Explanatory Framework for Well-Being Theories:

Systematic, Comprehensive, Persistent

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Abstract

Well-being is a broad construct widely acknowledged for being multidimensional, multidisciplinary and dynamic in nature. There is a growing need for a framework to assist in building comprehensive theories providing an explanation for well-being outcomes. In this thesis, a systems approach to well-being theories is proposed following research traditions in personality and organizational psychology and other disciplines. In these latter domains, a systems approach has provided many benefits including increased understanding of complex phenomena and theory formalization. Using conceptual analysis, systems theory is applied as a framework to develop five principles for building and evaluating theories of well-being: a well-being system framework. The principles are then applied to evaluate two integrative well-being frameworks: the engine of well-being (Jayawickreme, Forgeard, & Seligman, 2012) and the four qualities of life (Veenhoven, 2000). The theoretical contribution of this thesis is an explanatory framework aiming to guide theory development by suggesting components that a theory requires to explain well-being. The well-being system framework aims to open new avenues for research using a systems theory approach to assist in developing comprehensive models of well-being.

Statement of Originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Myriam Pitre

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The question as to whether well-being can change has been investigated by scholars of diverse disciplines and the answer is generally agreed to be in the affirmative (Sheldon & Lucas, 2014b). However, as Diener (2014) remarks, that well-being can change does not entail that well-being can be purposefully and lastingly improved. The next question, *how* can well-being can be purposefully and lastingly improved, is still very contentious and the object of a lively scholarly debate (Sheldon & Lucas, 2014a). Lyubomirsky and colleagues express the sentiment: “Unfortunately, however, relatively little scientific support exists for the idea that people’s happiness levels can change for the better” (Lyubomirsky, Sheldon, & Schkade, 2005, p. 112). To answer the change question, we need “an integrated understanding of change” (Røysamb, Nes, & Vittersø, 2014, p. 28).

As there is no consensus on how well-being should be defined or measured (Dodge, Daly, Huyton, & Sanders, 2012), let alone spelt, the working definition of well-being in this thesis is an inclusive one as to not limit any well-being definitions that may stem from the framework proposed. Ryan & Deci (2001) suggested that individual well-being can be viewed from two viewpoints: hedonic and eudaimonic. Hedonic well-being refers to affective aspects while eudaimonic well-being refers to what Aristotle called *the good life*, focusing on full functionality and virtues. Another commonly used definition is subjective well-being (SWB) which includes life satisfaction, positive affect, and the lack of negative affect (Diener, 1984). In social sciences, the term quality of life is used with a global meaning for well-being. Unless a specific meaning is stated, the working definition of well-being in this thesis relates to well-being of the individual in the global sense, inclusive of subjective and objective aspects.

A New Paradigm is Needed

The dominant theoretical paradigm for subjective well-being (SWB) over the last three decades has been set-point theory or one of its variants (Headey, 2010). Set-point theory "essentially claims that set-points are near-automatic consequences of hereditary characteristics" (Headey, 2008, p. 213). Set-point theory has strongly influenced research in the direction of SWB stability and its exceptions (Headey, Muffels, & Wagner, 2014). Empirical studies have demonstrated how resistant to change SWB is at the population level (Cummins, 2010; Cummins, Li, Wooden, & Stokes, 2014). Individuals also appear to return to their set-point or close to it after negative life events (e.g., Lucas, Clark, Georgellis, & Diener, 2003) and even positive life events (e.g., Brickman, Coates, & Janoff-Bulman, 1978; Clark & Georgellis, 2013).

The set-point paradigm has been supported by genetic and twin studies where SWB has been found to be highly heritable (Bartels & Boomsma, 2009; Lykken & Tellegen, 1996; Nes, Røysamb, Tambs, Harris, & Reichborn-Kjennerud, 2006). In a recent summary of genetic findings on SWB (Nes & Røysamb, 2016), the genetic influences on SWB have been estimated at 32 – 40% while the heritability of its stable component has been estimated in the 70 – 80% range. However, authors conducting panel studies have suggested that a significant minority experience a significant change of SWB over time (Headey & Muffels, 2017; Headey et al., 2014) and that certain life events cause SWB to change without completely returning to the set-point (Lucas, 2007; Lucas, Clark, Georgellis, & Diener, 2004). Some attempts have been made to revise set-point theory by suggesting the addition of several set-points (Diener, Lucas, & Scollon, 2006) or a set-point range (Cummins, 2014). Although set-point theory seems to explain some aspects of well-being, it appears to be a limited paradigm for the study of well-being (Headey, 2010).

Additionally, numerous factors have been found to have an influence on SWB like personality (Headey & Wearing, 1989), life goals (Headey, 2008), life events (Lucas, 2007; Lucas et al., 2004), intentional activities (Lyubomirsky et al., 2005), and age (Keyes, Shmotkin, & Ryff, 2002). Therefore, as Diener (2014) noted, further research needs to conducted to find how all these factors related to each other.

Interestingly, well-being interventions do not always work as planned. Although non-zero sum life goals (Headey, 2008) or intentional activities (Lyubomirsky et al., 2005; Sheldon & Lyubomirsky, 2006) can improve well-being for some time, the individual continuously needs to vary the positive activities (Sheldon, Boehm, & Lyubomirsky, 2013) and be committed to the improvement (Lyubomirsky, Dickerhoof, Boehm, & Sheldon, 2011) for well-being benefits to sustain. And even if an intentional positive activity is performed exactly as it should, well-being may not be improved or the improvement may not be persistent (Sheldon & Lyubomirsky, 2007). There appears to be a complex mix of factors underlying the dynamics of well-being.

The stability of well-being is considered desirable if it increases resilience when negative life events challenge it (Cummins & Wooden, 2014) but it is seen as an obstacle to overcome when the objective is a purposeful and persistent enhancement of well-being. Critics of the set-point paradigm argue that a new paradigm is needed to investigate lasting well-being improvements (e.g., Headey, 2010). The set-point paradigm has influenced research in the direction of stability, but what is now needed is a framework to influence well-being research in the direction of persistent and purposeful improvements (Headey, 2010; Headey et al., 2014).

Toward a Comprehensive Understanding of Well-being

A new theoretical framework is necessary to capture the complex causality structure of well-being and account for its remarkable stability. It also needs to provide adequate analytical tools to develop a theoretical explanation for lasting well-being improvements. A comprehensive explanation of the contributing factors to well-being would help hypothesize the conditions necessary to cause well-being to get over the tipping point and break the resistance to change, and to stabilize well-being at a new improved level (Diener, 2014).

Additionally, individual differences would also need to be adequately explained as some say that they have been downplayed by some researchers (Headey, 2010). Some marked individual differences have been found in response to major life events (Mancini, Bonanno, & Clark, 2011). The results suggest that individuals with higher levels of SWB prior to a positive or negative major event showed increased resilience: their well-being levels remained high throughout. Some positive interventions can even backfire for different individuals or people of a different culture (Layous et al., 2017; Layous, Lee, Choi, & Lyubomirsky, 2013). A comprehensive explanation of well-being should also explain why some interventions might fit some individuals better than others (Sheldon & Lyubomirsky, 2004).

An adequate framework for a comprehensive understanding of well-being should also provide tools for both the integration and differentiation of well-being aspects and disciplines (Dodge et al., 2012; Jayawickreme et al., 2012; Veenhoven, 2000). For example, an integrative framework could reconciliate the subjective well-being perspective (e.g., SWB, happiness, hedonic aspects) and the objective perspective (e.g., eudaimonic aspects, prosocial behaviour, non-zero sum life goals) of well-being (Veenhoven, 2000).

A review was conducted on quality of life indexes by Hagerty et al. (2001) to determine the validity and usefulness of quality of life indexes to public policy. Hagerty and colleagues remarked that none of the 22 most-used quality of life indexes were based on structured theories and recommended a systems approach. Several researchers have suggested the importance of more comprehensive theories of well-being hypothesizing the processes underlying well-being (Headey & Muffels, 2016; Headey et al., 2014; Rusk, Vella-Brodrick, & Waters, 2017), their moderators (Bartels & Boomsma, 2009; e.g., Hill, Mroczek, & Young, 2014; Lykken & Tellegen, 1996), and mediators (Lyubomirsky et al., 2011; Rickard & Vella-Brodrick, 2014; Sheldon et al., 2013).

Systems Theory as a Conceptual Framework

Systems theory is a potential framework to guide theory building for a comprehensive explanation of well-being. Systems theory is the study of system components in interactions between themselves and the environment (Bertalanffy, 1968a). Systems theory has provided a robust framework for the development and formalization of theories in personality psychology (e.g., Cramer et al., 2012; Mischel & Shoda, 1995; Shoda, LeeTiernan, & Mischel, 2002), and organizational psychology (Kozlowski & Klein, 2000; Weinhardt & Vancouver, 2012). Pioneering efforts have recently been made to apply it to well-being change (Rusk et al., 2017). However, systems theory has not yet been widely adopted in well-being theory development beyond these preliminary efforts.

Applied to understanding well-being, system theory would involve the study of dynamic interactions of individuals with their internal factors (e.g., life satisfaction, affect, genetics), and external factors (e.g., life events, employment, relationships). Thus, the different aspects of well-being could be conceptualized as internal or external outcomes of a system. Systems theory offers a great array of theoretical, analytical, graphical, and conceptual tools which may be beneficial to well-being investigations.

What is a Theory

A theory is hereby defined as a system of four main elements: (1) propositions defining the components or variables, (2) propositions delimiting the boundaries of the theory, (3) propositions defining the laws of interaction between the components or variables, and (4) testable hypotheses or predictions (Wacker, 1998). By defining the variables, domain, and laws of interactions, a theory can provide an explanation for predictable and testable outcomes (Bunge, 1967; Wacker, 1998). In other words, “a theory may be viewed as a system of constructs and variables in which the constructs are related to each other by propositions and the variables are related to each other by hypotheses” (Bacharach, 1989, p. 498). The theory should thus provide an adequate explanation for why and how a certain phenomenon occurs (Bunge, 1967; Wacker, 1998). Therefore, an adequate and comprehensive explanation of well-being would require analytical development, for which a systems approach is proposed.

