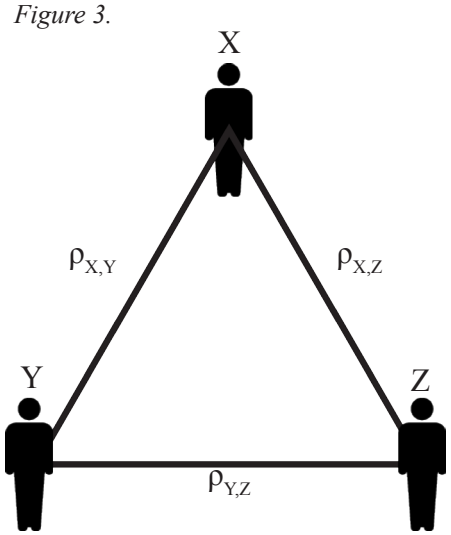
4.4.3 Relationship Dynamics

This section covers the findings related to the triadic LFR as well as the four different constellations that LFR appears in, according to this study. The four different constellations are listed below and expanded upon in the paragraph below that.

- The Leader Constellation
- Two Leader Constellation
- The Consensus Constellation
- The Disorder Constellation

The four constellations above are variations of behaviouristic and physiological patterns, which are observed throughout the study. The figure below depicts a triadic LFR upon which these four constellations will be explained.

Figure 3.



The figure above show three different participants, namely X, Y and Z as well as their respective relation towards each other. The relations are depicted through a connecting line between two participants and the name is based upon the names of the two participants between which it exists, hence ρX,Y, ρX,Z, ρY,Z. Moreover, ρ is the symbol for the correlation coefficient, hence placed before the names of the participants as the relation is derived from the correlation between the two participants' HR. In the case of the Leader Constellation, it is defined by a negative correlation HR between X and Y as well as X and Z, -ρX,Y, -ρX,Z. Furthermore, it also consists of a positive correlation HR between Y and Z, hence ρY,Z. The Two Leaders Constellation on the other hand consists of positive HR correlations between X and Y as well as X and Z, hence ρX,Y, ρX,Z. Moreover, there also exists a negative HR correlation between Y and Z, hence -ρY,Z. The Consensus Constellation is consisting of negative HR correlations between X,Y and Z, hence -ρX,Y, -ρX,Z, -ρY,Z. Finally, the Disorder Constellation, which consists of positive HR correlations between all participants, hence ρX,Y, ρX,Z, ρY,Z. The figure for the respective constellation is appended in Appendix VI. The occurrences of these patterns and their respective frequency are shown in the table below.

Table 14.

Two Leaders	The Leader
16,28%	69,77%
The Disorder	The Consensus
6,98%	6,98%

The table above shows the four different constellations that the LFR appeared in during this study. As can be discerned through the table above, The Leader Constellation is the most frequently occurring constellation at approximately 70% of the social interactions where there were more than 2 participants present. The Two Leaders Constellation is occurring in approximately 16% of the social interactions. Moreover, both the Disorder Constellation and the Consensus Constellation occurs at approximately 7% each of the social interactions. The Leader Constellation as well as the Two Leaders Constellation has been covered in the sections above, whereas the Disorder Constellation and the Consensus Constellation will be covered in the paragraphs below. Furthermore, none of the triadic LFR:s in this study has been statistically significant on all three correlations coefficients, which is due to small sample sizes. The small sample sizes are as explained in the cross validation section, due to the limited duration of emotional states, hence few of them lasting over 6 minutes and thereby the dilemma that significance can't be calculated on samples smaller than 6 minutes. Each of the four types of constellations categorised in this study corresponded to 100% coverage in the respective social interaction. That is, in the social interactions where one leader was observed, the Leader Constellation occurred in 100% of the times, and that is the case for all four distinct constellation variations, hence indicating that these are significant social phenomena.

The Consensus and Disorder Constellations

This section is divided into three parts, the first part is the finding from which these constellations can be derived, the second part will cover the Consensus Constellation and the final part will cover the Disorder Constellation. The finding in the first part consists of the observations related to a product and marketing meeting and the corresponding diagrams. Moreover, the meeting occurred at the 2015-02-25, between 14:10 and 14:54 and its participants was Fredrik, Neal, Jeff and 3.

Fredrik, Neal, Jeff and 3 is having a meeting regarding the information that is going to be presented to the customers as well as information concerning costs of production and expected deadline for delivery. Between 14:10-14:19 everybody is agreeing with each other and is difficult to discern which one is the source of imitation but Jeff is the one who mainly talks, hence a little bit more in charge of the situation. At 14:20, the mood changes and nobody is no longer mimicking one and other; instead they are arguing for their own perspective and their own interest and the main argument is between Neal and Fredrik concerning how to formulate the information from Jeff in text. The argumentation lasts until 14:29, when Jeff takes charge over the information by proposing a way to put it that both Neal and Fredrik can agree upon; they start to mirror Jeff's breathing and once again they turn their torsos' towards Jeff and focuses on what he has to say. Fredrik and Neal displays synchronised breathing and mimicked hand movements with Jeff until 41:41 when Neal starts to argue for his perspective and Jeff loses a bit of confidence, but both Fredrik and Neal continues to ha a synchronised breathing with Jeff even though it seems a little off from time to time.

The first part of the observation above is dedicated to the Consensus Constellation and the latter part of the observation above is dedicated to the Disorder Constellation. As can be seen in the observation above during the first part of the meeting every participant was in agreement, hence the name Consensus Constellation. The latter part displays an instance where everybody is disagreeing with each other, hence called the Disorder Constellation. The corresponding HR and GSR diagrams and tables are placed below.

The Consensus Constellation

The first diagram below depicts the participants' temporal changes in HR, the diagram below that depicts the participants' temporal changes in GSR and finally, the table lists the significance tests corresponding to the HR diagram. The two diagrams are compared and reflected upon below the GSR diagram.

Diagram 12.

