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# An enactive perspective of understanding leadership: A comparative case study approach

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**Abstract.** Leadership is a significant element in the present life of organizations. Recent reviews suggest building novel frameworks through which leadership, as a phenomenon, could be understood comprehensively, considering all the aspects of human experience. The autopoietic perspective on cognition suggests that the quality of human experience is determined by the interplay between the biological and social dynamics of an active situated human agent, we enact our ‘reality’, rather than recognize one. Thus, an integrated approach to the study of any phenomenon in the social domain requires focus on the interrelatedness of the biological, mental and social aspects. This exploratory paper provides an insight into the findings of an empirical study of leadership consonant with an enactive perspective on human experience, including the biological, behavioral and social dynamics of the leadership phenomenon. The research implemented mixed methods under the umbrella of a multidisciplinary comparative case study. Heart rate variability (HRV) demonstrated as the biomarker for physiological data, semi-structured interviews, the Leadership Behavior Development Questionnaire (LBDQ) and a researcher’s reflective diary were used to collect qualitative data and assist in understanding behavioral attributes. The results indicated a correlation between physiology, attitudes and behaviors, social dynamics and performance.

**Keywords:** Leadership, autopoiesis, complexity, self-organization



Kushwanth Koya is currently a Senior Research Assistant in Information Sciences at Northumbria University. His PhD led to a novel perspective on leadership studies, as a result of which there is ongoing research at Northumbria to understand different aspects of human behaviour, characterised by addressing physiological, behavioural and social interconnectedness. His specialisations include Sustainable Information Systems, Green Information Systems, Visualisation and Analytics of Big Data, Wellbeing

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## 1. Introduction

Leadership is a crucial phenomenon, visible in all facets of society: political, organizational, communal, educational, etcetera [81]. Recent research defines leadership as continuous self-development, and in social circumstances it is defined as managing a group functionally, emotionally and intelligently [35]. The quality of interpersonal relations between leaders and other individuals sustains multiple organizational aspects [21].

Every leadership theory explains leadership on differential levels, taking a leader-subordinate, leader-intrinsic or leader-subordinate-social perspective. Theory of autopoiesis brings into focus an enactive perspective on cognition, suggesting that the quality of human experience is determined by the interplay between the biological and social dynamics of an active situated human agent. Thus, an integrated approach to the study of the phenomenon of leadership, in social context, requires consideration of the interrelatedness of the biological, mental and social domains [27, 48, 82, 83]. It is the social environment [53], combined with physiological well-being [27, 28], that conditions an individual's behavior [1, 3, 64, 24]. This generative process has been overlooked in leadership theories [37, 70]. A generative perspective on leadership will address the question: 'How could we understand the dynamics of leadership from a holistic perspective that recognizes the emergence of leadership in the interplay between the biological, individual and social domains?' This approach to the concept of leadership necessitates taking an inter-disciplinary perspective.

In a recent review of literature on leadership, a need for such an approach to understanding leadership was identified, as there are no organizational studies available exploring the leadership phenomenon from an integrative paradigm [67, 78]. The enactive perspective on understanding human experience offers an

alternative that focuses on the continuity and interrelatedness of the biological, the mental and the social [77]. An exploratory study was thus conducted to understand the phenomenon of leadership, examining correlations in physiology, subjective experience, leadership behaviors and functional performance in organizations. Initial findings indicate a positive correlation between the three domains. This study makes the following contributions to leadership literature: (a) A new framework linking physiology, behaviors and social aspects of leadership is proposed. (b) Heart rate variability has been studied for the first time in leadership studies as a physiological indicator. (c) Leadership is viewed as an emerging phenomenon in groups, as opposed to something that is confined to 'a leader'.

## 2. Background

### 2.1. Interpersonal representations

Empirically and at a subjective level, research in leadership has recognized the importance of the relationships between leaders and their subjects [2, 33, 39]. Good performance and positive behaviors were found to be complementary between leaders and their subjects, as noted in transformational leadership [3, 5] and charismatic leadership research [15, 64]. Similarly, research in destructive leadership correlated the leader's behavior to the employee's psychological [76] and social well-being [66], and its impact on the organization [19, 55], also called 'high quality connections' [17]. These connections significantly alter behaviors [17], subjective experience [49, 61] and capabilities [8, 10, 38, 63]. Parallel to this, high quality connections offer physiological benefits and have an impact on well-being and performance [4, 7, 28]. Studies have shown how physiological markers [13, 31, 34, 45], emotions and behaviors [6, 7, 16, 12, 22] in a group are contagious. Resonant leadership as a state where there is synchrony in subjective experience, behaviors and physiology between the leader and the group [7]. This formed the motivation for the current work, considering leadership as a phenomenon and recognizing the physiological and behavioral correlations between the leader and the group. Theory of autopoiesis provides the link here as it explains the emergence of a phenomenon taking into consideration all the aspects of human experience, physiological, behavioral and environmental.

## 2.2. Autopoiesis: An enactive perspective on human experience

There exists a large body of knowledge, referred to as autopoietic theory, developed by two Chilean biologists: Humberto Maturana and Francisco Varela (1980). This body of work concerns the dynamics of living systems, asking the questions: What is the definition of a living entity? What does it mean to be alive [48]?

Maturana and Varela define a living entity as a system that produces itself, that is, a system whose output is itself. Such a system is autopoietic, that is, self-producing. An autopoietic (living) system is defined as a network of processes of production of components that produces the components that through their interaction and transformations continuously regenerate the network of processes that produced them [48]. Autopoiesis is basic to the living individual. What happens to the individual is subservient to its autopoietic organization, for as long as it exists the autopoietic organization remains invariant. What this means is that its identity and, therefore, its emergent global properties, are generated through a process of self-organization, within its network of components. However, we must also realise that this process of self-organization is conditioned by a two-way process of local-to-global and global-to-local causation; thus, we need to consider the mutual embeddedness of component dynamics, autopoietic entity and its environment. First, there is the local-to-global determination ('upward' causation) through which the entity, with its properties, emerges. Secondly, however, there is global-to-local determination ('downward' causation), where global characteristics constrain or direct local interactions between the components. Thus, the internal dynamics of the components (neuronal nets, metabolic nets, energy flow and so on) generate and sustain the global properties of the autopoietic entity. At the same time, however, the global properties (body, consciousness, mind, emotion, and so on) constrain and govern the behavior of the individual components.

This dialectic relationship between local and global levels is described in autopoietic theory as 'reciprocal causality' [68, 69]. For example, in organisms with a nervous system, the rules of interactions within the neuronal network are in reciprocal relationship with the overall activity of the autopoietic entity. To a very large extent, behavior is a regulator of perception. We enact our world rather than recognize one [41, 68–70]. Escher's crystal ball on Fig. 1, gives

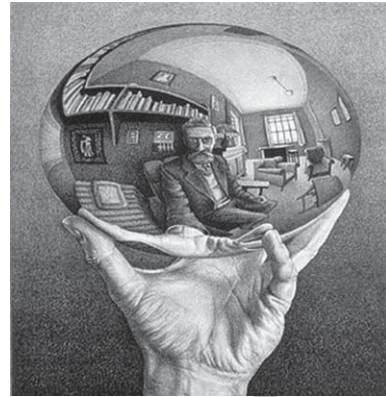


Fig. 1. M. C. Escher's Self-Portrait in Spherical Mirror in Locher, J. L. (2000) *The Magic of M. C. Escher*, Harry N. Abrams: New York.

an artistic representation of the concept of enaction: one could say that the quality of our understanding of what we see, notice, become aware of and take into consideration, is determined by the quality of our being in the world: physical, mental, emotional and relational.

An enactive perspective of understanding and developing leadership will require taking a systemic view and considering the interrelationships between the physical, mental, emotional and relational aspects of being in the world. This perspective could relate to a search for an integrated paradigm of leadership [78] and on resonant leadership [7]. However, in this present paper a different framework is developed, one that focuses on exploring the correlation between the physiological, behavioral and social aspects of leadership.