Methodology

The question to be explored in this thesis is whether systems theory can provide a useful framework for the investigation and development of explanatory theories of well-being and its purposeful and persistent improvement.

Two methodologies were considered to approach the development of a framework for explanatory theories of well-being: a typological approach and a systems approach. As the typological approach aims to categorize different aspects of a construct, it can be useful to integrate the multiple aspects of well-being. Two such approaches have already been applied to well-being and will be reviewed in chapters 3 and 4.

System theory was selected as a methodology for this thesis as it can be used to investigate problems of organized complexity (Bertalanffy, 1968a) and build theories (Dubin, 1978). It has the potential to provide an explanatory framework is it has done in many other disciplines like physics, chemistry, and biology (Bertalanffy, 1968a). A systems framework can be used to model and explain dynamical interactions while a typological framework can only highlight dependencies and static relationships. Hence, a system framework appears to be a potentially suitable framework for developing explanatory models of well-being.

The main assumption is that well-being is the outcome of the interaction between components within the person and with the environment in the natural sense. The environment is meant to include everything external to the person.

When defining concepts, Boag (2017) states that reification is a common logical error and consists of "confusing what something *does* with what it *is* [emphasis original]" (p.6). Another common logical error is circular explanation, which occurs when the outcome which is explained (*explanandum*) is described with the same term as the explanation (*explanans*) (Bell & Staines, 2001; Simon Boag, 2017). Interestingly, when using a system representation to study a problem, these logical errors should be avoided as the system description (what it *is*) is represented by the system structure, the explanation is represented by the system processes (*how it works*), and the outcome is the system output. In other words, systems theory offers an adequate framework to distinguish what a system *is* (its *structure*) from *how it works* (its *processes*) and from what is *does* (system *outcome*).

An explanatory framework will be developed to distinguish what well-being *is* from *how* it works by defining a potential well-being system's structure and processes. Well-being outcomes are defined by what the system *does* and depend on the system structure and processes. This thesis focuses on the structure and processes since it concerns an explanation for well-being. The theoretical outcomes of a well-being system are the variables representing potentially measurable dimensions of well-being. The theoretical formulation of outcomes of a well-being system is not covered in this thesis.

Aims of the Present work

The research question is whether a theoretical framework that utilizes systems theory can help guide the development of well-being theories to evolve towards a more comprehensive understanding of well-being and a theoretical explanation for lasting purposeful change.

The first objective is this thesis is to develop a framework which allows a deductive explanation for well-being through guiding principles for theory building based on fundamental properties of systems. The second objective is to provide a comprehensive framework which enables the development of a well-being model explaining both well-being stability and changeability. The third objective is to open avenues of research for persistent purposeful changes in well-being.

The first chapter sets the foundations of systems theory by elaborating on two fundamental properties of a system: its structure and its processes. The second chapter applies this framework to develop a well-being system framework by proposing a set of five principles that every comprehensive theory of well-being should consider. The third and fourth chapters critically analyse two integrative frameworks for well-being concepts: the engine of well-being (Jayawickreme et al., 2012) and the four qualities of life (Veenhoven, 2000). The last chapter is a discussion on the analysis and limitations, and also highlights potential research avenues.

Chapter 1

Systems Theory: Background and Terminology

There are two traditional major approaches for building theories: analytical and empirical (Wacker, 1998). The analytical approach is also called formal science and primarily uses deductive methods to build theories (Wacker, 1998). In contrast, the empirical approach uses inductive methods based on empirical observations to make theories (Wacker, 1998). Some researchers remark that the analytical approach is generally lacking across psychology and suggestions to increase the use of conceptual analysis have been voiced (e.g., Boag, 2011; Michell, 2011; Petocz & Newbery, 2010). Some well-being researchers have also made suggestions that future research should include more analytical approaches (e.g., Diener, 2014; Dodge et al., 2012).

This thesis aims to evaluate a potential analytical approach by using systems theory as a framework for building and evaluating theories of well-being. Thus, this chapter aims to provide a basic review of systems background and define some concepts of systems theory which may be useful in building a theory explaining well-being.

The Systems Perspective

In this thesis, the systems perspective means that a phenomenon can be viewed as a system by investigating its components, their interactions, the characteristics of the system itself, and the system's interactions with the environment. A system is defined as "a set of elements standing in interrelation among themselves and with the environment" (Bertalanffy, 1972, p. 417). According to Bertalanffy (1968a), the system perspective is useful for the study of systems of organized complexity: where the dynamic interplay between the system's components and between the components and environmental factors is complex and multifaceted. However, the systems perspective is not always useful. For example, in a simple cause and effect relationship, the systems perspective would be burdensome and unnecessary. For example, a car's motion can be calculated without a systems approach.

Generally, living systems like humans or animals are considered complex organisms and a systems approach can be useful for their investigation (Bertalanffy, 1968b). Bertalanffy (1968a) proposed general system theory as an alternative paradigm to solve problems of organized complexity, as found in living systems. In Bertalanffy's (1972) own words, "general system theory is a logicomathematical field whose task is the formulation and derivation of those general principles that are applicable to 'systems' in general" (p.11).

General system theory provides a framework of conceptual and analytic tools which facilitate the study of complex organized systems. For example, the system framework includes tools for graphical representation, mathematical formulations, probability predictions, and computer simulations. General system theory has been gradually developed over several decades by many contributors (e.g., Bertalanffy, 1968a, 1972; Boulding, 1956; Rapoport, 1976). It expanded concurrently with other system variants like cybernetics (Ashby, 1954), open systems theory (e.g., Katz & Kahn, 1978), organismic theory (Bertalanffy, 1968b), and the theory of living systems (J. G. Miller, 1955). By studying the aspects of systems in general, general systems theory facilitates the transfer of models and concepts between disciplines and thus contributes to the unification of science. What the varieties of systems approaches have in common is that they search for the laws of organization of a system to predict or influence future system states (Bertalanffy, 1968a).

From Classical Mechanics to Organized Complexity

In classical mechanics, a phenomenon can be decomposed into measurable quantities and their predictable interactions are then summed up to explain the system's behaviour. In other words, a mechanical system is the sum of its parts. Classical mechanics originates with the publication of Newton's *Principia* in 1687 when science became a framework to describe the universe in mechanistic terms (Skyttner, 2005). With Newton's classical mechanics, if the initial conditions and the laws of the system are known, the behaviour of the system can be predicted with precision using mathematics (Skyttner, 2005). For example, a car's behaviour can be determined with precision as it obeys the laws of classical mechanics. The scientific method was gradually established on the foundation of classical mechanics and classical science delivered a magnitude of accomplishments (Skyttner, 2005).

Some scientific problems cannot be explained by the laws of classical mechanics: There are no precise mathematical or physical laws that predict life, environmental disasters, political tensions, or wars, for example. Generally, predicting the behaviour of living systems and their interactions are problematic from a classical mechanics point of view (Bertalanffy, 1968a). For example, humans do not obey the laws of classical mechanics: There are no laws by which human behaviour can be precisely predicted (Bertalanffy, 1968b). The interactions of living systems' components are interlinked with other systems making their relationship complex. With living systems, the scientific problems to solve generally involve organized complexity (Bertalanffy, 1968b). Hence, systems theory appears to be a suitable framework for the investigation of well-being since well-being is a considered a problem of organized complexity.

The System perspective within Psychology

The system perspective has a long history with psychology. Freud viewed the human psyche as a dynamical system composed of the id, the ego, and the superego kept in a state of dynamic equilibrium with the environment, or homeostasis (Freud, 1923). Freud developed his theory by viewing the human psychological phenomena from a thermodynamics perspective. The initial idea came in 1874 from his supervisor, Ernst von Brücke, who viewed humans as systems in thermodynamic equilibrium where the first law of thermodynamics, conservation of energy, applies (Fieser, 2007). Freud extended this concept to personality proposing the human psyche to be an energy-system in dynamical equilibrium and ‘psychological thermodynamics’ became psychodynamics (Andersen, 2010). The conservation of energy assumption implies a closed system model, meaning that it follows the laws of classical mechanics.

In contrast, most modern theories of psychology are based on an open system model. A system is considered open if it system constantly exchanges energy, matter, and information with the environment. All living systems are considered open systems, as they heavily rely on their environment to survive (Bertalanffy, 1968b). Living systems are also considered dynamical systems as their components dynamically interact between themselves and with the environment. More recently, researchers in psychology have embraced dynamical system theory in personality research (e.g., Cervone, 2005; Cramer et al., 2012; Shoda et al., 2002), organizational psychology (e.g., Kozlowski, Chao, Grand, Braun, & Kuljanin, 2016; Kozlowski & Klein, 2000) and emotion psychology (e.g., Lewis, 2005) in particular. These theories also used an organized complexity approach. Some elements of these theories will be used as examples in the thesis to illustrate models, methodologies, and concepts that are potentially applicable to well-being theories.

Regardless of the simplicity or complexity of the system, there are two fundamental system properties common to all systems: system structure and system processes (Cervone, 2004). Every system has a structure, which is the description of the system in terms of components and their dependencies. The system structure is generally time independent, an enduring quality of the system. Every system also has processes, which are time dependent interactions, and describe the dynamics of the system. There are within-system and between-system processes, as well as bottom-up and top-down processes, in which energy, matter, or information is transformed. The well-being system framework proposed in the next chapter is based on fundamental system properties of structure and processes. The basic system concepts necessary to develop that framework will now be described.