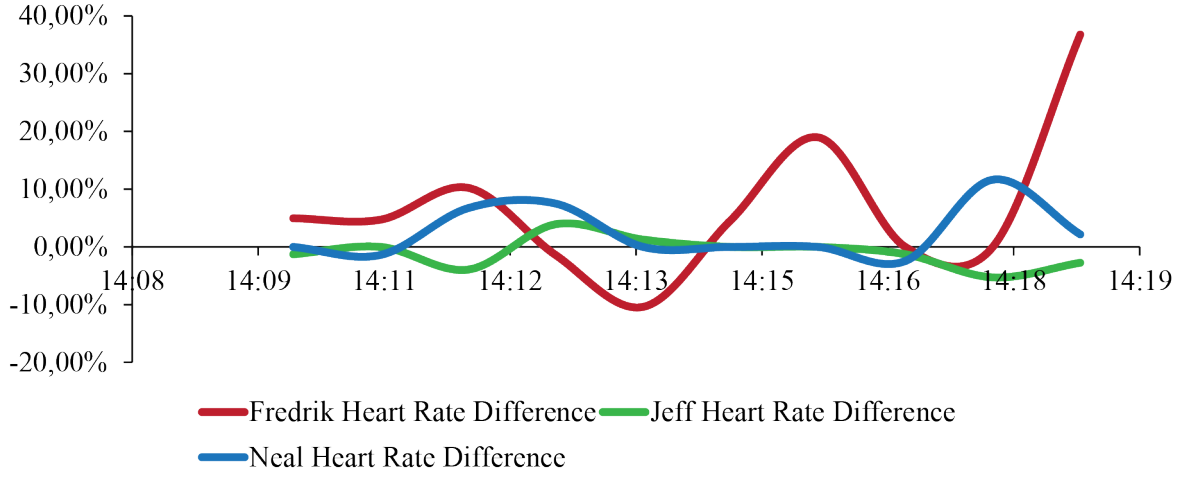
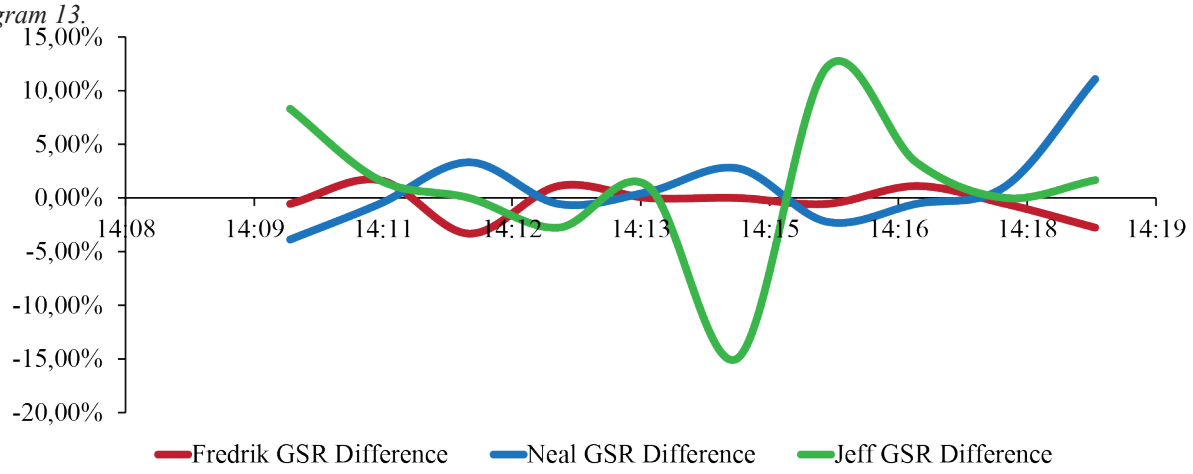


Diagram 13.



It is possible to discern the temporal changes in HR in the top diagram and the temporal changes in GSR in the bottom diagram. These diagrams are volatile in nature spanning over changes, reaching

from -10% to over 30% in the HR diagram and -15% to 13% in the GSR diagram, which indicates high level of emotional arousal. Through the observation above it is further possible to deduce that this emotional arousal is of a positive nature, such as enjoyment. On the other hand the two diagrams also show inconsistence that is for instance the highest peak in the HR diagram belongs to Fredrik whilst the highest peak in the GSR diagram belongs to Jeff. Fredrik's HR peak does not involve corresponding peaks in the GSR diagram and the same thing goes for Jeff, hence indicating physical arousal but a failure in interpreting the physiological signals corresponding to the emotional state. That is Fredrik might interpret Jeff's emotional state as happy, while Jeff is feeling more pleased, hence leading to a wrong emotional interpretation as well as wrong physiological manifestation. This emotional dissonance seems to be a socially extreme state even though the experienced emotional states have a positive valence, which leads to emotional chaos in order to achieve a new equilibrium or steady state. The table below is containing the correlation coefficients and the corresponding significance tests to the HR diagram above.

Table 15.

Fredrik & Neal	Fredrik & Jeff	Neal & Jeff
-0,06334	-0,33218	-0,3538742
Significance level 95%		
-0,17951	-0,99613	-1,0701538

The Table above shows the correlations coefficients for each of the relationships. Moreover, it is possible to see that all the correlations coefficients are negative. Furthermore, none of the coefficients are statistically significant as they are within the span of -2,306 and 2,306, hence indicating that the values are not low enough in relation to the sample size in order to discern a statistical relationship.

The Disorder Constellation

The first diagram below depicts the participants' temporal changes in HR, the diagram below that depicts the participants' temporal changes in GSR and finally, the table lists the significance tests corresponding to the HR diagram.

Diagram 14.

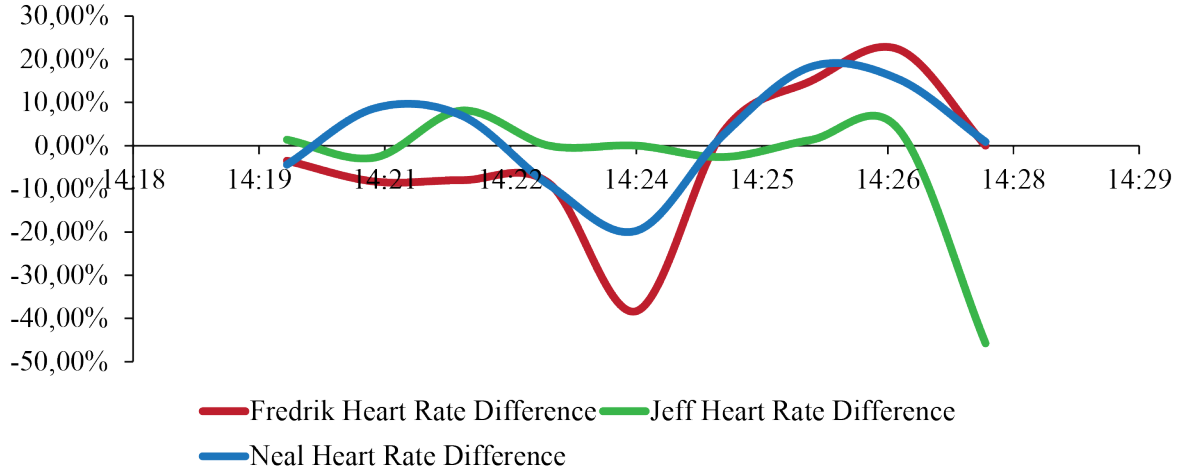
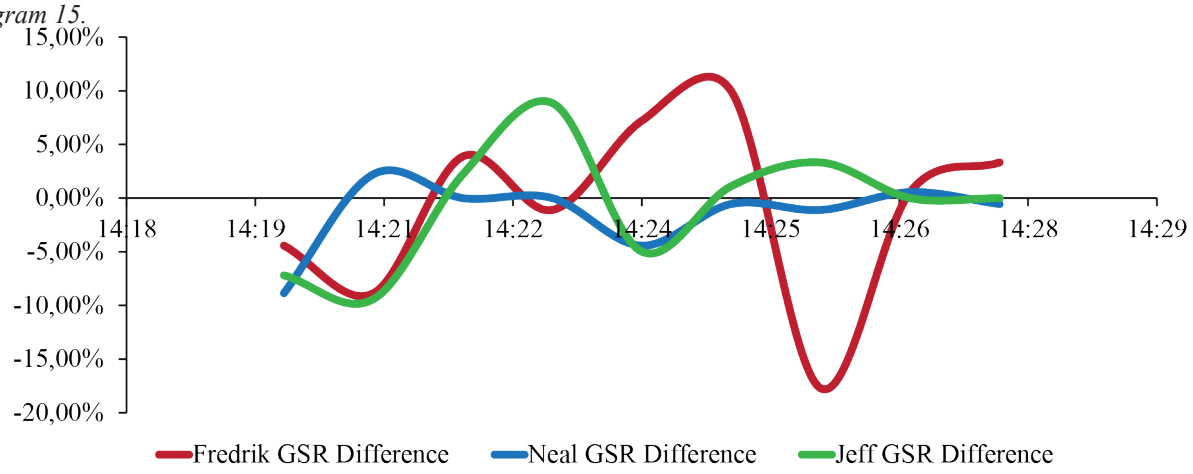