## 3. Indicators and methods

### 3.1. Case study methodology

A case study is an informative analysis of an individual or groups [54] that efficiently creates an understanding of an issue or object that is classified as being complex [79]. It can also be utilized to support a theory that has been researched in the past. Case studies place considerable importance on circumstantial analysis of conditions and relationships that result in particular events, assisting in understanding any deep-rooted behaviors and social dynamics. Careful planning is needed to reduce the chances of bias, due to the researcher's direct involvement in

the case. The case study method was used in this research as an exploratory tool in two organizations. The exploratory process of case study research consists of seven core steps [71, 79].

The researcher involved in the data collection realized, however, that another stage is required prior to the data collection stage. This could be called acclimatization as on Fig. 2. This stage was required to establish rapport and understanding between individuals involved in the case study and the researcher. Not only did it increase the confidence of the participants but also created an aspect of trust between the participants and the researcher. The first step involves focusing on the research objective as to what the researcher wants to know from the cases. The design phase of the process involves the researcher making judgments on the selection of case studies. Case studies can be performed at different levels in accordance with the research question, namely, a single case study or a multiple case study. Sometimes, a multiple case study consists of knowledge obtained from separate cases that contribute to the study as a whole. This research work follows such a process. The whole case is defined by the outcomes of two separate cases. The key strength of a case study lies in its ability to involve multiple sources and a wide range of techniques in the data collection process [80]. During the data collection stage, the researcher collects evidence and stores it in a systematic way. This allows the case to be flexible and allows documentation of the changes made, based on the observed phenomenon. The use of field notes is highly recommended as they record attitudes, questions from participants and record stories etcetera [80]. During the analysis phase of the case study, the data is examined using multiple constructs to find links between the research question and the research object. The researchers, however, remain open to novel insights and opportunities. The multiple methods used in the process of data collection and analysis permit triangulation of the data and, thus, the building of a strong case [71, 79]. The final phase then includes reporting the case study. It is essential that the researcher explicitly reports all the experience, findings and evidence [71]. In this research project, the findings from the two cases are examined and compared, making it a comparative case study.

### 3.2. The cases

Case A and Case B are part of several clinics that come under one umbrella organization. The

organization at the top level takes care of marketing, recruiting, business development, material purchase and operations etcetera for the clinics. The clinics are solely responsible for service delivery to their patients, escalation of issues and observance of any policies set by the top management. A separate clinic management structure exists at the clinics, for which the clinic head is responsible. This includes rosters, patient management, clinic issues and costing etcetera. DRSR is the head of Case A and VKDRSR is the head of Case B.

### 3.3. Case A

Case A has fourteen employees in total, of which eight volunteered to take part in this research work as participants. One of the participants had to be excluded from the investigation as he is a heavy smoker, which will affect the HRV data when considered as a whole. The participant coded as DRSR is the clinic head, a doctor herself. Two senior doctors, two junior doctors, a clinical nurse and an administrative assistant are part of this case study ( $n = 7$ ). The mean age of Case A at that time was 29, with a maximum of 33 and minimum of 21. The standard deviation was 4.90.

### 3.4. Case B

Case B also had fourteen employees, out of which seven ( $n = 7$ ) agreed to participate in this research work. VKDRSR is the clinic head, a doctor himself. In addition to the clinic head, three senior doctors, two junior doctors and a clinical nurse were involved in the study. The mean age at Clinic B at the time of the study was 29.71, with a maximum of 45 and a minimum of 20. Standard deviation was 7.32.

### 3.5. Ethics

This research was approved by Northumbria University ethics committee and required the informed consent taken of each participant. The identity of the participants was protected using a coding technique and the organizations cannot be named owing to the nature of the research and agreement.

### 3.6. Heart Rate Variability (HRV)

Harung et al. (2009) had, using EEG measurements in a laboratory, identified that leadership excellence is in correlation with psycho-physiological integration

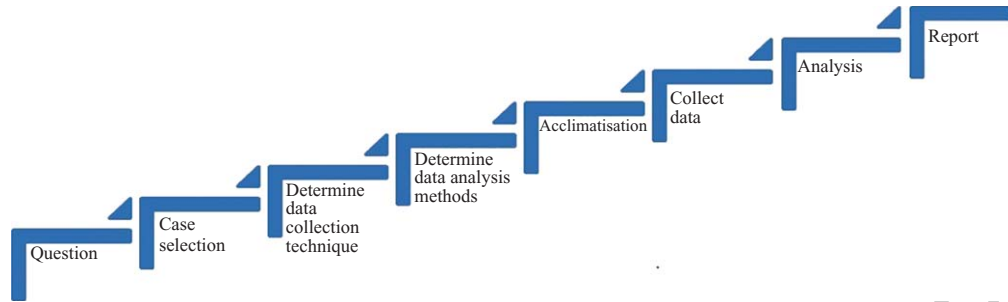


Fig. 2. Case-study implementation (Yin, 2012; Stake, 2010).

[27]. EEG methods can be invasive and need to be performed within a laboratory, whereas ECG measurements are less invasive and more mobile. HRV is derived from the ECG signal and is a marker of autonomic nervous system function [14, 43, 58]. It is calculated as the time interval between two successive heart beats (R peaks) in the ECG trace. Higher HRV is indicative of having greater self-regulatory abilities and lower stress levels [14, 58].

The ECG data was collected using HeartMath Institute's emWave device, the raw data cleaned [43] and then analyzed using Kubios, an open source HRV analysis software developed by the University of Eastern Finland.

### 3.7. HRV recording and analysis

The average recording time for each participant was 16 minutes. A five minute sample from the tachogram (between 6 and 11th minute), was analyzed to calculate the HRV measure. The timing of the sample ensured that the participant had already relaxed into the interview. Greater HRV values represent a resting yet focused state and better psychophysiological well-being [14, 58]. The HRV measures for every individual in the clinics were taken and then analyzed using SPSS statistics. The means between the clinics were compared and also the means of the Heads of clinics were compared separately to investigate whether there were any differences. Normal distribution and paired t tests were performed as an investigative measure, although it was expected that significance could not be achieved owing to a low sample size.

### 3.8. Rickter interviews

The Rickter Scale is a unique interview method developed by Rick Hutchinson and Keith Stead

during the early 1990s [29]. It involves a visual analogue scale (VAS), for an individual to self-assess themselves against factors relevant to their personal/professional lives. In the case of this project, the factors in consideration were the attributes of embodied leadership [37], as described in Table 1. The Rickter interviewing method was used in this research as a means of evaluating embodied leadership capability [37].

The Rickter method's theoretical grounding is in appreciative inquiry, emotional intelligence, applied positive psychology and solution-focused motivational interviewing. It gives utmost importance to a process called 'anchoring', whereby participants are encouraged to hold the slider on the Rickter board (the Visual Analogue Scale is presented as a set of physical sliders on a board), reflect and notice their emotions, while moving the slider across present, past and desired state for the assessment of each attribute. It is particularly suitable for assessing embodied leadership attributes as it facilitates self-assessment through connecting with one's reasoning and emotions, and exploring personal experience of past and present while linking this experience with desired future states [60]. In addition to self-assessment, the Rickter process requires exploring the meaning of the self-assessment through encouraging the interviewee to share narratives of lived past and present experience and imagined desired states. This assisted the researchers in making sense of the data and in the data analysis [36, 37].