System Structure: WHAT it is

The description of the system's structure is dependent on the level of abstraction of the system. Systems are typically categorised as one of three main types: a *natural* system, an *abstracted* system, or a *conceptual* system (Bertalanffy, 1968a, 1972). A real or natural system is defined as a set of components in interaction made of matter, energy, and information, in a specific location in time and space (e.g., a cardiovascular system, an apple tree). An abstracted system is the abstract representation of a natural system (e.g., the architectural plans of a building, the human genome). A conceptual system is a system made of interrelated constructs or concepts, which is another level of abstraction higher than the abstracted system (e.g., the human psyche, a mathematical model).

The structure of a system defines *what* the system under study is and this property is usually stable over time, or at least keeps its identity over time (e.g., a toddler or an elderly person would both be identified as a human). The description of a system structure includes its components and their dependencies which are relevant to the system's level of abstraction. For example, a natural system would be described in terms of its physical components (e.g., a cell is made of a nucleus, a membrane, cytoplasm, and organelles), while a conceptual system would be described in terms of interrelated constructs (e.g., well-being conceptualized in terms of autonomy, meaning, and affect). The components of the system have properties, which serve to identify the components from each other. If the properties come in degrees, the components can be said to also have attributes (Dubin, 1978). For example, a component could possess attributes like positive, negative, or activated. These attributes can be translated into variables (Dubin, 1978) (e.g., positive affect).

When defining a system, the system boundary must be clarified, whether observable or inferred. A system's boundary is defined by the observer of the system so the system's definition is relative to the observer's perspective (Bertalanffy, 1972). If an abstracted system model is intended to explain a natural phenomenon with a physically observable boundary, then several observers are more likely to reach consensus on the abstract system's delimitation. However, some systems under study cannot be delimited so easily. Researchers modelling a rat's physical body and components will probably find it easier to reach consensus on the boundary of a 'rat physical system model' than researchers modelling a 'psychological system model'. System models at higher levels of abstraction should be coherent with the natural system they are intending to represent. The assumption for well-being as stated in the introduction is that at least parts of a well-being system are natural (e.g., genetic factors, neurobiological factors). In this thesis, when building a well-being conceptual model which explains well-being, the model should intend to represent the natural well-being system, as opposed to a conceptual system based on ad-hoc explanations.

Another important property of a system is the level at which the system under study is located in relation to other levels, its level of analysis. Defining the level of analysis enables the study of multilevel interactions (Kozlowski & Klein, 2000; Sheldon, 2004). Multilevel interactions include bottom-up processes and top-down processes. The components of a system can be further decomposed in subsystems, unless the components are, theoretically, the basic units of existence (Weinberg, 1975). A lower level of analysis is more deeply embedded within the system under study and it also called a subsystem (Weinberg, 1975). A higher level of analysis than the system is the system's environment or suprasystem. Component attributes can be influenced by other components within the system (within-system processes), by subsystems (bottom-up processes or emergent phenomena), and by the environment (top-down processes or contextual influences) (Kozlowski & Klein, 2000).

Thus, the definition of the system's components and their dependencies, its boundary, its environment, and its level of analysis characterise some essential elements of the system's structure.

System Processes: HOW it Works

System processes define *how* the system works and explain the effects of the interactions between system components and their interplay with the environment. Some commonly used models to describe system processes in living systems include the *open* system model, the *feedback* model from cybernetics, and the *dynamical* system model. Elements of each of these types of systems will be used in this section.

The interaction between the system and its environment can be investigated with the open system model. An open system is a system which continuously exchanges matter, information, and energy with its environment (Katz & Kahn, 1978). The act of defining the system boundary determines the inputs (entering the boundary), the internal processes (within the boundary), and the outputs (exiting the boundary) (Katz & Kahn, 1978).

As the analytical framework developed in this thesis is intended to be used on humans, the focus in on processes found in living systems. All living systems are open systems, so all system properties of open systems apply to living systems. A living system contains processes which transform inputs of energy, matter, and information from the environment into outputs while other processes ensure its own survival and maintenance (Bertalanffy, 1968a). For example, a living system exchanges matter with the environment through food, water, and waste products. It also exchanges energy and information with the environment, for instance, as communication, behaviour, and contribution to others or community.

Before describing the types of processes which are relevant to living system, states and processes need to be distinguished. A state in systems theory can be mathematically represented by a set of variables at a point in time. A state is static as it is a cross-section of time, a snapshot. Processes are dynamic and define the interactions of the system.

Processes from Cybernetic Perspective

A living organism maintains equilibrium despite continuous perturbations, also referred to as stability. The main type of process which maintains the stability in living systems is homeostasis. The concept of homeostasis as proposed by Cannon (1932) is a physiological regulatory model ensuring the viability of a living system by defending against environmental changes and maintaining certain parameters within a set-point range. The homeostasis concept is mainly based on negative feedback processes, which are within-system processes working at narrowing the deviation between the system's current state and its equilibrium state, thus promoting stability. For example, in living systems, homeostatic processes regulate certain variables within the survival range of the organism (e.g., body temperature, blood calcium concentration) (Schulkin, 2003). Homeostatic processes can usually re-establish equilibrium after the challenge is removed if no irreparable damage was done. However, homeostasis can fail if the perturbation exceeds the rate of adaptation of the organism. For example, hypothermia is a state of homeostatic failure, but the body may restore its equilibrium temperature after the challenge is removed if no irreparable damage were done.

In regulatory physiology, if the change is temporary and moderate, the homeostatic model applies. On the other hand, if the change is ongoing or exceeding *normal* another regulatory model applies: allostasis (McEwen, 1998; Schulkin, 2003). The concept of allostasis was proposed by Sterling and Eyer (1988) to explain the mechanism responsible for the ongoing viability of an organism facing challenge and change, which they defined as stability through change. Allostatic mechanisms include positive feedback and feedforward processes and are a response to significant system perturbations. Positive feedback processes are within-system processes amplifying the deviation from its equilibrium (e.g., fever, parturition). Feedforward processes anticipate the change and include cognitive factors (e.g., putting a coat on before going outside in the cold). Positive feedback processes can cause the system to change state and evolve by establishing a new state of dynamic equilibrium (e.g., a child is born).

However, McEwen (1998) suggests that allostasis is an adaptive mechanism which if overstimulated can cause allostatic load, also known as the “price of adaptation” (p.33). An allostatic load maintained over a long period of time can lead to disease (e.g., post-traumatic stress) (Schulkin, 2003). Schulkin (2003) suggests that allostatic regulation is mostly a feedforward mechanism and does not have set-point boundaries like homeostasis. The anticipatory and proactive nature of allostasis makes it the opposite and natural complement of homeostasis, which is reactive.

In summary, both homeostasis and allostasis are useful models to explain processes of self-maintenance and survival: multiple instances of both types of processes may happen at the same time. A living organism can be perceived to survive because it has negative and positive feedback and feedforward processes which ensure that dynamical equilibrium is maintained in response to changes. If the perturbance to the system exceeds the organism’s rate or amount of adaptation, the processes can fail which may lead to disease or death.

Processes from Dynamical Systems Perspective

The systems approach is particularly beneficial when studying the complex and changing relationships between the components of a dynamical system. Bertalanffy (1968a) defines a dynamical system as “free interplay of forces” (p. 161). A dynamical system implies that complex nonlinear within-system processes can lead to outcomes difficult to predict. All living systems are open systems and nonlinear since they can dynamically respond to their environment and self-organize (Thelen & Smith, 2006; Weinberg, 1975). For example, the spread of a viral infection, the weather, reproduction processes, or adaptation processes are all nonlinear as the effect is not proportional to the cause. Nonlinear means that the effects are not proportional to the causes. Bertalanffy (1972) defines the stability of living systems as “the response of a system to perturbation” (p.418). This means that, from a dynamical systems perspective, stability in a living system is ensured by nonlinear dynamic interactions between system components and with the environment.

When dynamical system processes maintain the system variables within a certain range, the system is said to be in a steady state or in dynamic equilibrium (Bertalanffy, 1968b). A steady state is maintained in a constant state of near equilibrium or “disequilibrium” (Bertalanffy, 1968a, p. 209) and the resulting tensions created by this fluctuating state accumulates potential energy that can be transformed into work and behaviour. The steady state could be useful for modelling the stability of well-being. In mathematical terms, a steady state can be represented by an attractor. An attractor is a set of numerical values of a dynamical system toward which the system tends toward which is independent of initial conditions. According to Thelen and Smith (2006), an attractor is a system’s preferred mode of behaviour which the system comes back to after a perturbation. Simple systems, like a pendulum, may have a single fixed-point attractor, while living systems tend to have multiple equilibrium points, or attractors, depending on the initial conditions (Thelen & Smith, 2006).

In brief, the combination of dynamical system processes describes how the system works, both in self-maintenance processes and in function (producing outputs for other systems).

Summary of Chapter 1

Systems theory provides a useful framework for the study of organized complex systems by supplying an array of conceptual and analytical tools for the study of complex phenomena. A well-being system framework based on systems theory is proposed by using two salient system properties: system structure and system processes.

The system structure is useful for studying organized complex systems by defining *what* the system is by establishing its components, its boundary, and the level of analysis. The system processes describe *how it works* by defining the components' interactions between themselves and with the environment. The causal explanation for internal and external outcomes is then provided by the system processes in defining *how* the system works. This enables enhanced clarity in the system description and sets the foundations for a causal explanation of the system's behaviour and contributions.

As this framework will be applied to humans, processes pertaining to living systems are particularly relevant. The open system model is useful for distinguishing inputs from throughputs and outputs. Living systems maintain themselves in a state of dynamic equilibrium called steady state in the dynamical system model, or homeostasis in the cybernetic model. Living organisms are dynamical systems that survive through multiple complex interactions between their components and their interplay with the environment.