Diagram 15.



The top diagram depicts each of the participants' temporal changes in HR whilst the bottom diagram depicts each participant's temporal changes in GSR. These diagrams are also volatile in nature because it is spanning over changes reaching from -38% to 22% in the HR diagram and -17% to 11% in the GSR diagram, hence indicating high levels of emotional arousal. Via the observation above it is further possible to discern that the experienced emotional valence is of a negative nature, such as disagreement. As with the Consensus Constellation above, the two diagrams shows an inconsistency between the HR and GSR, even though the consistency between the diagrams are higher in this case than in the case described above. In the case Fredrik's HR and GSR is rather coinciding but the HR and GSR of both Jeff and Neal are not. Neal displays fluctuations with a vast fluctuation span in the HR diagram but shows no corresponding response in the GSR diagram and the opposite is true for Jeff. Even in this case there seems to be an emotional mismatch leading to physiological manifestations, hence causing a social extreme on the other side of the spectrum, which is the negative valence invoking a chaotic state. The table below contains the correlation coefficients as well as the significance test of the coefficients.

Table 16.

Fredrik & Neal	Fredrik & Jeff	Neal & Jeff
0,835183	0,005617	0,150908
Significance level 95%		
4,017808	0,014861	0,40389

The table above shows the correlation coefficients for each of the relationships. All the coefficients shown in the table above are of a positive nature. Moreover, there is only one significant relationship, which is that of Fredrik and Neal. This coefficient is the only one exceeding the critical values of -2,365 and 2,365.The weak nature of the relationships in the table above is probably due to the ever-changing nature of the chaotic emotional state, hence striving towards a new equilibrium.

Theoretical Support

The common denominator for all the constellations covered in the findings and analysis section is the physiological strive towards equilibrium. This is apparent in all four constellations above, where the Leader Constellation is the only constellation that seems to provide a physiological equilibrium (Codrons, Bernardi, Vandoni and Bernardi, 2014). The Two Leaders Constellation on the other hand seems to be of a transgressional nature, hence a state in the making, which occurs as the leadership changes from one participant to another. This transgressional process is not guaranteed a change of leader as the leader can maintain his leadership throughout the transgressional process but it seems as the change of the leader can't occur without the transgressional process. Both the Consensus and the Disorder constellations seems to be extremes, because of that they have a short duration before they mitigates towards a steady state.

The Consensus and Disorder constellations are high arousal states, which have a propensity to cause high motivational goal attainment. These extreme states are congruent with the theory of emotional contagion, as described by Bartel and Saavedra (2000). These high arousal group states motivate collective action towards a common goal or set of goals and this is explained as the participants have more emotional investments in the specific goals, hence the high level of arousal. This is also consistent with the findings above; the goal is defining what is going to be communicated about the product to the customers, which Fredrik, Neal and Jeff have invested many hundreds of hours into during the two years they have worked together. Moreover, the findings above also indicate that there exists an inconsistency between the interpretation of the emotional states and the physiological manifestation of these emotions, because the GSR and the HR is not coinciding within the participants. For instance, Neal's apparent arousal according to the HR fluctuations between -20% and 20%, whilst his apparent lack of arousal according to the GSR fluctuations are between -4% and 2%, in Diagram 14 and 15. This inconsistent physiological response leads to ambiguity when mirrored by others, hence causing emotional states in others that are not corresponding to emotional state of the source. Such

as, Neal conveys arousal through his perspiration (GSR) as well as expressing his motivation through his posture, this arousal and motivation is picked up by Fredrik, but his physiological response is increased HR. Both Fredrik and Neal are displaying arousal and similar motivation but not similar manifestations of emotion, such as the difference between happiness and anger. As both happiness and anger are aroused states, with forward motivation and showing the teeth, yet the social difference is immense (Hess and Blairy, 2001). This is congruent with Hess and Blairy's (2001) statement that the wrong interpretation of the others' emotional states leads to wrong physiological manifestations, hence sending the wrong emotional feedback to others. Furthermore, it is important to bear in mind that the physiological expression of the human body is more sensitive and continuous than the lingual categorisations or facets of emotional states.

Theoretical Deviance

The four constellations found in this thesis are covered in neither Attachment theory nor RLT. The main focus in both Attachment theory and RLT is upon the Leader Constellation, that is when everything is ordered and equilibrium is achieved. Even if the Two Leaders, Consensus and Disorder constellations are limited in occurrence, hence not fully representative of a LFR, they still provide important information regarding the participant social interactions, motives and values. For instance, when the Consensus Constellation occurred, everybody was agreeing with each other, that is often interpreted as a desirable result but as shown above it is an extreme state, hence instable and not a desirable state. This is further supported by the rare occurrences of these two extreme states; the Consensus and Disorder constellations, each occurring only around 7% of all triadic social interactions. Even though, changes in the possession of the role of the leader are occurring in accordance with RLT, it does not provide any description of how this is happening.

4.5 Summary of the Results

4.5.1 Emotional Influence

Emotions influence the executive decision-making of both leaders and followers within organisations. These emotionally based decisions can lead to dire ramifications for the whole organisation and its participants as well as within the LFR. These decisions can lead to lack of commitment and trust amongst the participants of the LFR.

4.5.2 The Role of the Leader

A leader is according to this paper defined by three tenets, which are listed below.

1. Interdependence: The role of the leader is assigned to the individual via its followers, which implies that role can change and be possessed by different participant depending upon the situation.
2. Extra Salient Contributions: The role of the leader is assigned to the participant that is perceived to make extra noticeable contributions to the LFR.
3. Power: Power is according to this paper the ability to exclude or include participants and resources to the LFR, goal or organisation.