### 3.9. Analysis of rickter interviews

The interviews were analyzed based on a visual analogue scale and narrative transcripts. SPSS was used for statistical analysis of the VAS data [61] and the interviews were analyzed applying a grounded theory based analysis process, by bringing forward

Table 1  
Attributes of Embodied Leadership and corresponding Rickter based question (Koya et al., 2015)

Attribute	Question
Being Non-judgmental	How easy is it for you to be non-judgmental about what you see and hear, 10 very easy, 0 not easy at all?
Intention	How much do you feel your actions align with your intentions, 10 a lot, 0 not at all?
Uncertainty	How well do you feel you cope with uncertainty in your life, 10 very well, 0 not so well?
Active listening	How well do you feel you pay attention to people and engage with them with all your senses, 10 very well, 0 not well at all?
Congruence	How important is being true to your values in the way you lead your life, 10 very important, 0 not so important?
Intuition	How much do you feel you rely on your intuition, 10 a lot, 0 not very much?
Reflective Practice	How important is it for you to reflect on some of the actions you take, 10 very important, 0 not important at all?
Meaning/ Purpose	How much of your work and life do you feel is driven by meaning or purpose, 10 a lot, 0 not at all?
Decision making	How much are you able to disassociate with your ego and how good are you at making decisions, 10 very good, 0 not at all?
Authentic Presence	How much do you feel you operate from the awareness of being in the present, 10 a lot, 0 not at all?

403 themes identified from the transcripts. It should be  
 404 clarified that this is not a grounded theory study;  
 405 rather, it uses the coding technique, where the results  
 406 are grounded in the data [73]. This method has been  
 407 used successfully in the past for coding and identifica-  
 408 tion of themes in case studies [72]. It is important  
 409 to mention here that the themes are built not only  
 410 on the basis of the researcher's interpretations, but  
 411 are also based upon the research participants' per-  
 412 spective, which ensures credibility and rigour. The  
 413 analysis follows a Straussian approach [75] until the  
 414 level of identifying the open-ended codes. Open cod-  
 415 ing was performed to understand the concepts of the  
 416 data. This was followed by a review of all the available  
 417 data, which resulted in eliciting the embodied leader-  
 418 ship attributes that were then used in the case studies  
 419 for further exploration. Memos were taken while ana-  
 420 lyzing the themes to keep track of the subtle semantic  
 421 nature of those themes.

### 422 3.10. Leadership Behavior Development 423 Questionnaire (LBDQ)

424 The LBDQ is a three-part questionnaire that is  
 425 used by researchers to understand the behavior of a

426 leader from the perspective of the subordinates, the  
 427 leadership qualities that subordinates desire, and the  
 428 behavior of a leader from the perspective of the leader,  
 429 via a behavioral self-assessment questionnaire that  
 430 the leader answers her/himself [74] as in Table 2.  
 431 The work on LBDQ first started in 1945, as there  
 432 were then no theories describing leadership behav-  
 433 ior. Years of research led to the first version of the  
 434 questionnaire in 1957.

435 After a general application of the questionnaire,  
 436 a few more attributes with regard to self-definition  
 437 and courtesy were added to the questionnaire and the  
 438 latest version was released in 1963. It is still being  
 439 used today as a means to analyze leadership behav-  
 440 ior. When administered carefully, the questionnaire  
 441 can provide a holistic measure of leadership within  
 442 an organization. It has been successfully applied in  
 443 different organizations in the past and data valida-  
 444 tion of the same proved to be successful as well. This  
 445 method also takes up a socio-constructivist approach  
 446 and is thus in accord with paradigm of the present  
 447 project: understanding leadership as a phenomenon in  
 448 a social context. With regard to this research project,  
 449 the LBDQ was administered in the two case study  
 450 organizations.

Table 2  
LBDQ categories and definitions

LBDQ category	Definition	No. of sub-categories
Representation	Representative of the group	5
Demand re-conciliation	Reconciles demands and reduces disorder in the group	5
Tolerance to uncertainty	Tolerates and expects uncertainty in the system	10
Persuasion	Convinces individuals and is perusal in conversation	10
Structure initiation	Their role and the followers role is well defined	10
Freedom and clemency	Sub-ordinate decisions and initiatives are tolerated	10
Role assumption	Actively exercises leadership role	10
Consideration	Humane outlook on sub-ordinates	10
Productivity	Application of positive pressure to attain goals	10
Predictive accuracy	Foresight and prediction skills	5
Integration	Solves conflicts within group and maintains unity	5
Superior orientation	Maintains cordial relations with superiors	10

LBDQ is a measure that involves analysis in addition to describing a trait. It also takes real situations into account, thus, suitable for application in this study. The LBDQ analyzes twelve categories, each consisting of either five or ten sub-categories. The participant's scores (in brackets) in each sub-category are represented alphabetically: A (5), B (4), C (3), D (2) and E (1). For a few sub-categories, the scoring system works in reverse order and they are starred in the scoring sheet for the researcher's reference. A visual analogue scale approach to analysis is followed and the final scores which are summated are analyzed using statistics in SPSS.

### 3.11. Researcher's diary

A researcher's diary was maintained throughout the time spent in the clinics. This helped the researcher to describe events and experiences on a day-to-day basis, recording the new knowledge, feelings and reactions of not only the researcher, but also other individuals connected to the clinic. The diary was maintained in electronic format and is a clear primary data source offering qualitative evidence. Reflexivity was practised [50] after time spent in the clinic, whereby the researcher came back from a day of work and described what he felt and experienced in

the clinics. The diary consists of factual accounts of the tasks performed by the researcher, thoughts, questions for exploration, observation, reports and action plans, etcetera. The experiences described in the diary helped in the analysis. The diary was maintained separately for both clinics and thus comparisons could be drawn.

## 4. Findings

### 4.1. HRV results

The people working at Clinic A had greater average measures of HRV than those working at Clinic B [59]. As there is a high level of correlation between HRV and cognitive behavioral attributes, it may be argued that Clinic A could exhibit leadership behaviors pertaining to embodied attributes. Figure 3 summarizes the time and frequency measures of HRV in both the clinics.

### 4.2. Rickter interview findings

This section analyzes the difference in the scores of the visual analogue scales and the narratives with respect to the leadership attributes that were included



Standard RR				Paired t-test of Std RR			
Clinic A		Clinic B		Paired t for C1 – C2			
Participant	Std RR (ms)	Participant	Std RR (ms)	N	Mean	StDev	SE Mean
Dram	50.3	kddaz	83.9	C1	7	63.83	18.01
Dras	56.8	Shrvk	44.5	C2	7	54.74	15.29
Drma	83.3	Vkdcrc	67.0	Diff	7	9.09	25.49
Drsr**	64.5	Vkdrcj	42.3	95% CI for mean difference:			
Drvy	93.8	Vkdrmrnl	44.5	(-14.49, 32.66)			
Kdbms	49.2	vkdrsr**	51.6	T-test of mean difference = 0 (VS not=0)			
Kdcr	48.9	Vkmmvth	49.4	T-value = 0.94			
Average	63.8	Average	54.7	p-value = 0.382			

RMSSD				Paired t-test of RMSSD			
Clinic A		Clinic B		Paired t for C4 – C5			
Participant	RMS SD (ms)	Participant	RMS SD (ms)	N	Mean	StDev	SE Mean
Dram	50.0	kddaz	68.9	C4	7	67.40	30.00
Dras	68.6	Shrvk	40.4	C5	7	47.00	13.20
Drma	93.9	Vkdcrc	60.6	Diff.	7	20.40	33.50
Drsr**	68.1	Vkdrcj	31.8	95% CI for mean difference:			
Drvy	117.3	Vkdrmrnl	39.9	(-10.6, 51.4)			
Kdbms	41.8	vkdrsr**	47.6	T-test of mean difference = 0 (VS not=0)			
Kdcr	32.3	Vkmmvth	40.0	T-value = 1.61			
Average	67.4	Average	47.0	p-value = 0.159			