The next chapter develops an explanatory framework to evaluate and build comprehensive wellbeing theories through five principles derived from the fundamental system properties of structure and process: the well-being system framework.

Chapter 2

A Systems Framework for Building Theories of Well-Being

A review was conducted on quality of life indexes by Hagerty et al. (2001) to determine their validity and usefulness to public policy. An expert panel created a list of 14 criteria to evaluate quality of life indexes and make recommendations for future research. Three main recommendations came out of it: (1) quality of life should be measured by distinct and substantial domains which when combined constitute the totality of life experience; (2) the instrument should be derived from a theory built on a nomological net of constructs including causal pathways distinguishing input from throughput and output variables; and (3) the index components should be reliable, valid, and sensitive. The authors remarked that all 22 most-used quality of life indexes performed poorly on the theory criterion and recommended a systems approach. As quality of life is often generalized to well-being in social sciences, this recommendation for using a systems approach also applies to well-being theories.

This chapter aims to use the system structure and process elements described in the last chapter to develop a framework for building theories of well-being. Aspects of well-being models will be analysed with the two fundamental system properties of structure and processes. A list of five guiding principles is proposed to suggest elements that any comprehensive theory of well-being should comprise or consider.

Part 1: System Structure

The system structure defines what the system *is* by describing what it is composed of and how it relates to its subsystems and environment. The system structure property will now be applied to well-being to demonstrate how defining a system which may contribute to well-being through its components, boundary, and level of analysis can be useful to build a comprehensive theory of well-being.

Components.

Components are basic system units (Bertalanffy, 1968a). The interactions between the components and with the environment constitute the system processes, which will be described in the system process section in part 2 of this chapter. Components form part of the description of what the system *is*, in the structural sense. Dubin (1978) proposes that components also have attributes (e.g., positive, negative) which can be assessed as variables. He defines an attribute as "a property of a thing distinguished by the quality of being present" (Dubin, 1978, p. 44). He also defines a variable as "a property of a thing that may be present in degrees" (Dubin, 1978, p. 44). This can be illustrated by an example: an *affective well-being component* can have an attribute of *quality* which can vary between *positive* and *negative*. The current thesis proposes that attributes of system components can be influenced by system processes, thus attributes can represent outcomes (e.g., *positive affect*). If the system has multiple *affective well-being components,* the affect for the whole system will be an aggregate composed of multiple affective components.

As discussed in the methodology section of the introduction, distinguishing what a system *is* (system description) from *how it works* (system processes) and what the system *does* (system outcome) can help avoid errors of logic. According to Boag (2017), the description of a phenomenon is logically independent from its explanation since describing the phenomenon does not require giving an explanation for it. In the well-being literature, well-being is often discussed in terms of well-being dimensions. However, well-being dimensions are a source of confusion since some dimensions may be used to describe well-being (e.g., well-being described as life satisfaction, presence of positive affect and absence of negative affect), other dimensions may be used to explain well-being (e.g., SDT proposes that basic psychological needs satisfactions are predictors of well-being), while other dimensions again might be used to evaluate a well-being outcome (e.g., life satisfaction measured before and after a life event or intervention). In this thesis, well-being dimensions are generally referred to as the outcome aspect of well-being.

From a systems perspective, the dimensions that describe well-being outcomes need to be logically independent from the components of the system used to describe what the system *is*. The system components and the system processes describing the interactions of the components between themselves and the environment are on the causal side, and contribute to describing what the system *is*, while outcomes are on the effect side and contribute to explaining what the system *does*. The components of the system that contribute to well-being must thus be logically independent from well-being outcomes (effect), like well-being dimensions used in self-report surveys such as life satisfaction. Some outcomes of a well-being system can be represented by properties that emerge from the system processes and can only be observed at the whole system level (e.g., meaning, accomplishment, life satisfaction), as opposed to component level. Emergent phenomena by definition are only observable at the whole system level as they emerge from the complex and dynamic interactions of the system (Kozlowski & Klein, 2000; Sheldon, 2004). In any case, whether a well-being outcome variable is an emergent property, state, or a component's attribute, it should be logically independent from the description of system components (e.g., affective component, cognitive component) to avoid logical errors.

Two types of well-being system components are frequently suggested in well-being literature: cognitive and affective (Busseri & Sadava, 2011; Diener, 1994; Hudson, Lucas, & Donnellan, 2017; Luhmann, Hofmann, Eid, & Lucas, 2012). The suggestion was initially made by Andrews and Withey (1976) who propose that well-being is made of cognitive evaluations and degrees of positive and negative affect. The cognitive and affective factors have been suggested as assessable dimensions of well-being, hence also denoting system outcomes (Diener, 1984; Diener & Lucas, 1999). The placement of affective and cognitive aspects as both component and well-being outcomes can lead to confusion.

Personality theorists suggest that behaviour is the outcome of a system composed of affective and cognitive components (Mischel & Shoda, 1995), thus considers cognitive and affective to be components, not outcomes. Russell (2003) suggests that core affect, a content-independent background neurophysiological state, can influence cognitive processes and behaviour. Russell (2003) proposes that core affect is also affected by the environment and other internal components (e.g., genetics, hormone changes, diurnal rhythms). This presents a problem: affective and cognitive components are viewed by some as components of a well-being system, and by other as well-being outcomes. They cannot be both as it would cause a logical error. However, this problem can be resolved by describing the affective and cognitive components as possessing variable attributes, such as *quality* (e.g., positive, negative), which can be influenced by system processes. Thus, the quality attribute of the cognitive and affective components represents system outcomes.

The point to be made here is the systems framework provides conceptual tools that enable a distinction between the components of a well-being system and well-being dimensions meant to assess well-being outcomes. This distinction is useful if the objective is to hypothesize a causal explanation for a purposeful and lasting change in system behaviour, as hypothesizing what the components are and how they interact can suggest a causal explanation involved in the emergent well-being outcomes. Hence, the current well-being system framework proposes that components be described and distinguished from well-being outcomes.

Principle 1: The components of a system explaining well-being should be clearly defined and logically independent from well-being outcomes.

Boundary.

The boundary of the system defines the domain where the system's laws of organization apply: what is *in* is distinguished from what is *out*. This distinction is useful to distinguish within-system and between-system processes. It also assists in hypothesizing whether a certain variable is on the input side of a process, therefore malleable, or the outcome side, or both (two-way causation). While the boundary in an open system can be difficult to define as it is permeable, the boundary is generally defined as the area that delimitates where the system's identity is preserved despite a constant flow of energy, matter, and information in and out of the system (Bertalanffy, 1968a). For example, the identity of a human physical system can be delimitated by its skin and this identity is preserved whether the human is a toddler or an elderly, even though some attributes within the two systems are substantially different. Weinberg suggests that system interface may be used instead of boundary (Weinberg, 1975).

Aware of the limitations brought by an ill-defined system, Allport (1960) suggested an integumentary (skin bound) view of the psychological phenomenon based on the open systems model and called it the person-system. The person-system entails that: the components of the person-system are inside the person; the input is therefore defined as any energy, matter or information passing from the environment to the person; the throughput or within-person processes are those occurring inside the person; and the output becomes any influence the person has on the environment, including other people. From this perspective, input relates, for example, to relationships, life events, and workplaces, while output relates to work and behaviour. Affect and cognition relate to within-person components and processes (throughput). These distinctions are useful to clarify the dependencies of variables and can be readily applied to interventions or psychometric instruments (e.g., input is important for policy making as some input variables can be influenced by policy).

The person-system model is also consistent with most recent dynamical system theories of personality and well-being which use an integumentary perspective of the psychological phenomenon (e.g., the CAPS system (Mischel & Shoda, 1995), the synergistic change model (Rusk et al., 2017)). The person-system model can be applied to well-being theories and used to distinguish input, throughput, and outcome variables. As a system boundary is not absolute and depends on the researcher's definition of the system, it is important to define the boundary to minimize misinterpretations.

The distinction between input and output variables is not solely dependent on the boundary but can be due to more complex dependencies (e.g., two-way causation). Depending on the well-being aspect discussed and the system's definition, a variable can even be both an output of a process and the input in another. Hence, when defining the system boundary, the theorist should also classify the variables in terms of input, throughput, and output relative to their main function.

The well-being system framework thus suggests that the well-being system boundary be explicitly defined to distinguish which variables are *in* the well-being system and which belong to the environment. The criterion for a variable inside the boundary is suggested to be that the variable's identity is preserved despite the constant exchanges of energy, matter, and information with the environment. For example, *choice* is within the person, while a *relationship* is not. Component's attributes preserve their identity even though they are fluctuating due to their interactions with inputs and processes.

Principle 2: The system boundary should be clearly defined, distinguishing within-system variables from environment variables.

Level of analysis.

Most well-being researchers recognize well-being as a multidisciplinary topic (e.g., Dodge et al., 2012; Forgeard, Jayawickreme, Kern, & Seligman, 2011; Jayawickreme et al., 2012; Sheldon, 2004). The level of analysis of a model can be helpful for understanding how the model relates to other related fields of research.

For example, genetic factors are on a different level of analysis from psychological factors of well-being. The mutual influence between gene, environment, and well-being is complex, using multiple mechanisms, and is best described as *gene-environment interplay*, according to Røysamb, Nes, & Vittersø (2014). As mentioned in the introduction, there is ample evidence of strong genetic influences on the stability aspect of well-being (Bartels & Boomsma, 2009; Lykken & Tellegen, 1996; Nes & Røysamb, 2016; Nes et al., 2006). Røysamb and colleagues (2014) have advised that "the well-being field can benefit strongly from not disregarding or dismissing this evidence" (p.27). Genetic factors can be integrated with well-being by using a multilevel approach.