4.5.3 Relationship Dynamics

The findings of this paper show that there are four different kinds of constellations that might occur within the LFR. These four constellations are listed below.

- The Leader Constellation: A physiological and emotional steady state.
- Two Leaders Constellation: A transgressional state that occurs when the LFR changes its assigned leader.
- The Consensus Constellation: A short-lived unstable state in which all participants within a LFR agrees.
- The Disorder Constellation: A short-lived unstable state in which all participants within a LFR disagrees.

5 Discussion

The purpose of this paper is to explore the relation between the HR dynamics of the participants within a LFR and their executive decision-making process. The findings of this paper show that emotions influence the executive decision-making, which can lead to dire ramifications for the organisation or participants within the LFR. The results also show that the leadership process is an emotional process, which is based upon emotional exchanges; hence the importance of reaching physiological equilibrium as it implies psychological equilibrium as well. Moreover, the results show that this physiological and psychological equilibrium amongst participants within a LFR is only attainable during HR phase out. That is when participants mutually influence each other's physiological states such as HR in order to attain equilibrium, hence striving towards negative correlation between the temporal changes in HR of the participants. Such an example is, the HR of participant X is increasing by 10% and the HR of participant Y is decreasing by 10%, hence phasing out (10-10 = 0) each other HR changes through a reciprocal process and thereby reaching equilibrium. This is the desired physiological and emotional state amongst individuals and according to the findings of this paper it is the most prevalent state, occurring in approximately 70% of all the triadic social interactions and is named the Leader Constellation. Furthermore, the paper also found a transgressional state, which occurs during the change of the leader role named Two Leaders Constellation as well as two chaotic extreme states, which were named the Consensus Constellation and the Disorder Constellation. This paper also defined the role of the leader through three tenets, which were related to the attainment of the Leader Constellation, these tenets are Interdependence, Extra Salient Contributions and Power.

Striving towards the physiological equilibrium entails emotional influences upon the executive decision-making and that it is a social and interdependent process. The HR is a known manifestation of emotions and as the HR changes the emotional state changes as well, because of the bidirectional relationship between the heart and the brain. Moreover, as can be seen in the Emotional Influence section of the findings, Mats HR increased as he got emotionally aroused, which lead to the making of a more risky decision and its execution. The decisions made during a high HR are more irrationally inclined according to Thayer, Hansen, Saus-Rose and Johnsen (2009), which are congruent with the findings of this paper, as can be seen in the case of Mats decision, because he knew what the rational approach was. Furthermore, Thayer, Hansen, Saus-Rose and Johnsen (2009) also state that this is due to the bidirectional connection between the frontal cortex and the heart, which would explain why Mats emotional decision was not based rationally inclined. This also implicates that the HR of other participants affects if a decision is more rational or emotionally inclined. This has real world consequences as with whom and at which activity are the decision made and executed.

This paper shows that social interactions of a certain kind coincided with a specific physiological pattern. The occurrence of these physiological patterns was significant even if not all the tested relationships that these patterns consist of were significant. This is interpreted in this paper as a consequence of limited data, due to limited temporal resolution of the physiological measurements, mainly regarding the HR and GSR. The main reason that this consequence is interpreted as such is because the inherent duration of emotional responses are short-lived and seldom spanning over 6 minutes, which were minimum duration in order to calculate the significance. Hence, implicating that the significant correlations in this paper are measuring emotional states; with a longer duration and lower intensity, such as moods (Phelps, 2009).

The ethnographical study of the paper has some limitations as it only lasted for two weeks and many ethnographical studies have a longer duration than two weeks. The observations can because of the only depict social processes based upon a limited number of observations. This paper can on the other hand say that these were the social processes that occurred at the setting during these two weeks.

Another physiological measurement that is highly correlated to emotional states and communication is respiration. Even though it is mentioned in this thesis and slightly applied, a record over the different respirations can bring additional understanding for the social processes related to communication and therefore leadership as well. The synchronisation of breathing is important in all verbal communication and even in movements, hence providing crucial information regarding the mimicking of physiological responses and mirroring amongst participants (Butler, Wilhelm, & Gross, 2006; Codrons, Bernardi, Vandoni, & Bernardi, 2014). Despite the anatomical linkage between the respiration and the heartrate dynamics, the measurement of respiration might entail additional relationships, which are not captured by the heartrate dynamics alone (Yasuma & Hayano, 2004).

This thesis facilitates new theoretical understandings through the triangulation of theories stemming from different ontological and epistemological backgrounds, hence leading to further understanding of the social interactions and processes that occurred within the setting. These findings and understandings on the interplay between physiology, emotions and social construction have shown aspects of social processes that are normally overlooked. The perspective of social constructionism does not consider the influences of non-conscious processes upon social interaction and social construction, whereas this paper shows that these non-conscious processes are integral in the social construction (Hosking, 2015). Moreover, the physiological and psychological perspectives are often dichotomised, hence not comprehending the interplay between the mind and the body (Ramsøy, 2014). Furthermore, the perspective of neuro science seldom takes the social influences amongst individuals in to accounts due to previously cumbersome equipment and the ever-different outcomes due to individual differences (Decety and Batson, 2007).

This paper builds it theoretical foundation regarding the LFR upon the attachment theory. The main body of research concerning the attachment theory are built upon parental as well as partner relationships, whereas the organisational context is less explored (Siegel, 2001). The interdependence theory, which is a sub-theory to the social exchange theory, offers another perspective on the interpersonal relationships, which is built upon the concept that interactions are induced through cost-benefit analysis (Johnson & Johnson, 2005). The interdependence theory is therefore aligned with the social constructivist ontology instead of the positivistic ontology of the attachment theory. Moreover, the interdependence theory is according to Hazan and Shaver (1994) able to explain parts of interpersonal relationships that attachment theory is not, such as mutual construction of relationship narratives, hence recommending to complement the attachment theory with interdependence theory (Hazan & Shaver, 1994). The ontological perspective of interdependence theory is because of that more aligned with that of RLT, hence leading to a less positivistic dominance, theoretically wise.

Another theory stemming from social exchange theory is the affect theory, which adds the emotional dimension to the social exchange theory (Lawler, 2001). The affect theory is because of that both aligned with the RLT, the notion of emotions and emotional contagion. The affect theory explains how emotions and affective process facilitates interpersonal relationships. This theory is also stemming from social constructivism.

The methodical approach of this paper is based upon the combination of methods in order to gather different kinds of data, which allows for the exploration of both non-conscious and conscious processes. The combination of ethnography and physiological measurements allowed the exploration of leadership related processes and relationships. The ethnography in this paper allowed the researcher to explore the meanings and interpretations of social interactions, hence providing the context to the physiological measurements. The physiological measurements on the other hand allowed the exploration of non-conscious processes and their influences upon those meanings and interpretations. Moreover, the ethnography is also providing valence information, which is imperative in order to discern the physiological data. It is through the combination of these methods that this paper gets an unprecedented understanding of leadership processes and relationships.