NN50				Paired t-test of NN50			
Clinic A		Clinic B		Paired t for C7 – C8			
Participant	NN50 (count)	Participant	NN50 (count)	N	Mean	StDev	SE Mean
Dram	116	kddaz	153	C7	7	164.70	72.20
Dras	208	Shrvk	88	C8	7	98.70	35.10
Drma	218	Vkdcrc	136	Diff.	7	66.00	85.20
Drsr**	195	Vkdrcj	48	95% CI for mean difference:			
Drvy	257	Vkdrmrnl	85	(-12.8, 144.8)			
Kdbms	91	vkdrsr**	96	T-test of mean difference = 0 (VS not=0)			
Kdcr	68	Vkmmvth	85	T-value = 2.05			
Average	164.7	Average	98.7	p-value = 0.086			

Total Power				Paired t-test of TotalPower			
Clinic A		Clinic B		Paired t for C3 – C6			
Participant	Total Power (ms <sup>2</sup> )	Participant	Total Power (ms <sup>2</sup> )	N	Mean	StDev	SE Mean
Dram	2056	kddaz	6100	C3	7	3244	1827
Dras	3257	Shrvk	1727	C6	7	2921	1764
Drma	2547	Vkdcrc	4641	Diff	7	323	2847
Drsr**	3246	Vkdrcj	1412	95% CI for mean difference:			
Drvy	7230	Vkdrmrnl	2469	(-2310, 2956)			
Kdbms	2223	vkdrsr**	1760	T-test of mean difference = 0 (VS not=0)			
Kdcr	2148	Vkmmvth	2336	T-value = 0.30			
Average	3243.85	Average	2920.71	p-value = 0.774			

Fig. 3. Comparison of HRV data of the clinics.

in the Rickter interviews. This research considers the present situation of the clinic and the desired or future state. The present state is considered as it represents the employee state and the leader's effect on the clinic. The future or desired state is considered as it represents the aspirations of reaching a higher state of the particular attributes in the clinic. The past state could be considered to acknowledge the progress that has been made by the employees from what they were as they perceived themselves in the past. There are a few sections in the narratives where some of the participants have either credited the leader with their personal development and well-being or blamed the leader for their decline. Table 3 represents the means of the attributes from all the participants in the clinics. Table 4 represents the attribute scores of the leaders in their respective clinics. The scores that have been starred in Table 3 represent a higher attribute score, which characterizes more effective embodied leadership. It is evident that Clinic A is leading in scale on both present and future or desired states in all the attributes except *Congruence* and *Decision Making*.

It is interesting to see that Clinic A is behind Clinic B with regards to the situation in the past. The attributes of uncertainty, congruence, intuition, reflective practice, decision making, meaning/presence, intention and authentic presence are either equal or lower in Clinic A. This could imply that collectively the clinic had managed to overcome its tough past. From Table 3, it could be implied that, overall, Clinic A is doing a better job than Clinic B, i.e. has scored high on the scales of the attributes of embodied leadership.

Table 4 shows the scores of the attributes that the leaders of the clinics have scored themselves. The present situation scores support the leader of Clinic A. When it came to the desired future state, the leader of Clinic B aspired higher than that of his counterpart. Another surprising aspect of Table 4 is that the leader of Clinic A had lower past scores than the leader of Clinic B, except on the attributes of decision making and authentic presence. This might indicate that the leader of Clinic A had worked more effectively and understood the complexities involved in managing a clinic better than her counterpart. Additionally, the visual analogue scales indicate a clear advantage to Clinic A over Clinic B in the leadership attributes.

Additionally, the following comparison will bring forth any difference in operations or behaviors found in the clinics through the descriptions of the participants during the Rickter interviews. Table 5 shows the different themes of opinions of the participants

about the functioning of their clinic. These opinions were extracted from the interviews.

#### 4.3. Comparison of LBDQ results

The LBDQ questionnaire was used to understand the behavior of the leader from the perspective of that leader's subordinates: their expectations and whether their leader fulfils their expectations. From Table 6, it is observed that the staff of Clinic A have higher expectations of their leader than the staff of Clinic B in all characteristics except in tolerance of uncertainty, tolerance of freedom, predictive accuracy, and superior orientation. What is also interesting to see is that the leader of Clinic A reaches the expectations of her staff only in the characteristics of tolerance of uncertainty, whereas, the leader of Clinic B was able to reach the expectations of his staff in the characteristics of representation, tolerance of freedom and consideration.

Previous findings in this research have given an impression that the leader of Clinic B expects his staff to take ownership and responsibility of their own decisions and actions. This is reflected here in the observation of tolerance of freedom, where the leader meets the expectations of his staff. With regard to Clinic A, there seems to occur a reverse Pygmalion effect [18], where the good performance of the leader has raised the expectations of the staff and thus the leader is trying to meet those expectations. The LBDQ thus presents mixed results, favoring neither Clinic A nor Clinic B.

#### 4.4. Researcher's experience of the working profiles

At this point, it is important to discuss the difference in the profiles and working methods of the two Heads of clinics as there is a great difference in the working cultures of the clinics. The Heads of both clinics share the common ground of a strong work ethic and a good work-life balance. One of the critical factors that exists in their methods is that the head of Clinic A believes in a guided or mentored learning approach, sharing knowledge proactively with the clinic staff, whereas the head of Clinic B believes in independent learning and reactive dissemination of knowledge. This was visible clearly in the case of Clinic B during the compression incident where the staff did not know how to operate the compression unit and the clinic head had to come and fix the problem. Another key difference is that the head of

Table 3  
Comparison of means of attributes measured in the clinics

Attributes	Clinic A			Clinic B		
	Past	Present	Future	Past	Present	Future
Being Non-judgmental	3.28	5.71*	8.85*	2.17	4.28	7.28
Intention	3.85	8.00*	9.71*	3.85	6.42	9.14
Uncertainty	1.28	6.14*	9.14*	3.14	5.42	7.71
Active Listening	4.28	8.42*	10.00*	3.85	6.57	8.85
Congruence	4.71	8.00	9.57	5.42	8.00	9.85*
Intuition	3.14	6.71*	9.00*	3.71	6.14	8.57
Reflective Practice	2.85	6.85*	9.85*	3.42	6.14	8.28
Meaning/Purpose	4.42	8.00*	9.71*	4.42	6.71	9.00
Decision Making	3.28	6.85	9.00	3.42	6.85	9.57*
Authentic Presence	3.28	7.00*	9.14	3.71	5.71	9.14

\*Indicates higher score

Table 4  
Comparison of means of attributes measured of clinic heads

Attributes	Clinic A (DRSR)			Clinic B (VKDRSR)		
	Past	Present	Future	Past	Present	Future
Being Non-judgmental	1	5*	10*	2	3	5
Intention	3	9*	10	5	8	10
Uncertainty	1	9*	10*	2	4	5
Active Listening	2	9*	10*	4	7	9
Congruence	3	9*	10	5	8	10
Intuition	2	8*	9	4	7	9
Reflective Practice	2	9*	10	4	7	10
Meaning/Purpose	3	9*	10	4	7	10
Decision Making	5	7*	9	3	6	10*
Authentic Presence	5	8*	10	2	5	10

\*Indicates higher score

Table 5  
Themes of opinions in participant interviews

Clinic A	Clinic B
Sharing experience; happy and content; open environment; proactive advice seeking; warm relationships; discuss personal issues with colleagues; continuous guided training; gratitude; guiding; respecting colleague opinions; positive future outlook; approachable clinic head	Undefined job profile; pressure to perform; fulfill responsibilities; no training/self-learning; high expectations; conflict within the clinic; lack of support system; torn between two; self-absorbed; politicking; doubtful decisions; freedom to express; friction in relationships

597 Clinic A took personal responsibility for training any  
598 staff in the clinic, whereas the head of Clinic B dele-  
599 gated training duties to other staff that he deemed as  
600 knowledgeable. Both clinics were centered on clear  
601 performance indicators, that is, quality and treatment  
602 standards for their staff, apart from a few restrictions