Top-down influences have also been suggested by social science studies hypothesizing and testing how social contexts can influence well-being (e.g., Knight & McNaught, 2011; La Placa, McNaught, & Knight, 2013; Ryan & Deci, 2017). The multilevel influence on well-being is particularly relevant to public policy which is at the core of the research on social indicators (e.g., Cummins, 2016a; Forgeard et al., 2011; Huppert & So, 2013). Self-determination theory (Ryan & Deci, 2017) also emphasizes the importance of the social context is seen as providing the nutrients for the fulfillment of the basic psychological needs of autonomy, competence, and relatedness, which is said to promote well-being. The influence of the social context is proposed to either promote well-being by providing the nutrients that help satisfy those basic psychological needs or inhibit well-being by frustrating those basic needs. Hence, both bottom-up and top-down influences should be considered when using a multilevel approach. An example of multilevel approach is provided in the appendix.

The specification of the level of analysis and the description of bottom-up and top-down influences can facilitate the integration of well-being constructs between related disciplines, and consequently, enhance the integration of research findings (Sheldon, 2004). Overall, the multilevel perspective is useful for a comprehensive understanding of well-being (Sheldon, 2004). Therefore, the well-being system framework suggests that the level of analysis and the relation to other levels be specified for a comprehensive explanation of well-being which includes factors pertaining to other disciplines.

Principle 3: The level of analysis of the model should be defined for greater comprehensive explanation and integration with other disciplines.

Part 2: System Processes

The system processes relate to the system throughput and aim to explain how the system transforms inputs into internal and external outcomes: the hypothesized processes explain how the system works. A living system is composed of multiple types of processes, many of which might be relevant to well-being. System processes represent interactions between system components and with the environment. According to Bertalanffy (1968a), modelling a living system as an open system raises two main problems: its *statics*, meaning the “maintenance of the system in a time-independent state” (p.158), and its *dynamics*, defined by the “changes of the system in time” (p.158). Those two characteristics are observable phenomena which can be viewed as emergent system properties resulting from system processes. As much of well-being research relates to the apparent dichotomy of stability and changeability, this section will categorize relevant system processes under these two emergent properties.

Stability.

A comprehensive theory of well-being should explain the almost inevitable stability of well-being observed in empirical research and provide an explanation for three main types of investigation: (1) the genetic influence on stability; (2) the return to stability after most life events; and (3) the correlation between the stability of well-being and the stability of personality. These three approaches relevant to the stability of well-being will now be discussed. Only a selection of studies and theories that report on these three fields will be referred to in this section as a full review is unnecessary for the scope of the argument.

Firstly, genetic studies on the stability of well-being have brought into perspectives heritability considerations. Lykken and Tellegen (1996) conducted large scale twin studies on well-being and concluded that between 44% and 52% of the variance in well-being is due to genetic variation. Furthermore, they estimated that 80% of the stable component of well-being is heritable and suggested that each person may have a “happiness set point” (Lykken & Tellegen, 1996, p. 186). Lykken and Tellegen’s (1996) famous quote clearly express the main implication: “It may be that trying to be happier is as futile as trying to be taller” (p.189). Numerous subsequent studies have provided additional evidence for the stability of well-being (e.g., Bartels et al., 2010; Bartels & Boomsma, 2009; Nes et al., 2006; Røysamb et al., 2014). A recent review on genetic studies on well-being has estimated that the stable component of well-being is 70 – 80 % heritable (Nes & Røysamb, 2016). However, genetic researchers remark that heritable does not mean unchangeable since there is a complex gene-environment interplay affecting well-being components through multiple mechanisms (Røysamb et al., 2014). These mechanisms are still largely unknown and more research is required to elucidate them.

Secondly, although major life events may increase or decrease life satisfaction, most individuals eventually adapt and return to their ‘normal’ level of life satisfaction. Some studies based on longitudinal panel surveys show an almost inevitable return to a life satisfaction level as it was prior to a major event. Those who experience the death of a spouse go back or very close (within about 0.15 points) to pre-event level of life satisfaction within 7 years (Lucas et al., 2003). However, some events seem more difficult to recover from such as divorce (Lucas, 2005) and unemployment (Lucas et al., 2004). Similarly, positive events in general seem also to have no long-term effect on life satisfaction levels: People seem to return to their baseline relatively shortly after a positive event. For example, people adapt to marriage relatively rapidly coming back to pre-event level within 2 years on average (Clark & Georgellis, 2013; Lucas et al., 2003). Similarly, the birth of a child brings an increase of life satisfaction up to 3 years before the event but goes back to its original level soon after the event (Clark & Georgellis, 2013). However, set-point theory or its variants does not explain the conditions or factors that promote adaptation for some individuals and a lasting change for others.

Thirdly, personality traits are believed to be relatively stable across the lifespan and their stability has been correlated to the stability of well-being. Well-being has been strongly linked to personality since Costa and McCrae (1980, 1984) demonstrated a significant correlation between well-being and the personality traits of extraversion and neuroticism. Following that proposition, Headey and Wearing (1989) conducted a study from a four-wave Australian panel survey to test the hypothesis. They found that these stable person characteristics moderately correlated with both well-being and life events. They suggested that equilibrium is re-established by personality traits predisposing a person to certain life events. For example, people high on extraversion who seek positive events will tend to regain their prior level of well-being more rapidly after a negative event. They proposed a dynamic equilibrium model of well-being where personality, life events and well-being remain in dynamic equilibrium. However, it does not explain how people low on extraversion, for instance, might also recover their prior level of well-being.

Homeostasis has also been proposed as an explanation to well-being stability (Cummins, 2010, 2016b; Dodge et al., 2012). Homeostasis is believed to be achieved by a combination of processes including mainly negative feedback processes, but may also contain some positive feedback and feedforward processes. However, according to Bertalanffy (1968a), the homeostatic model is an inadequate model for living systems as it is based on a closed system model. Bertalanffy argues that for psychological and psychiatric applications, a model of stability based on an open systems model is more adequate because of the constant exchanges of energy and information with the environment, and also because a human being is an active organism capable of influencing its own processes. He suggests that the steady state model is more appropriate to model the psychological system. In dynamic system modelling, a common way to represent a stable state is with an attractor, as mentioned in chapter 1. An example of use of attractors representing a stable state is given in the appendix.

A dynamical system approach could be a potentially fruitful avenue for research on well-being as it can model how stability is maintained through a flow of constants inputs and outputs. Any comprehensive theory of well-being should provide a satisfactory explanation for the relative stability of well-being and show the limits where stability applies.

Principle 4: A comprehensive theory of well-being should explain the processes that contribute to the observed stability of well-being.

Changeability.

The results of studies on positive interventions are generally encouraging and most participants report an increase in well-being in the short-term and some in the medium-term (e.g., Bolier et al., 2013). However, recent studies revealed that positive interventions can even backfire (Layous et al., 2017). A study conducted in both U.S.A. and South Korea where participants were asked to write a gratitude letter revealed that while the activity increased well-being in the majority of U.S.A participants it caused a decrease of well-being in South Korean participants (Layous et al., 2013). Another study (Layous et al., 2017) where participants were asked to complete a gratitude exercise revealed that additionally to feeling gratitude after the exercise participants also felt more unpleasant emotions than the comparison conditions, such as indebtedness. Some individuals also felt guilt, embarrassment, or shame after the exercise. Hence, it is important to understand the underlying dynamics of change to design effective and safe positive interventions. A comprehensive model of well-being change should explain how the components, attributes, and processes contributing to well-being can be varied to cause a change in well-being dimensions, whether the change is volitional or in reaction to an event.

Prior to exploring problems about models of well-being change and potential solutions that a systems approach can offer, the types of change should first be discussed as each type presents its own challenges. Eid & Kutscher (2014) posit that three different and distinct types of change occur in well-being variables: (1) change due to measurement error, (2) state variability due to environmental or temporary influences (state-like change), and (3) systematic trait change due to system alteration (trait-like change). The two latter types, state-like and trait-like change, are of prime interest in theoretical approaches to explain well-being change. Those two types of change can vary toward the more desirable end, positive change (e.g., positive affect, high life satisfaction), or the least desirable, negative change (e.g., negative affect, lower life satisfaction).

The homeostatic model has been used to propose an explanation for a negative state-like change in well-being. Cummins (2010) suggested that when a negative challenge exceeds the duration or intensity an individual can adapt to, homeostatic stress or failure may occur and prevent the individual from returning to their well-being set-point for some time. The allostatic load discussed in chapter 1 represents such a state. For example, hypothermia is a failure of homeostatic mechanisms. If an individual is in a state of homeostatic stress or failure at the beginning of an experimental intervention and well-being increases, two possible deductions could be made: there has been a restoration of well-being to the individual’s normal level (state-like change) or the set-point has changed (trait-like change). Consequently, the claim that the set-point has changed to a new and higher level of well-being cannot be fully substantiated if the individual was in homeostatic stress or failure at the start of the intervention, as it is possible that the homeostatic processes would have been released regardless of the intervention and brought the same change (Cummins, 2013). However, as mentioned in the previous section, Bertalanffy suggested (1968a), the homeostatic model is more is not adequate for psychology.

Two examples of models for well-being change in the recent well-being literature propose a theoretical explanation for well-being to increase and prolong the improvement: the hedonic adaptation prevention (HAP) model (Sheldon et al., 2013) and the synergistic change model (Rusk et al., 2017). The hedonic adaptation prevention model (Sheldon et al., 2013) posits that the adaptation process after a positive event or life change operates via two main pathways. The first path postulates that the effects of a positive life change reduce over time as the individual gets used to them. The second path stipulates that as an individual’s positive feelings rise, so do the individual’s aspirations, thus keeping a gap between the person’s aspirations and their positive feelings. The authors posit that the first path to adaptation can be moderated by variety so that varying positive activities and ways to generate positive feelings can help maintain a higher level of well-being. The adaptation through the second path is moderated by variety and continued appreciation for the positive change. The new well-being state is maintained by continued effort and variety. This model thus aims for a state-like change.