There is an inherent concern with this thesis and its application of triangulation, combining both methods and theories stemming from different paradigms. This concern can be described as an ontological confusion and it can be seen throughout this paper. Moreover, it is a common critique of triangulation in research, which is described by Blaikie (1991). According to Blaikie, this is a consequence of misunderstanding the interpretivistic foundation of social constructivism. This is done through maintaining the absolutist perspective of an existing truth in which the pluralism of realities is revealing parts of that truth whereas the interpretivistic perspective sees the pluralism of realties

as just that, hence denying the absolutist concept of truth (Blaikie, 1991). It is this confused notion of social constructionism that can be found throughout this thesis, where an undesired positivistic presence influences the interpretations of findings and results. One such example is the correlations of participants HR, the correlation measurement per se is a relativistic measurement just show the relation between two variables. An interpretivistic interpretation would have acknowledged these as the process itself, hence interpreting it as the presence of different interpretations within the relationship and therefore not chasing underlying causation. Furthermore, the interpretation also interprets the lack of perfect correlations as support of different realities and not different interpretations of a reality. Finally, it is through the acceptance of the relative nature of the measurements it is possible to avoid a positivistic perspective of truth, hence claiming a social constructivist perspective of this paper (Hammersley, 2008).

This thesis shows that organisations are dependent upon the physiological and psychological health of its participants. It also claims that it is imperative to incorporate the body, emotions and relationships, when assessing leadership, as they are all interrelated processes and affects the executive decision-making. Moreover, it is important to take the social nature of humans into account, as moods, interactions and relationships all affect the decision-making process. As shown in this paper, the decisions of an individual is not isolated, instead it is heavily influenced by the participants of the relationship or social environment.

Another practical implication is that the physiological measurements combined with observations, quickly disclose participants with psychopathic inclinations within organisations. This is done as psychopaths have problems with experiencing empathy and emotional contagion, hence indicated through the HR as an instable state (Singer, 2009). Hence, it is causing a state more similar to the Two Leaders constellation due to the lack of emotional and physiological reciprocity, which causes positive correlations between leader and followers.

6 Future Research

This thesis suggests that additional statistical research is performed upon physiological measurements as they may provide predictive insights on behaviours related to the leadership process. The predictive ability of the measurements can be discerned through the application of a Granger Non-Causality test upon a Vector Autoregression (VAR) (Zivot & Wang, 2002). The predicative nature can facilitate the understanding of other physiological factors of importance for the physiological exchanges processes related to social interaction and leadership.

Further suggestions on future research are exploring additional organisations with different cultures. This study chose to explore the leadership processes at Sensative, which is a technology company consisting of employees with a prominent belief in rationality. The results of other organisations and organisational contexts can entail a better understanding of the social processes covered in this paper. Leadership in other geographically and culturally different settings might provide further clues as well as convey differences in social interactions and leadership processes.

The final suggestion for future research is to explore the effects of social moods upon the emotional states of participants within organisations. The affective state of individuals are claimed to be affected by the prevalent mood of society, according to Nofsinger (2005). These social moods are claimed to influence the investments decisions and are also the pretence for the herding effect described by Pretcher and Parker (2007), which states that individuals during uncertainty are following another individual they perceive to be more certain about the situation. The influences of both the herding effect and social moods upon the leadership process can further increase the understanding of leaders and their executive decision-making.

7 Conclusion

The ambition of this paper is to explore the relation between the LFR participants HR and their executive decision-making. This paper found that the HR of the LFR participants affects their leadership and executive decision-making process. This is because of the interdependent relationship between the brain and the body. Moreover, the results show that emotional states can influence decisions that have severe consequences for the LFR and even the whole organisation. The results also show that the physiological states influence the decision-making process. Furthermore, it is also indicates that decisions always are socially influenced and that all the participants of the LFR is affecting the decision both physiologically and psychologically.

The results of this paper also led to a definition of the role of the leader based upon three tenets, which were derived from the findings. The first of these tenets implicate that the role of the leader is assigned to a participant by the other participants of the LFR, hence entailing that the leadership process is adaptive and dynamical in nature. The leadership process is therefore also dependent upon the context as well as the participants. The second tenet claims that the role of the leader is assigned to the participant that is perceived by the other participants as making extra salient contributions to the LFR. The extra salient contributions of the chosen leader lead to the emergence of inequalities amongst the participants, hence allowing the leader to influence the other participants of the LFR. Furthermore, the ability to influence the other participants of the LFR is dependent upon the alignment of the leaders communicated interests and their alignment with the interests of the other participants. The final tenet is power and according to this paper that is the ability to exclude or include resources and participants from the LFR, tasks or goals. All of these tenets affect the physiological and psychological states of the participants as well as the LFR as a whole, hence inferring that these are affecting the executive decision-making as well.

The results of this paper also show that there exist four different constellations in which the triadic LFR can attain. These four are named the Leader, the Two Leaders, the Consensus and the Disorder constellations and describes different relational states based upon the participants' physiological and emotional states. The Leader constellation includes a desirable emotional state where only one leader exists within the LFR. Moreover, the leader is assigned through a physiological reciprocal process, where the leader's and the participants' HR is mutually influenced, hence reaching a physiological and emotional equilibrium. The Two Leaders Constellation on the other hand is a transgressional state, which occurs during the change of the leader within the LFR. This inherent instable state causes the existence of two leaders within the same LFR at the same time, competing over the participants as followers. The Consensus Constellation is a chaotic state, where all the participants agree with each other. Finally, the Disorder Constellation is another chaotic state, where all the participants disagree with each other. Both of these states are short-lived as they strive after the Leader Constellation as it is a physiological and emotionally steady state.

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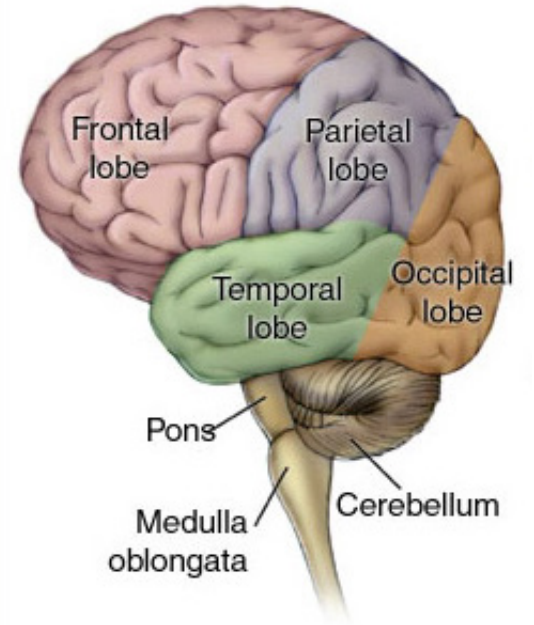
Appendix I

Brain Anatomy

The brain consists of many regions and only regions relevant to this paper are mentioned in this section. These are 5 overarching regions that is covered; the frontal lobe, the parietal lobe, the occipital lobe, the temporal lobe and the medulla oblongata. All of these regions are shown in the figure below.