603 that were enforced in Clinic B, for example, a 'staff  
604 room for doctors only' rule, which seemed divisive.  
605 Another difference between the clinic heads is that  
606 the head of Clinic B had financial interests in the  
607 clinic and had made an investment in the clinic. Addi-  
608 tionally, he had owned a clinic in the past and had

Table 6  
Comparison of means of LBDQ characteristics in the clinics

Characteristics	Clinic A		Clinic B	
	Exp	Actual	Exp	Actual
	Means	Means	Means	Means
Representation*	22.50*	21.25*	19.28	<u>20</u>
Reconciliation*	21.25*	18.5	19.42	18.71*
Tol. Uncertainty	34.62	<u>35.62*</u>	36.14*	34.57
Persuasion	40.12*	38.75*	36.14	35.85
Structure	48.12*	44.75*	45.00	43.42
Tol. Freedom	39.75	36.12	40.14*	<u>40.14*</u>
Role Assumption	43.25*	39.8*	38.71	38.14
Consideration	46.12*	43.12	43.28	<u>44.00*</u>
Production Emph	42.00*	40*	38.71	37.00
Predictive Accuracy*	20.5	19.12	20.85*	20.00*
Integration*	24.25*	22	22.85	22.52*
Superior Orient	42.37	40.87	43.85*	41.71*

\*Indicates higher scores. Indicates meeting or exceeding expectation.

the experience of running an independent clinic. The head of Clinic A had started her career working in clinics and this present position was the first in which she assumed responsibility for an entire clinic.

The head of clinic B is very knowledgeable and experienced, whereas the head of Clinic A is knowledgeable, but her experience is limited. Demographically, there is a 12-year age difference between the two clinic heads, in addition to the gender difference. Another observation that was made is that the head of Clinic A exuded empathic intelligence [30], which was clearly missing in the head of Clinic B. Some of the staff of Clinic A had mentioned that they had observed a change in the behavior of their clinic head, her behavior becoming more appreciative. This change in behavior could be attributed to the maternal instincts of the clinic head, who had in the recent past given birth [32]. An observation of behavior of mothers at workplaces pre and post-natal, reported a shift of mothers behaviour towards becoming more compassionate [32]. This is attributed to oxytocin that is produced during childbirth and lactation [46] and that increases parasympathetic activity [50]. Raising the parasympathetic activity is linked to increased HRV [43, 44, 57] and to the reduction of anxiety or stress. From what has been observed above, the head of clinic A clearly has an advantage over her counterpart. One of the key points to consider is that although independent and responsible learning conditions may be good, it is necessary to understand what the staff wants in the first place. From the experience of the researcher, it seems that the head of Clinic B needs

to have a dialogue with his staff regarding the functioning and needs of the clinic. These are the key differences in profiles and working styles between the heads of these two clinics.

#### 4.5. Difference in performance parameters

The clinic performance factors were collected from the HR and Finance department. Table 8 indicates a clear advantage as regards training period, income, unscheduled leaves and equipment wastage.

## 5. Discussion

The results from the Rickter interviews, HRV data, LBDQ questionnaire and the researcher's experience in both clinics were compared.

### 5.1. Linearity in findings

From the VAS results of the Rickter interviews it was noticed that the participants in Clinic A exhibited higher scores of embodied leadership attributes than their counterparts in clinic B. Similarly, the leader of clinic A exhibited higher scores than the leader of clinic B. From the narratives of the Rickter interviews, clinic A was able to garner more positive themes than clinic B. Correlation between physiology and subjective experience (embodied leadership attributes) was achieved when the HRV results showed that participants of clinic B were more

Table 7  
Themes obtained from researcher's diary

Clinic A	Clinic B
<p>Young clinic; organized commotion; operational control; friendly, helpful and empathetic; cooperative and consensual; genuine action to instructions; domestic issues are shared; proactive; purpose motivated; ceding ignorance; 'going out of the way' behavior; role-switching with ease; experienced and critical; enthusiastic and curious; learners and involved; clinic head takes responsibility of training; assurance of improvement following bad performance; open to feedback; confidence; no restrictions in clinic; collective professionalism; clinic head heavily involved during the clinic's foundation years.</p>	<p>Junior doctors train the staff; high expectations; divisive; cooperative staff; shallow behavior; young clinic; resourceful clinic head; duty concerned and enthusiastic staff; rift between clinic head and senior doctor; staff seemed a little untrained; good teamwork; no personal support system; caught between two sides; no rapport with patients; need for soft skills training; requires support system; elitist ('staff room for doctors only' rule)</p>

Table 8  
Difference in performance parameters in the clinics

Performance factors	Case A	Case B
Operational errors	2	2
Total sick days	19	32
Income	Advantage	Disadvantage
Average training period	16	21
Equipment wastage	Advantage	Disadvantage

stressed than the participants of clinic A. There was also a significant difference between the HRV data of the leaders of both clinics, where the leader of clinic A was less stressed than her counterpart in clinic B. The LBDQ questionnaire revealed that the subordinates were satisfied with their respective leaders. However, in clinic A, a reverse Pygmalion effect occurred whereby the subordinates expected more from their leader, which was due to her good performance in the recent past.

The themes from the researcher's experience in the clinics also favoured clinic A and the themes gathered from the researcher's diary closely matched the themes from the narratives of the Rickter interviews. Other aspects brought forward were the working styles and beliefs of the leaders in both clinics. A key revelation was that the head of clinic A followed a mentoring approach in the clinic, taking ownership of the development of her staff at every step. The head of clinic B took a self-sufficiency approach in

which he believed that the staff was mature enough to understand the world and its members could be left to fend for themselves. Lastly, it could be concluded that clinic A was physiologically and cognitively more efficient than clinic B; there exist significant correlation between the physiological, behavioral and social domains of leadership.

## 5.2. Strengths and limitations

This work has had its own set of challenges. Owing to time and financial restrictions, only two clinics were studied. Cultural differences could affect the generalizability. The authors believe that a wider selection of cases would have provided richer data. Although case studies are useful in understanding the culture and behavior of groups, one of the primary limitations is the sample size involved in the case. Most case studies have a general sample size of four participants and are extremely limited [47]. As fourteen participants in total volunteered to take part in the present research, the sample was limited to seven participants from each clinic. Additionally, baseline HRV measures were not taken as this was performed as a pilot experiment. A longitudinal study using similar methods has high potential to bring forward richer data and thus generalizability of this research. The sample size also restricted the statistical analysis. There is the opportunity to use statistical functions to analyze the data set by applying a logarithmic

function, but this compromises the integrity of the data by data transformations, which further skews an already small sample. Thus triangulation and comparison of means was used during analysis of the cases, which is the heart of mixed methods [27] and research was driven by its aims [11].

The key strength of this research is the integrated framework of study and mixed methodology. In all aspects of data analysis, statistical manipulations were avoided and were replaced by triangulations and differentiating the means. Triangulations were carried out between the relationships of HRV and leadership attributes in leaders and their subordinates. This is the perspective grounded in the theory of autopoiesis and a generative approach to leadership. Although this is a short-term study, it provides a gateway for further research to be performed using longitudinal methodologies. Most case studies in organizations involve an external agent coming in and performing research. This may present a threat or engender a lack of trust with the employees and the data collected could thus be biased or inaccurate. In this case, however, the researcher had time to establish rapport with the organization, thus creating a sense of open dialogue with the participants and, as expected, the quality of the data was therefore consistent and reliable. The framework of study was able to identify the differences in the leadership landscape and performance of the two clinics.

### 5.3. Implications

Theory of autopoiesis proposes that the quality of human experience, cognition and action, are determined by the interplay between the internal dynamics (biological processes) and the environment (social and other) of an active situated human agent, and thus offers an alternative perspective to interpreting and enacting leadership capability [48, 69]. Leadership appears as both deeply personal and inherently collective and may be defined as shaping 'life-enhancing' conditions [70]. This requires focus on the 'common good' for the individual human agent to flourish [23, 48].