The other example of a model for change is the synergistic change model (Rusk et al., 2017). The model uses a dynamical systems approach proposing a pathway to positive lasting change from a complex system perspective. In a complex dynamical system, a new state can be achieved by synergy. A synergistic approach means that the method uses the amplification potential of dynamical systems by activating an entrainment effect. The authors propose to make changes in several system components concurrently to produce an entrainment effect where each change is amplified by the others. If the intervention is applied properly, this can produce a trait-like change. However, this model is very recent and has not yet been empirically tested.

Research on theoretical models which can explain lasting positive change is in its infancy, and further research is required to develop robust and comprehensive models for well-being stability and change which can then be empirically tested. Many modern theories of personality take a dynamical system approach (e.g., Cervone, 2005; Cramer et al., 2012; Nowak, Vallacher, & Zochowski, 2005; Shoda et al., 2002) and similar approaches could be applied to well-being. Even though personality psychology has made great use of the dynamical system approach and built theories upon it, there have been only few attempts to apply this approach to wellbeing.

The conceptual complexity of well-being is too often overlooked and the resulting explanation oversimplified (La Placa et al., 2013). If we are developing theories to effect lasting change, the dynamic nature and complexity of wellbeing must be modelled as accurately as possible and include an adequate definition of the system structure and processes.

In brief, one of the main objectives of a comprehensive theory of well-being is to provide a theoretical explanation for a purposeful positive trait-like change. Change, like stability, can be viewed from a system perspective as a complex phenomenon involving multiple processes at multiple levels of analysis. A complex dynamical system approach is more adequate for such a problem as it includes a conceptual explanation for both stability and change.

Principle 5: A comprehensive theory of well-being should explain the processes that contribute to change well-being to a new stable state.

Example of a Well-Being Model Following the Five Principles

Here is a parsimonious example of how the five principles of the well-being system framework might be applied. The model is succinctly described below without any demonstration of the propositions as the aim is to illustrate a potential application of the principles, not to demonstrate the validity of the model. Each principle is translated by the model into a proposition.

Proposition 1: The well-being system is composed of basic cognitive units, which themselves contain a subcomponent of affective basic units. The system also contains a single component of *choice*. The basic cognitive components possess cognitive attributes representing satisfaction, beliefs, attitudes, and goals. The affective subcomponents possess attributes representing negative and positive.

Proposition 2: There are 3 levels of analysis: the outer boundary, the cognitive boundary, and the affective boundary. The outer boundary is the boundary of the person-system, which defines the psychological identity of the individual. The cognitive boundary defines the domain where cognition takes place, and is at the same level as the boundary of choice. The affective boundary defines the spaces where affect takes place.

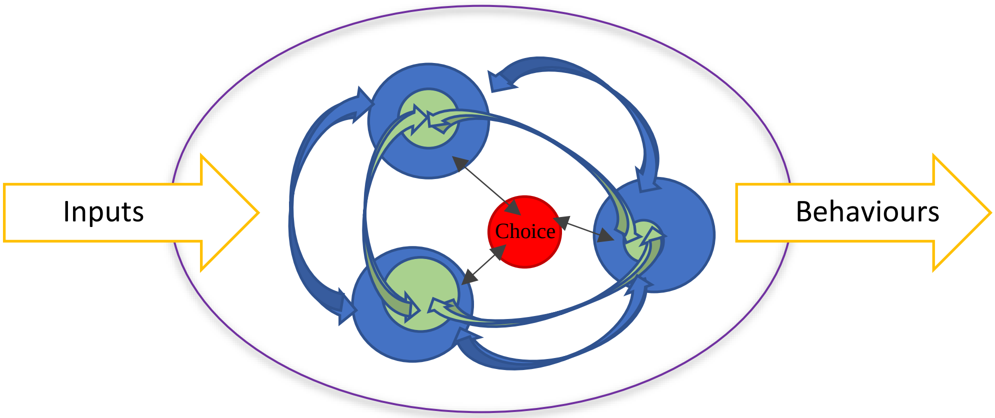

Figure 1. Example of well-being model based on the well-being system framework. The well-being system is composed of cognitive components (in blue) which are themselves composed of an affective component (in green). The component of choice can interact with the cognitive components, and affect behaviour, which is the system's output. The cognitive components can interact between themselves and with choice as well as with the environment, producing satisfaction. The affective components can interact between themselves and with the environment, producing affect. The result of all these interactions produces satisfaction, affect, and behaviours.

Proposition 3: Each basic cognitive component has an external boundary by which it can exchange energy with other cognitive components and the environment, and an internal boundary by which it can exchanges energy with its affective subcomponent. Each affective basic unit has an external boundary with which it can exchange energy with the cognitive component that surrounds it, and with the environment through both boundaries.

Proposition 4: The stability processes of the system are defined as steady state: a state of near equilibrium that reacts to inner and outer perturbations. The conditions for stability depend on the coping capacity for perturbations for both the cognitive and the affective components. Each component, whether affective or cognitive, has a coping capacity within an operating range which is structurally defined and represents the set point range of functionality for that component. Different cognitive components have different operating ranges, and same for affective components. The steady state is maintained as long as external inputs do not require the functionalities outside the operating range for all components of the system. The component of choice acts as a moderator by adjusting the environment through volitional changes in circumstances and situations, and can also interact with cognitive components within their operating range. The outcome of the interaction between all affective components and with inputs is *affect*. The outcome of the interaction between all cognitive components, with choice, and the environment is *satisfaction*.

Proposition 5: If the perturbations require functionalities which are outside of the operating range of the cognitive components, then cognitive disequilibrium occurs and can cause non-volitional behaviours. If the perturbations require functionalities which are outside of the operating range of the affective components, then affective disequilibrium occurs and can cause undesirable affect. When functionalities require are outside the operating range of a component, that component disconnects from other components, either partially or fully. This means that the functionality of that component to the overall system functionality is reduced, or bypassed.

Proposition 5a (state-like change): Compensatory processes may try to re-establish the steady state through other connections. Once the new connections are formed, a new steady state is established. This constitutes a change in the dynamics processes of the system and would be considered a state-like change. Such a state-like change may be short or medium term, as system process reorganizations can be relatively stable.

Proposition 5b (trait-like change): A trait-like change would be achieved by changing the limits of the operating range of a component. An optimal trait-like change (e.g., flourishing) would be achieved by widening the limits of the operating range for all components, cognitive and affective. This would be defined as resilience: all components operating at full functionality. Changing the limits of the operating range of a component means altering its attributes so that full functionality is possible for each of the component's attributes.

In this example, hypotheses to be tested can be deducted from the propositions. The propositions provide a deductive explanation for well-being. It illustrates that a comprehensive model for well-being could be built using the five principles of the well-being system framework.

Synthesis of the Well-Being System Framework

As stated in chapter 1, the intent when building a well-being model should to have the closest correspondence possible between the conceptual model of well-being and the natural system which produces well-being outcomes. Five principles are proposed as a guide to model the well-being system based on universal properties of systems. Those principles are categorized in two system metaproperties of system structure and system processes, summarized in table 4 below.

System Structure What the system *is*	• *Principle 1*: The components of a system explaining well-being should be clearly defined and logically independent from well-being outcomes. • *Principle 2*: The system boundary should be clearly defined, distinguishing within-system variables from environment variables. • *Principle 3*: The level of analysis of the model should be defined for greater comprehensive explanation and integration with other disciplines.
System Processes *How* it works	• *Principle 4*: A comprehensive theory of well-being should explain the processes that contribute to the observed stability of well-being. • *Principle 5*: A comprehensive theory of well-being should explain the processes that contribute to change well-being to a new stable state.

Table 1. The well-being system framework contains five principles for a comprehensive explanation of well-being in two categories relating to meta system properties of structure and processes.

Hence, the result of this analysis means that the five principles provide a framework for a deductive explanation of well-being by analysing the system's components, boundary, level of analysis, and dynamic processes of stability and change.

The next chapter will apply the five principles of the well-being system framework to two well-being models: the engine of well-being (Jayawickreme et al., 2012) and the four qualities of life (Veenhoven, 2000). These models are typological frameworks for well-being, hence not intended as theories of well-being but as classification systems to integrate concepts and terminologies from multiple disciplines. However, they will be evaluated as if they were potential theories of well-being as they use a comprehensive approach to integrate multiple aspects of well-being.

Chapter 3

The Engine of Well-Being: A Critical Evaluation

The first account assessed is the engine of well-being framework by Jayawickreme, Forgeard, and Seligman (2012). The engine of well-being can be broadly understood as an integrative framework for well-being approaches and constructs from psychology and other disciplines. It is a typological approach meant to assist in categorizing well-being concepts and constructs by their causal relationship to well-being into input, process, and output variables. The engine was created as a reaction to Hagerty and colleagues (2001) who suggested that none of the quality-of-life indexes evaluated were based on a well-established theory and proposed a systems approach to remediate this deficiency, as previously mentioned. The engine model was proposed to address this deficiency and provide an integrative framework to unify well-being theories, measurements and interventions. This chapter aims to critically evaluate the engine of well-being framework with the well-being system framework proposed in this thesis.