Figure 4.



The most central part of the brain in relation to this text is the frontal lobe and especially the uttermost front of the frontal lobe, called the prefrontal cortex. The frontal lobe as an overarching region, deals with reward, planning, attention, short-term memory tasks and motivation. The frontal lobe is also modifies emotions to fit social behaviour, such as norms (Ramsøy, 2014). It is also dealing with future expectations and consequences resulting from actions and decisions. The prefrontal cortex is dealing with motivation, complex planning and even personality traits (www.nih.gov/news/pr/may2001/nimh-29.htm).

Another part that plays a central role in this paper is the medulla oblongata, which is responsible for multiple automatic functions, such as heart rate, respiration and perspiration. Moreover, it is where the spinal cord is attached to the brain, which allows bidirectional communication between the brain and the rest of the body.

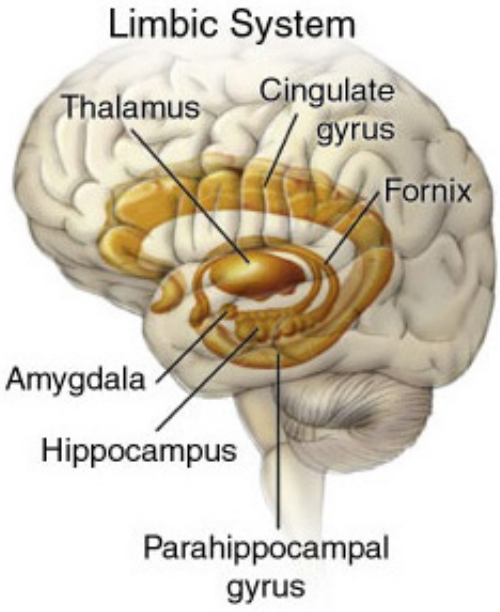
The parietal lobe is related to information processing, especially information regarding navigation, the sense of touch and motor functions (Schacter, Gilbert, Wegner, & Hood, 2011). This part is also related to language processing. Moreover, this region is mainly relevant to this thesis as it is responsible for physiological mirroring of other individuals physiological manifestations of emotions.
The occipital lobe is related to processing the visual information; this region is only relevant to this thesis in conjunction with other regions such as the parietal lobe (Ramsøy, 2014). A majority of the sensory input is gathered through the eyes, hence an active role in mirroring processes.

The temporal lobe is involved in processing sensory input related to language comprehension, emotional association as well as meanings derived from visual memories (Ramsøy, 2014). This part is relevant to this thesis but not the chosen method of investigation.

The Limbic System

The limbic system involves two smaller regions of the brain, which are central to this thesis. The limbic system is involved in functions such as, emotions, olfaction, behaviour, motivation and long-term memory. The two regions are known as hippocampus and amygdala (Schacter, Gilbert, Wegner, & Hood, 2011). The Hippocampus is located in the parietal lobe and is responsible for processes related to the long-term memory as well as navigation. Amygdala on the other hand is also located in the temporal lobe and is involved in processing memory, emotional reactions and decision-making. It is because of that involved in processes related to learning as well. Both the hippocampus and the amygdala are displayed in the picture below.

Figure 5.

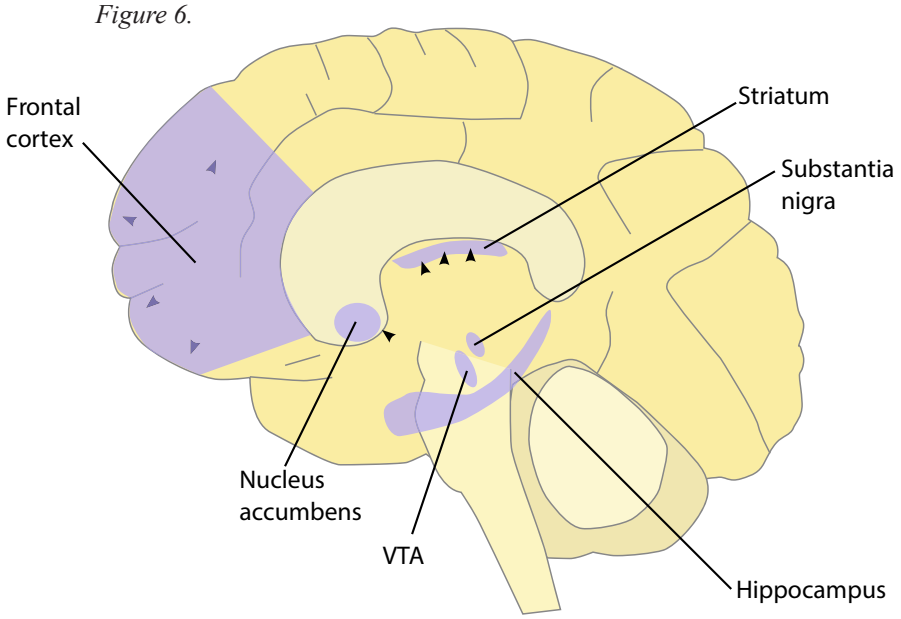


The Striatum

The striatum is located near the forebrain and is further divided into two parts the ventral and dorsal striatum. The ventral striatum is most relevant for this paper, as it is related to the reward system of the body. The ventral striatum consists of three different regions namely, nucleus accumbens, olfactory tubercle and islands of Calleja (Rolls, 1994). The nucleus accumbens are involved in processes related to motivation, reward, pleasure and aversion (Stocco, Lebiere, & Anderson, 2010). The olfactory tubercle is also involved in processes related to rewards; as it processes sensory information and arousal as well as behavioural responses (Wesson & Wilson, 2011). The islands of Calleja is a specific region of the olfactory tubercle and is involved in processing incentives and socially related rewards. Dopamine is a neurotransmitter, which is involved in processes related to arousal, motivation, cognitive control and rewards (Björklund & Dunnett, 2007). The effect and function of the dopaminergic releases are based upon in which region the release occurs, the regions mainly associated with dopamine are shown in the figure below.

Neuropeptides

Figure 6.



In the figure above it is possible to see that dopamine play a crucial role in reinforcing and inhibiting cognitive processes related to emotions and decision-making, which entails that decisions are guided by the rewards of the expected outcomes, hence involving regions such as prefrontal cortex, nucleus accumbens and hippocampus (Björklund & Dunnett, 2007).