From the perspective of autopoiesis and theory of complex systems, the phenomenal domain of human enterprises is realized through the network of interactions between the human actors [41, 48]. Such networks through the interactions of local agents are capable of spontaneous self-organization, to produce emergent patterns of behaviors of the network with-

out any prior comprehensive, system wide blueprint for the evolution of the system [69]. The immediate local 'intentions' of the interacting human actors are continually emerging in a context.

This paper suggests that the quality of 'intentions' and quality of 'interactions' are interlinked, and effective leadership is distributed and impacted by both the structure of the system and its emergent properties, i.e. trust, wellness, sustainability, as well as, by the individual intent, morality, creativity and motivation.

Research into conditions and models of governance that promote collegial decision making also implies that both quality of awareness, emotional intelligence and morality of individual actors, as well as, the structure of the interactions, will need to be attended in parallel for catalyzing leadership [23, 82].

This paper also brings into focus the 'embodied' aspect of leadership [71]. Behavior is interlinked with both biological processes and responses to environmental triggers [68]. It is thus important to take into account measures of the 'invisible' aspects of cognition that are impacted by the function of the nervous system, i.e. Heart Rate Variability [14, 43, 58], etc.

Additional research using similar methods and indicators, but a larger and more diverse sample could improve the understanding of the dynamics of leadership behavior and produce statistical results that are significant. While this study uses Heart Rate Variability as a physiological measure, it would be interesting to look at cortisol profile as stress marker and also identify different physiological indicators that can recognize its relationship with leadership behaviors.

The team welcomes an open dialogue with other researchers in order to further develop a holistic framework of understanding leadership in organizations.

### References

- [1] M. Ardizzi, F. Martini, M.A. Umiltà, M. Sestito, R. Ravera and V. Gallese, When early experiences build a wall to others' emotions: An electrophysiological and autonomic study, *PLoS ONE* 8(4) (2013).
- [2] B.M. Bass, Transformational leadership: Industrial, military, and educational impact, Lawrence Erlbaum Associates, Mahwah, NJ, (1998).
- [3] B.M. Bass and B.J. Avolio, Transformational leadership development: Manual for the multifactor leadership questionnaire, Consulting Psychologists Press, Palo Alto, CA, (1990).
- [4] R.F. Baumeister and M.R. Leary, The need to belong: Desire for interpersonal attachments as a fundamental human motivation, *Psychological Bulletin* 117(3) (1995), 497–529.

- 814 [5] W.H. Bommer, R.S. Rubin and T.T. Baldwin, Setting the  
815 stage for effective leadership: Antecedents of transfor-  
816 mational leadership behavior, *The Leadership Quarterly*  
817 **15**(2) (2004), 195–210. DOI: 10.1002/job.342. Retrieved  
818 on 21/05/2014.
- 819 [6] J.E. Bono and R. Ilies, Charisma, positive emotions and  
820 mood contagion, *The Leadership Quarterly* **17**(4) (2006),  
821 317–334. doi: 10.1016/j.leaqua.2006.04.008. Retrieved on  
822 2/2/2014.
- 823 [7] R. Boyatzis and A. McKee, *Resonant Leadership: Renewing*  
824 *Yourself and Connecting with Others Through Mindfulness.*  
825 *Hope, and Compassion*, Harvard Business School Press,  
826 Boston, MA (2005).
- 827 [8] R.E. Boyatzis, M.L. Smith and N. Blaize, Develop-  
828 ing sustainable leaders through coaching and compas-  
829 sion, *Academy of Management Learning & Education*  
830 **5**(1) (2006), 8–24. doi:10.5465/AMLE.2006.20388381.  
831 Retrieved on 21/12/2013.
- 832 [9] R.E. Boyatzis, A. Passarelli, K. Koenig, M. Lowe, B.  
833 Matthew, J. Stoller and M. Phillips, Examination of neural  
834 substrates activated in experiences with resonant and dissonant  
835 leaders (2 ed.). *The Leadership Quarterly* **23** (2012),  
836 259–272.
- 837 [10] A. Carmeli, D. Brueller and J.E. Dutton, Learning  
838 behaviors in the workplace: The role of high-quality inter-  
839 personal relationships and psychological safety, *Systems*  
840 *Research and Behavioral Science* **26**(1) (2009), 81–98.  
841 DOI: 10.1002/sres.932. Retrieved on 20/01/2013.
- 842 [11] K. Charmaz, *Constructing grounded theory: A practical*  
843 *guide through qualitative analysis*, Thousand Oaks: Sage.  
844 (2006).
- 845 [12] T.L. Chartrand and R. van Baaren Human mimicry,  
846 *Advances in experimental social psychology*. Academic  
847 Press, London. **41** (2009), 219–274.
- 848 [13] J.A. Coan, H.S. Schaefer and R.J. Davidson, Lending a  
849 hand social regulation of the neural response to threat,  
850 *Psychological Science* **17**(12) (2006), 1032–1039. doi:  
851 10.1111/j.1467-9280.2006.01832.x. Retrieved on 04/09/  
852 2013.
- 853 [14] H. Cohen, M. Kotler, M.A. Matar, Z. Kaplan, U. Loewen-  
854 thal, H. Miodownik and Y. Cassuto, Analysis of heart  
855 rate variability in posttraumatic stress disorder patients  
856 in response to a trauma-related reminder, *Biological Psy-*  
857 *chiatry* **44**(10) (1998), 1054–1059. DOI: 10.1016/S0006-  
858 3223(97)00475-7. Retrieved on 01/11/2012.
- 859 [15] J.A. Conger, R.N. Kanungo, and S.T. Menon, Charismatic  
860 leadership and follower effects, *Journal of Organizational*  
861 *Behavior* **21**(7) (2000), 747–767. DOI: 10.1002/1099-  
862 1379(200011)21:7<747::AID-JOB46>3.0.CO;2-J.  
863 Retrieved on 20/02/2014.
- 864 [16] M.T. Dasborough, Cognitive asymmetry in employee  
865 emotional reactions to leadership behaviors, *The Lead-*  
866 *ership Quarterly* **17**(2) (2006), 163–178. DOI: 10.1016/  
867 j.leaqua.2005.12.004. Retrieved on 30/11/2/13.
- 868 [17] J.E. Dutton, *Energize your workplace: How to create and*  
869 *sustain high-quality connections at work*. San Francisco:  
870 Jossey-Bass (2003).
- 871 [18] D. Eden, Leadership and Expectations: Pygmalion  
872 Effects and other self-fulfilling prophecies in organiza-  
873 tions, *The Leadership Quarterly* **3**(4) (1992), 271–305.  
874 DOI: 10.1016/1048-9843(92)90018-B. Retrieved on  
875 20/08-2013.
- [19] S. Einarsen, M.S. Aasland and A. Skogstad, Destructive  
876 leadership behavior: A definition and conceptual model,  
877 *The Leadership Quarterly* **18**(3) (2007), 207–216. DOI:  
878 10.1016/j.leaqua.2007.03.002. Retrieved on 30/09/2013.  
879
- [20] M.C. Escher, *Hand in Reflecting Sphere*. Lithograph Print.  
880 (1935).  
881
- [21] J.K. Fletcher, Leadership, Power, and Positive Relation-  
882 ships. In Dutton, J. E. & Ragins, B. R. (Ed),. Exploring  
883 positive relationships at work: Building a theoretical and  
884 research foundation. LEA's organization and management  
885 series., (pp. 347–371). Mahwah, NJ, US: Lawrence Erlbaum  
886 Associates Publishers, xxi, (2006), pp.421  
887
- [22] P.J. Frost, Handling Toxic Emotions: New Challenges  
888 for Leaders and their Organization, *Organizational*  
889 *Dynamics* **33**(2) (2004), 111–127. Doi: 10.1016/j.orgdyn.  
890 2004.01.001. Retrieved on 20/10/2013.  
891
- [23] N.C. Georgantzias, Politicia: A high-technology human system,  
892 *Human Systems Management* **34**(2) (2015), 91–104.  
893 DOI: 10.3233/HSM-150828. Retrieved on 28/06/2016.  
894
- [24] C.R. Gerstner and D.V. Day Meta-Analytic review of  
895 leader–member exchange theory: Correlates and construct  
896 issues. *Journal of Applied Psychology* **82**(6) (1997), 827.  
897 doi: 10.1037/0021-9010.82.6.827. Retrieved on 25/09-2013  
898
- [25] D. Goleman, A. McKee and R. Boyatzis, Primal leader-  
899 ship: Realizing the power of emotional intelligence. Boston,  
900 Mass.: Harvard Business School Press (2002).  
901
- [26] R. Goodman, Psychometric properties of the strengths  
902 and difficulties questionnaire, *Journal of the American*  
903 *Academy of Child & Adolescent Psychiatry* **40**(11)  
904 (2001), 1337–1345. doi:10.1097/00004583-200111000-  
905 00015. Retrieved on 02/06/2013.  
906
- [27] H. Harung, T. Fred, B. Warren and D. Heaton, Higher  
907 development, brain integration, and excellence in leader-  
908 ship, *Management Decision* **47**(6) (2009). Retrieved on  
909 10/04/2014.  
910
- [28] E.D. Heaphy and J.E. Dutton, Positive social interactions  
911 and the human body at work: Linking organizations and  
912 physiology, *Academy of Management Review* **33**(1) (2008),  
913 137. doi:162. 10.5465/AMR.2008.27749365. Retrieved on  
914 08/08/2013.  
915
- [29] D. Hughes, The Rickter Scale: Making a Difference, Avail-  
916 able at <http://tinyurl.com/msaoc3v> (2010).  
917
- [30] F. Ioannidou and V. Konstantikaki, Empathy and emotional  
918 intelligence: What is it really about?, *International Journal*  
919 *of Caring Sciences* **1**(3) (2008), 118–123.  
920
- [31] J.K. Kiecolt-Glaser and T.L. Newton, Marriage and health:  
921 His and hers. *Psychological Bulletin* **127**(4) (2001),  
922 472. DOI: 10.1037//0033-2909.127.4.472. Retrieved on  
923 6/10/2013.  
924
- [32] C.H. Kinsley and K.G. Lambert, The Maternal  
925 Brain, *Scientific American* **294**(1) (2006), 72–79. doi:  
926 10.1038/scientificamerican0106-72. Retrieved on 21/11/  
927 2013.  
928
- [33] S.R. Komives, N. Lucas and T.R. McMahon, Exploring  
929 leadership: For college students who want to make a dif-  
930 ference, John Wiley & Sons (2009).  
931
- [34] M. Kouzakova, R. van Baaren and A. van Knippen-  
932 berg, Lack of behavioral imitation in human interactions  
933 enhances salivary cortisol levels, *Hormones and Behavior*  
934 **57**(4) (2010), 421–426. doi: 10.1016/j.yhbeh.2010.01.011.  
935 Retrieved on 20/04/2014.  
936