Part 1: Summary of the Engine of Well-Being Framework

The engine of well-being framework (Jayawickreme et al., 2012) is based on an open systems model where the input, processes, and outcomes are functionally distinguished. The engine analogy implies that *inputs* are *processed* by an engine to produce *outputs*, thus differentiating the well-being constructs and variables into predictors (*input variables*), internal states (*process variables*), and outcomes (*output variables*). The *input variables* are of two types: exogenous variables related to the environment and endogenous variables related to the individual's characteristics. Exogenous input variables include aspects such as income, education, genetics, green spaces, political climate, and healthcare. Endogenous variables refer to individual characteristics such as optimism, neuroticism, values, strengths, personality, and psychological needs. The *input variables* are transformed by the engine's *process variables*. The authors define *process variables* as the internal states that influence the individual's choices. *Process variables* include beliefs, cognitive evaluations, attributions, affect, moods, and emotional states. The *output variables* of the engine result from the interaction between inputs and the individual's internal states and choices. Well-being outcomes consists of *output variables* such as accomplishment, engagement, meaningful activity, and positive relationships, that are generally described as voluntary, autonomous, and goal-driven behaviour.

The engine of well-being then relates these variables to a framework used in political philosophy where well-being theories are classified as *wanting*, *liking* and *needing theories* (see Parfit, 1984). This typological approach is described below and linked to the engine framework in terms of where the variables fit. The authors also integrate into their engine framework constructs from developmental economics of Sen's capability approach (1999) and Nussbaum capabilities approach (2003, 2011).

Needing theories – Input related.

The first category, *needing theories*, relates to objective lists and eudaimonic accounts of well-being (Jayawickreme et al., 2012). An *objective list* is a list of constructs deemed necessary for well-being from an economic perspective. It is the equivalent of *eudaimonia* used in psychology, usually defined as *positive psychological functioning* (Ryff, 1989) or *self-realization* (Ryan & Deci, 2001), and refers to a list of constructs deemed objectively desirable (e.g., autonomy, meaning). The focus of these theories is on what is *good* for the individual whether the individual values them or not. Needing theories are associated with *input variables* because a *need* is viewed as a required input. The meaning of *need* in this context is something that is deemed necessary for an individual's well-being. *Needing theories* focus on satisfying basic psychological needs, growth needs, and achieving optimal human functioning.

Theories in this category include Ryff's psychological well-being (PWB; Ryff, 1989, 2013), self-determination theory (SDT; Ryan & Deci, 2017), and Seligman's well-being theory also referred to as PERMA (positive emotions, engagement, relationships, meaning, accomplishment; Seligman, 2011). Needing theories category also includes objective list theories like Maslow's hierarchy of needs (Maslow, 1943) and Sen's capability approach (1999). Variables belonging to this category include exogenous input variables like GDP, income, unemployment rates, but also endogenous input measures of character strengths, values, and personality.

Liking theories – Process related.

The second category, *liking theories*, concerns theories focusing on subjective aspects of well-being such as positive emotions, life satisfaction, happiness, and quality-of-life (Jayawickreme et al., 2012). The point of focus of liking theories is on *process variables* because they relate to *internal states* which relate to an individual's characteristics and influence the individual's choices. In psychology, such internal states are usually described with subjective variables such as positive affect, moods, and beliefs.

The theories in this category describe the subjective experience of well-being and include affective and cognitive variables such as subjective well-being (Diener, 1984, 1994), positive and negative affect (Watson, Clark, & Tellegen, 1988) but also include the momentary overall state (e.g., Csikszentmihalyi & Larson, 1987) and core affect (Russell, 2003) could be added to the list.

Wanting theories – Output related.

Thirdly, *wanting theories* are characterised by a focus on satisfying preferences or the fulfilment of personal desires (Jayawickreme et al., 2012). In political philosophy, these theories are referred to as *desire-fulfilment* theories. This category of theories is what mainstream economics is based on and money is the most common indicator of preference. Wanting theories are associated with *output variables* as the focus in on variables of behaviour like consumption and utility.

The *wanting* category is focused on choice, voluntary behaviour, and preferences (Jayawickreme et al., 2012). Outcome variables include meaning, accomplishment, engagement, and positive relationships. As satisfying one's preferences does not necessarily cause an increase in well-being, the concept of *idealized preferences* (e.g., Dolan & White, 2007) has been suggested to determine which preferences would likely cause a well-being increase (e.g., healthy nutrition habits compared to smoking, drinking, and eating fast food). Idealized preferences are preferences where cognition is deemed to have access to the full information relating to the preferences, which include future prediction of the possible consequences. Psychological reinforcement theories would be classified as *wanting* theories.

Evaluation with the Well-Being System Framework

The engine of well-being model will now be critically evaluated according to the well-being system framework developed in chapter 2. The engine of well-being is a good candidate to be extended into a comprehensive theory of well-being as it uses open system model concepts.

Part 2: Critical Evaluation Using the Well-Being System Framework

***Principle 1*: The components of a system explaining well-being should be clearly defined and logically independent from well-being outcomes.**

The authors describe the composition of the engine as including the components of choice and internal states. The process variables are defined as the "internal states that influence the choices that individuals make; the outcomes of these choices are the behaviors that constitute outcome variables" (Jayawickreme et al., 2012, p. 329). Thus, the interaction of inputs with internal states and choices cause well-being outcomes. This terminology can cause confusion as it does not completely follow systems theory traditional use of this terminology. Processes in systems theory are the interactions between components or subsystems and with the environment, while a state is a snapshot of the system. A redefinition of variables following a system theory readjustment of what states and processes would be useful when further developing this model.

The engine of well-being framework (Jayawickreme et al., 2012) lists two within-system components: *internal states* and *choices*. Viewed from the well-being system framework, the list of items that internal states points to can be considered components and include positive affect, beliefs, cognitions, and attributions. Choice also fits as a component. The inclusion of *choice* is useful as it entails that some well-being processes can be influenced by the individual: Well-being is not something that simply *happens* to a person. The component of *choice* adds to the complexity of the system as the system structure or processes might change because of *choice* interacting with other components or aspects of the environment.

The outcome variables representing dimensions of well-being are logically independent from the components as they relate to the interactions between inputs with components, which are both distinct from outcomes. Since the input variables are categorized as endogenous or exogenous, further model development could also separate outcome variables in the same two types: endogenous outcomes and exogenous outcomes. Autonomous behaviours thus could be considered exogenous outcomes, and endogenous outcomes would include positive accomplishment and meaning, for example. The applicability of the engine framework could be enhanced by defining more specific outcomes.

Thus, components in the engine model are adequate for a system representation and logically independent from outcomes. However, a more comprehensive list of system components would be useful to extend the engine framework into a theory that would comprehensively explain well-being.

***Principle 2*: The system boundary should be clearly defined, distinguishing within-system variables from environment variables.**

The distinction between endogenous and exogenous input variables could be viewed to imply two boundaries: one that interfaces with the environment to receive exogenous input variables, and one that interfaces with internal components to receive endogenous input variables. Thus, there could be two imbedded boundaries in the engine model: an external interface and a deeper, internal boundary. Distinguishing input variables in two types, endogenous and exogenous, is useful as it relates directly to potential applications. For example, exogenous variables can be manipulated by economic and political policies and interventions, while endogenous variables could potentially be influenced by psychological interventions (Jayawickreme et al., 2012).

However, defining a double boundary could make classifying certain variables challenging. For example, *meaning* is classified as an outcome variable in the section describing the engine itself but it is also claimed as part of needing theories in the eudemonic theories, which are related to input variables (Jayawickreme et al., 2012). Other variables are confusing in their classification, such as positive affectivity, which is classified as an input variable (endogenous trait), and positive affect as a process variable in the section describing the engine. This confusion could be dispelled by clarifying the double boundary and defining, for example, positive affect as an emergent state due to bottom-up processes and dynamic interactions between certain *positive affectivity* related components at a lower level of analysis.

Another problematic aspect of the engine framework relates to the concept of life satisfaction: the construct is classified as part of the liking theories which relate to process variables and claimed to be inappropriate as an outcome measure (Jayawickreme et al., 2012). However, if a double boundary were defined, then subjective variables like meaning and positive accomplishment would be endogenous outcome variables. If so, then life satisfaction should also be an endogenous outcome variable since it is also subjective. Thus, this means that defining a double boundary can be useful as these endogenous and exogenous outcomes relate to different fields of research, thus this categorization assists in both differentiating and integrating their domains.

The difficulty in organizing the variables within the three classes is acknowledged by the authors. They write: “Many of the relationships among these elements, moreover, may turn out to be merely correlational, rather than causal. The Engine approach, nevertheless, encourages researchers to declare what part of the engine their variables are” (Jayawickreme et al., 2012, p. 336). The authors recognize that there might be important feedback effects which contribute to the difficulty in categorizing certain variables. Further development of the model could either detail more precisely those feedback effects using cybernetic constructs, or use a dynamical systems approach which models the complex interactions of multiple variables.

Further development of the engine could include to redefine the system boundary, or double boundary, and consequently the input, process, and output variables would greatly enhance the applicability of the engine model as a classification framework. It is noted that the authors of the engine model are currently revising the model which may increase its clarity (Jayawickreme, Brocato, & Hayes, 2017).

***Principle 3*: The level of analysis of the model should be defined for greater comprehensive explanation and integration with other disciplines.**

The engine only defines one level of analysis where endogenous and exogenous inputs are transformed by the engine's processes to produce well-being outcomes. However, classifying the inputs from the environment at the same level as the inputs from characteristics of the person is illogical from a systems theory perspective as both types of inputs would necessarily contribute to different types of processes. For example, an input such as income would involve different within-person processes from the input of personality variables.

This logical issue could be solved by using the double boundary concept as an extension of the endogenous and exogenous attributes to reveal multiple levels of analysis within the person-system. For example, the inner level of analysis could be composed of deeper characteristics of the person (e.g., personality components) which contribute to endogenous outcomes (e.g., observed personality trait of affective positivity). These endogenous outcomes become endogenous inputs as they are passed on through bottom-up processes to the outer level of analysis and the endogenous inputs of this level (e.g., positive affect).

Thus, defining two levels of analysis using a double boundary can be a useful addition. The engine framework demonstrates an integrative capacity in relating well-being variables and concepts pertaining to various fields of research and enhance multidisciplinary communications and knowledge transfer (e.g., policy making, economics, psychology, social science).