Oxytocin is a neuropeptide, which plays a crucial role in social behaviour. It is linked to social interactions, such as mating, maternal bonding (attachments), pair bonding and social recognition. Re-

leases of oxytocin related to the brain are found in regions such as, amygdala, nucleus accumbens as well as the brain stem. Both the amygdala and nucleus accumbens is related to processing of rewards as mentioned above and is linked to rewards associated with social interactions, hence very related to the scope of this thesis (Šešo-Šimić, Sedmak, Hof and Šimić, 2010).

Appendix II

Picture 1.

Picture 2.

Picture 3.

Picture 4.

Picture 5.

Appendix III

Approval of Usage

I hereby approve that the name of the company is allowed to be mentioned within the Master thesis of Kristian Axelsson and eventual procedures and discourse related to the Master thesis process at Copenhagen Business School (CBS). I hereby also approve the use of my first name and current position at the company within the Master thesis and the related discourse and procedures related to the Master thesis process at CBS.

Signature	Date and Place
	Mats Pettersson, VD, 13/5-15, LUND
	Fredrik Westman, Sales & Marketing, 13/5-15 LUND
	Neal Greenspan, 13/5-2015, Lund
	Jeffrey S. Roberton 2015-05-13 Lund, Se

Appendix IV

Below are the 100 items that the personality test consists of.

Table 17.

Often feel blue.
Dislike myself.
Am often down in the dumps.
Have frequent mood swings.
Panic easily.
Am filled with doubts about things.
Feel threatened easily.
Get stressed out easily.
Fear for the worst.
Worry about things.
Remain calm under pressure.
Rarely lose my composure.
Seldom feel blue.
Feel comfortable with myself.
Rarely get irritated.
Am not easily bothered by things.
Am very pleased with myself.
Am relaxed most of the time.
Seldom get mad.
Am not easily frustrated.
Feel comfortable around people.
Make friends easily.
Am skilled in handling social situations.
Am the life of the party.
Know how to captivate people.
Start conversations.
Warm up quickly to others.
Talk to a lot of different people at parties.
Don’t mind being the center of attention.
Cheer people up.
Have little to say.
Keep in the background.
Would describe my experiences as somewhat dull.
Don’t like to draw attention to myself.
Don’t talk a lot.

Avoid contacts with others.
Am hard to get to know.
Retreat from others.
Find it difficult to approach others.
Keep others at a distance.
Believe in the importance of art.
Have a vivid imagination.
Tend to vote for liberal political candidates.
Carry the conversation to a higher level.
Enjoy hearing new ideas.
Enjoy thinking about things.
Can say things beautifully.
Enjoy wild flights of fantasy.
Get excited by new ideas.
Have a rich vocabulary.
Am not interested in abstract ideas.
Do not like art.
Avoid philosophical discussions.
Do not enjoy going to art museums.
Tend to vote for conservative political candidates.
Do not like poetry.
Rarely look for a deeper meaning in things.
Believe that too much tax money goes to support artists.
Am not interested in theoretical discussions.
Have difficulty understanding abstract ideas.
Have a good word for everyone.
Believe that others have good intentions.
Respect others.
Accept people as they are.
Make people feel at ease.
Am concerned about others.
Trust what people say.
Sympathize with others' feelings.
Am easy to satisfy.
Treat all people equally.
Have a sharp tongue.
Cut others to pieces.
Suspect hidden motives in others.
Get back at others.
Insult people.
Believe that I am better than others.

Contradict others.
Make demands on others.
Hold a grudge.
Am out for my own personal gain.
Am always prepared.
Pay attention to details.
Get chores done right away.
Carry out my plans.
Make plans and stick to them.
Complete tasks successfully.
Do things according to a plan.
Am exacting in my work.
Finish what I start.
Follow through with my plans.
Waste my time.
Find it difficult to get down to work.
Do just enough work to get by.
Don’t see things through.
Shirk my duties.
Mess things up.
Leave things unfinished.
Don’t put my mind on the task at hand.
Make a mess of things.
Need a push to get started.

Appendix V

Heart Physiology

This section covers the physiology of the heart in order to further comprehend the heart rate as a measurement as well as why it is measure in that way. This section contains 17 images, which goes through the corresponding stages to what is referred to as a heartbeat. The hearts function is to pump the blood throughout the body and providing it with oxygen. The pumping function is a consequence of the hearts muscular contractions and releases, which is elicited through electrical signal from the vagus nerve (National Heart, Lung, and Blood Institute, 2007). The first state is known as atrial depolarisation, which is the start of the signal also known as the P wave. It starts as a small contraction of the top left chamber on the figures below as well as opening the valves to the bottom chambers of the heart. The P wave in the pictures below is known as the physiological pace maker. The red lines in the figures below are representing the electric signal and its movement throughout the heart.

Figure 7.

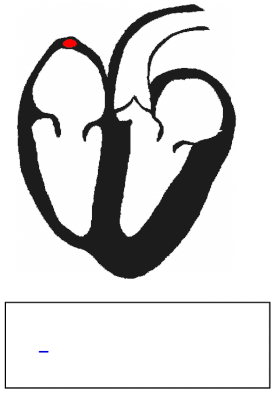


Figure 8.

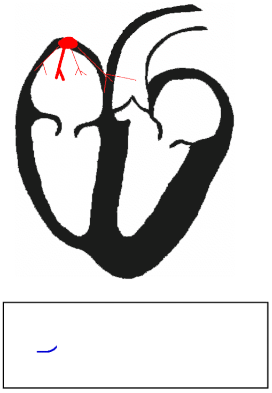


Figure 9.

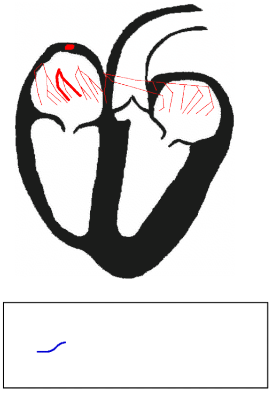


Figure 10.

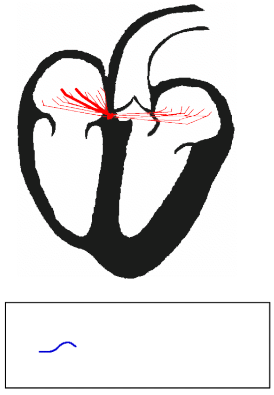


Figure 11.

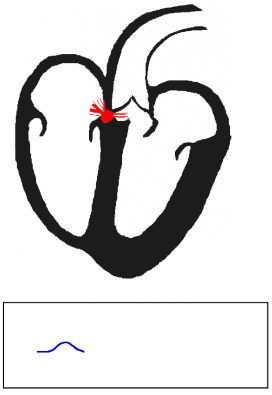
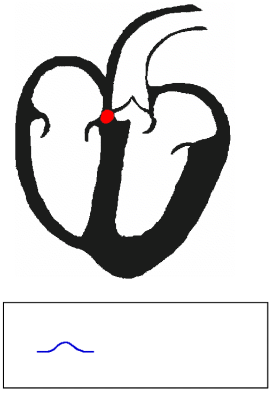
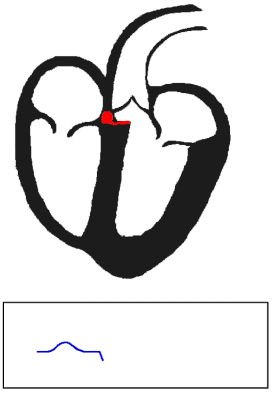


Figure 12.