- 937 [35] J.M. Kouzes and B.Z. Posner, The truth about leadership:  
938 The no-fads, heart-of-the-matter facts you need to know,  
939 Chichester: John Wiley (2010).
- 940 [36] K. Koya, An autopoietic perspective of understanding and  
941 developing leadership. PhD Thesis. Northumbria Univer-  
942 sity, Newcastle-upon-Tyne (2014).
- 943 [37] K. Koya, J. Anderson, P. Sice and R. Kotter, Attributes of  
944 Embodied Leadership. *Human Systems Management* **4**(5)  
945 (2015), (In Press).
- 946 [38] J.M. Lilius, M.C. Worline, S. Maitlis, J. Kanov, J.E.  
947 Dutton and P. Frost, The contours and consequences of  
948 compassion at work, *Journal of Organizational Behavior*  
949 **29**(2) (2008), 193–218. DOI: 10.1002/job.508. Retrieved on  
950 01/12/2013.
- 951 [39] J. Lipman-Blumen, *Connective leadership: Managing in a*  
952 *changing world*, Oxford University Press (2000).
- 953 [40] J.L. Locher, *The Magic of M. C. Escher*, Harry N. Abrams:  
954 New York (2000).
- 955 [41] D. Large, P. Sice, G. O'Brien, S. Mansi, R. Geyer, Complex  
956 Processes and Complex Systems: A Synergy of Perspec-  
957 tives, *International Journal of Systems and Society* (2015),  
958 ISSN 2327-3984.
- 959 [42] J.B. Lyons and T.R. Schneider, The effects of leadership  
960 style on stress outcomes, *The Leadership Quarterly* **20**(5)  
961 (2009), 737–748. DOI: 10.1016/j.leaqua.2009.06.010.  
962 Retrieved on 11/06-213.
- 963 [43] M. Malik, Heart Rate Variability: Standards of Mea-  
964 surement, Physiological Interpretation, and Clinical Use,  
965 *Circulation: American Heart Association* **93** (1996),  
966 1043–1065. doi: 10.1161/01.CIR.93.5.1043. Retrieved on  
967 02/06-2010.
- 968 [44] O. Manfrini, C. Pizzi, D. Trere, F. Fontana and R.  
969 Bugiardini, Parasympathetic failure and risk of subsequent  
970 coronary events in unstable angina and non-ST-segment  
971 elevation myocardial infarction, *European Heart Journal*  
972 **24**(17) (2003), 1560–1566. Retrieved on 29/10/2010.
- 973 [45] C.D. Marci, J. Ham, E. Moran and S.P. Orr, Physiologic  
974 correlates of perceived therapist empathy and social-  
975 emotional process during psychotherapy, *The Journal of*  
976 *Nervous and Mental Disease* **195**(2) (2007), 103–111.  
977 DOI: 10.1097/01.nmd.0000253731.71025.fc. Retrieved on  
978 02/04/2011.
- 979 [46] E.N. Marieb, *Human Anatomy and Physiology*. 5 edn, Ben-  
980 jamin Cummings, London, 2001.
- 981 [47] M. Mason, Sample size and saturation in PhD stud-  
982 ies using qualitative interviews, In *Forum Qualitative*  
983 *Sozialforschung/Forum: Qualitative Social Research* **11**(3)  
984 (2010).
- 985 [48] H.R. Maturana and F.J. Varela, *The tree of knowledge:*  
986 *The biological roots of human understanding*, New Science  
987 Library/Shambhala Publications (1987).
- 988 [49] J.B. Miller and I.P. Stiver, *The healing connection: How*  
989 *women form relationships in therapy and in life*. Beacon  
990 Press (1997).
- 991 [50] K.U. Moberg and M. Petersson, Oxytocin, a mediator of  
992 anti-stress, well-being, social interaction, growth and heal-  
993 ing, *Journal of Psychosomatic Medicine and Psychotherapy*  
994 **51**(1) (2005), 57–80. doi: 10.1371/journal.pone.0005523.  
995 Retrieved on 06/2/2011.
- 996 [51] S. Nadin and C. Cassell, The use of a research diary as a tool  
997 for reflexive practice: Some reflections from management  
research, *Qualitative Research in Accounting & Manage-*  
998 *ment* **3**(3) (2006), 208–217. Retrieved on 14/07/2011.  
999
- [52] National Instruments. (2012) Using LABView for Heart  
1000 Rate Variability Analysis. Available at <http://www.ni.com/example/30832/en/>.  
1001  
1002
- [53] I. Nonaka and H. Takeuchi *The knowledge-creating com-*  
1003 *pany: How Japanese companies create the dynamics of*  
1004 *innovation*, Oxford University Press, Oxford, 1995.  
1005
- [54] W. Outhwaite and S.P. Turner, *Social Science Methodology*,  
1006 Sage, London, 2007.  
1007
- [55] A. Padilla, R. Hogan, and R.B. Kaiser, The toxic triangle:  
1008 Destructive leaders, susceptible followers, and conducive  
1009 environments, *The Leadership Quarterly* **18**(3) (2007),  
1010 176–194. doi: 10.1016/j.leaqua.2007.03.001. Retrieved on  
1011 06/04/2012.  
1012
- [56] M.A. Patriquin, A. Scarpa, B.H. Friedman and S.W. Porges,  
1013 Respiratory sinus arrhythmia: A marker for positive social  
1014 functioning and receptive language skills in children with  
1015 autism spectrum disorders, *Developmental Psychobiology*  
1016 **55**(2) (2013), 101–112. doi: 10.1002/dev.21002. Retrieved  
1017 on 16/11-2013.  
1018
- [57] A.M. Pellizzer, N.E. Straznicki, S. Lim, P.W. Kamen and  
1019 H. Krum, Reduced dietary fat intake increases parasympa-  
1020 thetic activity in healthy premenopausal women, *Clinical*  
1021 *Experimental Pharmacology and Physiology* **26**(8) (1999),  
1022 656–660. Retrieved on 8/8-2011.  
1023
- [58] S.W. Porges, The polyvagal theory: New insights into adap-  
1024 tive reactions of the autonomic nervous system, *Cleveland*  
1025 *Clinic Journal of Medicine* **76**(2) (2009), 586–590. doi:  
1026 10.3949/cejm.76.s2.17. Retrieved on 14/02/2011.  
1027
- [59] G.E. Prinsloo, W.E. Derman, M.I. Lambert and L.  
1028 Rauch, The effect of single session of short duration  
1029 biofeedback-induced deep breathing on measures of heart  
1030 rate variability during laboratory-induced cognitive stress:  
1031 A pilot study, *Applied Psychophysiology and biofeedback*  
1032 **38**(1) (2013). DOI: 10.1007/s10484-013-9210-0. Retrieved:  
1033 06/12/2013.  
1034
- [60] J.O. Prochaska, J. Norcross and C.C. DiClemente *Changing*  
1035 *for good: The revolutionary program that explains the six*  
1036 *stages of change and teaches you how to free yourself from*  
1037 *bad habits*, New York, Morrow, 1994.  
1038
- [61] R.W. Quinn and J.E. Dutton, Coordination as energy-  
1039 in-conversation, *Academy of Management Review* **30**(1)  
1040 (2005), 36–57. Retrieved on 6/6/2011.  
1041
- [62] U.D. Reips and F. Funke, Interval-level measurement with  
1042 visual analogue scales in Internet-based research: VAS Gen-  
1043 erator, *Behavior Research Methods* **40**(3) (2008), 699–704.  
1044 Retrieved on 13/03/2010.  
1045
- [63] L.M. Roberts, From proving to becoming: How posi-  
1046 tive relationships create a context for self-discovery and  
1047 self-actualization. Exploring positive relationships at work:  
1048 Building a theoretical and research foundation, (2007),  
1049 29–45.  
1050
- [64] J. Rowold and L. Laukamp, Charismatic leadership  
1051 and objective performance indicators, *Applied Psy-*  
1052 *chology* **58**(4) (2009), 602–621. DOI: 10.1111/j.1464-  
1053 0597.2008.00365.x. Retrieved on 21/09/2011.  
1054
- [65] J.P. Saul, P. Albrecht, R.D. Berger and R.J. Cohen 'Analysis  
1055 of long-term heart rate variability: Methods, 1/f scaling and  
1056 implications', *Computers in Cardiology*, IEEE Computer  
1057 Society, Washington, DC, (1988), 419–422.  
1058



- 1059 [66] J. Schaubroeck, F.O. Walumbwa, D.C. Ganster, and S. 1089  
 1060 Kepes, Destructive leadertraits and the neutralizing influ- 1090  
 1061 ence of an “enriched” job, *The Leadership Quarterly* **18**(3) 1091  
 1062 (2007), 236–251. DOI: 10.1016/j.leaqua.2007.03.006.  
 1063 Retrieved on 25/1/2013.
- 1064 [67] C. Senior, N. Lee and M. Butler, Organizational Cogni- 1092  
 1065 tive Neuroscience, *Organization Science* **22**(3) (2011), 1093  
 1066 804–815. <http://dx.doi.org/10.1287/orsc.1100.0532>. 1094  
 1067 Retrieved on 05/01-2014.
- 1068 [68] P. Sice and I. French, (2004), Understanding Humans and 1095  
 1069 Organizations – Philosophical Implications of Autopoiesis, 1096  
 1070 *Journal of Philosophy of Management, Special Issue on* 1097  
 1071 *Organization and Decision Processes* **4**(1) (2004), 55–66.
- 1072 [69] P. Sice and I. French, A Holistic Frame of Reference for 1098  
 1073 Modelling Social Systems, *Kybernetes*, ISSN 0368-492X, 1099  
 1074 **35**(5–10).
- 1075 [70] P. Sice, K. Koya and S. Mansi, Leadership capability: An 1100  
 1076 autopoietic perspective, *Human Systems Management* **32**(2) 1101  
 1077 (2013), 95–103. DOI: 10.3233/HSM-130790. Retrieved on 1102  
 1078 29/01/2014.
- 1079 [71] R.E. Stake, *Qualitative research: Studying how things work*, 1103  
 1080 New York: Guildford Press (2010).
- 1081 [72] C. Stall-Meadows and A. Hyle, Procedural methodology 1104  
 1082 for a grounded meta-analysis of qualitative case studies, 1105  
 1083 *International Journal of Consumer Studies* **34**(4) (2010), 1106  
 1084 412–418. DOI: 10.1111/j.1470-6431.2010.00882.x. 1107  
 1085 Retrieved on 06/10-2011.
- 1086 [73] K. Steinar and S. Brinkmann, *Learning the craft of* 1108  
 1087 *qualitative research interviewing*, Thousands Oaks: Sage 1109  
 1088 Publications (2009).
- [74] R.M. Stogdill, *Manual for leadership Behavior Develop- 1089  
 ment Questionnaire*. Chicago, Fisher College of Business, 1090  
 Ohio State University (1963).
- [75] A.L. Strauss and J.M. Corbin, *Basics of qualitative research: 1092  
 Techniques and procedures for developing grounded theory*, 1093  
*Los Angeles: Sage* (2008). 1094
- [76] B.J. Tepper, Consequences of abusive supervision, *Academy 1095  
 of Management Journal* **43**(2) (2000), 178–190. DOI: 1096  
 10.2307/1556375. Retrieved on 15/4/2011. 1097
- [77] F.J. Varela, E. Thompson and E. Rosch, *The Embodied 1098  
 Mind*. The MIT Press, Cambridge, (1995). 1099
- [78] F. Yammarino, Leadership Past, Present, and Future, *Jour- 1100  
 nal of Leadership & Organizational Studies* **20**(2) (2013), 1101  
 149–155. DOI: 10.1177/1548051812471559. Retrieved on 1102  
 04/2/2014. 1103
- [79] R.K. Yin, *Case study research: Design and methods*. Thou- 1104  
 sand Oaks: Sage (2009). 1105
- [80] R.K. Yin, *Applications of case study research*. Thousand 1106  
 Oaks: Sage (2012). 1107
- [81] G.A. Yukl, *Leadership in organizations*. New Jersey: Pren- 1108  
 tice Hall (2010). 1109
- [82] M. Zeleny, Machine/organism dichotomy of free-market 1110  
 economics: Crisis or transformation? *Human Systems Man- 1111  
 agement* **29**(4) (2010), 191–204. 1112
- [83] M. Zeleny, *Human Systems Management: Integrating 1113  
 Knowledge, Management and Systems*. Hackensack 1114  
 (NJ):World Scientific (2005). 1115