The valves are then starting to close, which creates a valley known as the Q wave. This is known as repolarisation of the atrium.

Figure 13.



As the valves closes entirely the electric signal is spreading to the lower part of the heart as well as the outside walls of the lower chambers, hence starting the contraction of the chambers, known as depolarisation of the ventricles (National Heart, Lung, and Blood Institute, 2007). This peak is known as the R wave, and it is the time interval between two such waves that is measured through an ECG.

Figure 14.

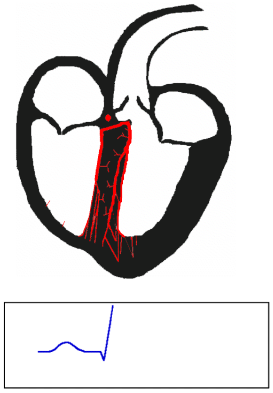
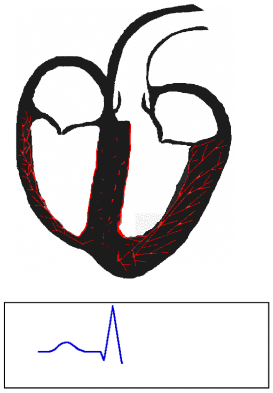
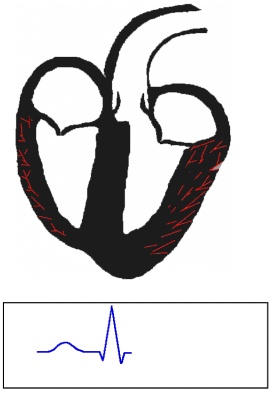


Figure 15.



The contraction causes another valley known as the S wave, as the electric signal anticipates the contraction of the chamber walls.

Figure 16.



The final peak is known as the T wave and is the hearts restoration of homeostasis. It is also known as ventricular repolarisation as the electric signal dies out and the heart reaches the resting state once more (National Heart, Lung, and Blood Institute, 2007).

Figure 17.

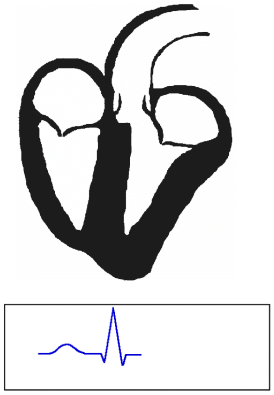


Figure 18.

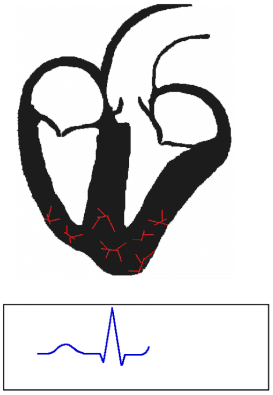


Figure 19.

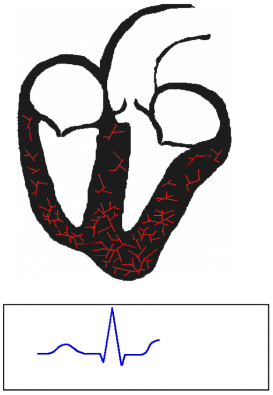


Figure 20.

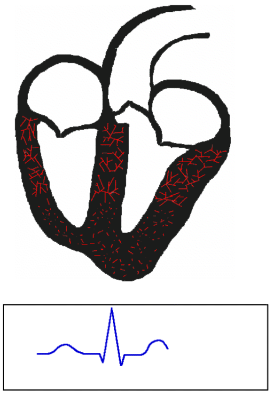


Figure 21.

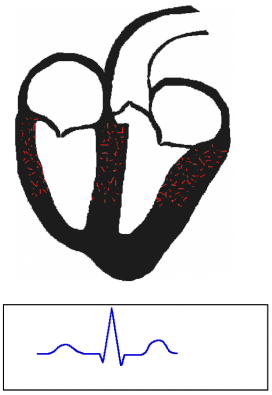


Figure 22.

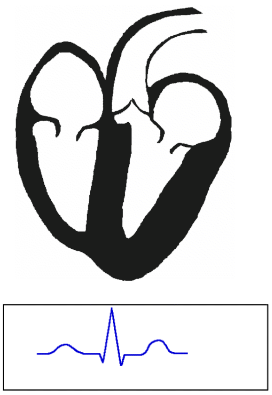
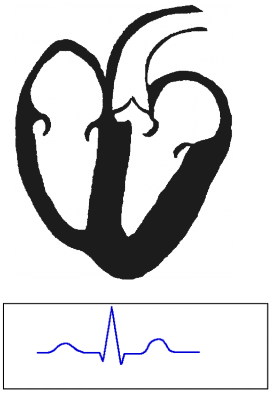


Figure 23.

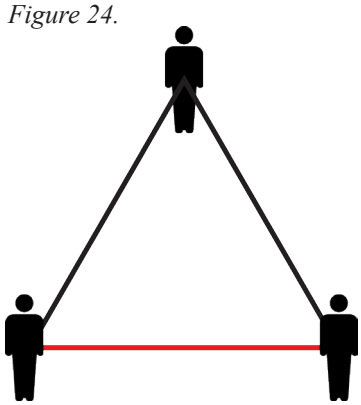


Appendix VI

The red lines are dyads with positive correlation coefficients and the black lines represent negative correlations.

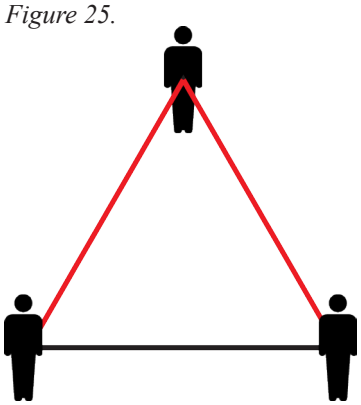
The Leader Constellation

Figure 24.



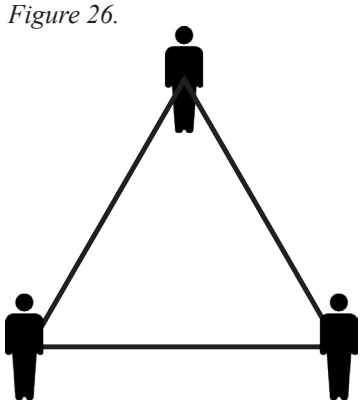
The Two Leaders Constellation

Figure 25.



The Consensus Constellation

Figure 26.



The Disorder Constellation

Figure 27.