***Principle 4*: A comprehensive theory of well-being should explain the processes that contribute to the observed stability of well-being.**

There is no explicit explanation for the stability of well-being in this model as it is a typological approach. The authors state that: "The most common chain of causality goes from input (e.g., income or the personality trait of extraversion) through process (good mood and the expectation of success) to outcome (good social relationships and highly engaged work)" (Jayawickreme et al., 2012, p. 336). The mention of *chain of causality* refers to a classical mechanics perspective, or linear model.

However, the authors also acknowledge feedback effects which can influence variables in addition of the main direction of causality (Jayawickreme et al., 2012). The theoretical feedback effects are noted but not described in the framework. The authors state that a complete list of feedback effects would be outside the scope of the article. There is no detailed explanation of how variables might be influenced by feedback affect beyond a few examples. Hence, to provide an explanation for stability, the engine model could be developed further to include a description or model of the processes which contribute to the remarkable stability of well-being.

***Principle 5*: A comprehensive theory of well-being should explain the processes that contribute to change well-being to a new stable state.**

The authors state that the "engine is intended as a causal model, but not an exhaustive one" (Jayawickreme et al., 2012, p. 336). As has just been discussed in the principle 4 section, the organization of variables around input, process, and outcome assumes a linear causality relationship between these variables as the main effect. The engine model is intended as a "prologue to any adequate theory of the future" (Jayawickreme et al., 2012, p. 336) (p.336). Such a theory of the future would be expected to fill in the gaps about *how* the input and process variables interact to produce the outcome. The authors encourage well-being investigators to expand their understanding and "seek out causal relationships as well as correlations and other irregularities among the levels" (p.336).

Summary of Chapter 3

The engine of well-being model can be seen to provide a useful framework for the integration of various disciplines and enhances the clarity of the various types of variables. The engine of well-being model could evolve to a theory if propositions were developed clarifying the double boundary issue, defining the system components without using the term *states*, and redefining the input, process and outcome variables accordingly. From these propositions, an explanation for well-being stability and change could be suggested and tested. The engine model provides an adequate foundation to build a comprehensive theory of well-being if further steps were taken to pursue its development and refinement.

Chapter 4

The Four Qualities of Life: A Critical Evaluation

This chapter evaluates the four qualities of life framework (Veenhoven, 2000). The four qualities of life can be broadly understood as a classification framework for well-being concepts from multiple disciplines. The author's objectives are to use the framework to distinguish the different meanings of well-being dimensions and concepts, classify well-being variables used for measurement, and demonstrate that an overall measure of well-being cannot be created by summing up its related variables. The meaning of *quality of life* in the four qualities of life framework is used as *well-being*. This chapter aims to first describe the four qualities of life framework and then critically evaluate it by applying the guiding principles of the well-being system framework to the four qualities of life.

Part 1: Summary of the Four Qualities of Life Framework

The four qualities of life framework is summarized by four quadrants: one axis distinguishes life *chances* and life *results* and the other distinguishes *inner* and *outer* qualities (Veenhoven, 2000). The distinction between life chances and life results differentiates variables deemed on the causal side of well-being, also referred to as opportunities, from those on the effect side, also referred to as outcomes. Inner qualities refer to variables internal to the individual and outer qualities refer to external variables, relating to the environment.

The amalgamation of life chances and results with inner and outer qualities creates four qualities of life categorized in four quadrants: (1) liveability of environment, (2) life-ability of the person, (3) utility of life, and (4) appreciation of life (Veenhoven, 2000). The resulting fourfold matrix is represented in table 1.

	Outer qualities	*Inner qualities*
Life chances	Liveability of environment	Life-ability of the person
Life results	Utility of life	Appreciation of life

Table 2. The four qualities of life framework: 1) the combination of life chances and outer qualities is described as liveability of environment, (2) the intersection of life chances and inner qualities make the life-ability of the person, (3) life results and outer qualities combine to produce utility of life, and (4) the junction of life results and inner qualities create the subjective appreciation of life. Adapted from "The four qualities of life: Ordering concepts and measures of the good life," by R. Veenhoven, 2000, Journal of Happiness Studies, 1, p.4.

Each of the four qualities of life will now be described as Veenhoven (2000) defines them.

Outer quality - Life chance: Liveability of environment.

The Liveability of environment contains variables relating to external living conditions relevant to the person (Veenhoven, 2000). The term liveability denotes objective characteristics of the environment. Variables belonging to this quadrant cannot be listed exhaustively as there are almost limitless environmental factors which can influence an individual's well-being. Veenhoven provides examples from multiple perspectives (also see Veenhoven, 1996). From a sociological point of view, it includes variables like sociodemographic information, political freedom, and social capital. For ecologists, the liveability of environment refers to environmental variables such as pollution, climate change, and water quality. Town planners consider that variables like sewerage, waste management, and planning of roadways contribute to the liveability of environment. From an economical perspective, environmental variables include nationwide economic growth, welfare, and employment rates. The qualities in this quadrant which contribute to the liveability of environment are deemed objectively good for the person as they comprise resources that satisfy human needs from a variety of perspectives (Veenhoven, 2000).

Outer quality - Life result: Utility of life.

The utility of life quadrant refers to the external outcomes of an individual's life (Veenhoven, 2000). The functional meaning of utility denotes the contribution of the individual to family, workplace, community, and society that is objectively observable, whether the individual is aware of their contribution or not. Veenhoven cites Gerson (1976) "transcendental conceptions of quality of life" (Veenhoven, 2000, p. 975). It includes aspects like rearing children, contribution to family and friends, and work contributions. Utility can also be aesthetic as in artistic creations and performances. Moral utility also belongs in this quadrant and includes the contribution of inspiring role models and individuals who are deemed to have lived an exemplary life (e.g., Florence Nightingale; Veenhoven, 2000). Overall this quality of life could be described as good citizenship. Multiple additional utilitarian aspects belong to this quadrant which cannot all be listed such as contribution to human progress, inventions, or compassion. As Veenhoven remarks: "this quadrant is typically the playground of philosophers" (Veenhoven, 2000, p. 10).

Inner quality - Life chance: Life-ability of the person.

The life-ability of the person quadrant describes an individual's inner resources. This quality of life refers to the individual's capabilities for coping with life's challenges and adapt to changes. It denotes "the body and mind working as designed" (Veenhoven, 2000, p. 9) where the term *designed* refers to a functional meaning. At its optimum, life-ability of the person can be viewed as "excellence of function" (Veenhoven, 2000, p. 9) comprising the absence of physical and mental defects. This quadrant describes predictors of functionality like physical and mental health: a functional body and the absence of mental defects. In addition, this quality of life also includes abilities which can be acquired through education, skill development, and the expansion of mental and physical capabilities through various interventions. Veenhoven (2000) remarks that Sen’s (1999) capability approach belongs in this quadrant.

Inner quality - Life result: Appreciation of life.

The appreciation of life quadrant relates to well-being as the individual perceives it (Veenhoven, 2000). It is a subjective cognitive and affective appraisal of life and includes aspects such as happiness, positive affect, and positive moods. Life satisfaction belongs in this quadrant and includes satisfaction across varied domains: work satisfaction and relationship satisfaction, for example. Veenhoven argues that that it is not possible to evaluate this quadrant comprehensively with a single variable like *life satisfaction* or by asking a life-as-a-whole self-report question as was suggested by Andrews and Withey (1976). Veenhoven argues that the aggregation of the satisfactions from various life domains into a single life satisfaction variable is not informative or meaningful because the satisfaction from different domains of life “differ in significance” (Veenhoven, 2000, p. 23) and satisfaction cannot be judged exhaustively.

The detailed sub-meaning of each of the quadrants are represented in table 2 below (Veenhoven, 2000).

	Outer qualities	*Inner qualities*
Life chances	**Livability of environment** · Ecological e.g. moderate climate, clean air, spacious housing, · Social e.g.. freedom, equality and brotherhood · Economical e.g. wealthy nation, generous social security, smooth economic development · Cultural e.g. flourishing of arts and sciences, mass education · Etc…	**Life-ability of the person** · Physical health negative: free of disease positive: energetic, resilient • Mental health negative: free of mental defects positive: autonomous, creative • Knowledge e.g. literacy, schooling • Skills e.g. intelligence, manners • Art of living e.g. varied lifestyle, differentiated taste • Etc….
Life results	**Objective utility of life** · External utility e.g. For intimates: rearing children, care for friends e.g. For society: being a good citizen e.g. for mankind: leaving an invention · Moral perfection e.g. authenticity, compassion, originality • Etc…	**Subjective appreciation of life** · appraisal of life-aspects e.g. Satisfaction with job e.g. satisfaction with variety · Prevailing moods e.g. Depression, ennui e.g. zest · Overall appraisals Affective: general mood-level Cognitive: contentment with life

Table 3. The sub-meaning of each of the four qualities of life: (1) liveability of environment, (2) life-ability of the person, (3) utility of life, and (4) appreciation of life. Each quality of life contains multiple variables which represent an aspect of that quality. Adapted from "The four qualities of life: Ordering concepts and measures of the good life," by R. Veenhoven, 2000, Journal of Happiness Studies, 1, p.11.

Each quadrant of the four qualities of life framework contains variables representing one quality of life which is functionally different from the others. The four qualities of life complement each other and each is either a predictor or an outcome of well-being. This framework enables the categorization and integration of variables belonging to different fields of research. The multiplicity of variables allows a comprehensive appraisal of a person’s well-being (Veenhoven, 2000).

The four qualities of life model will now be critically evaluated according to the list of evaluation criteria developed in chapter 2.

Part 2: Critical Evaluation Using the Well-Being System Framework

Principle 1**: The components of a system explaining well-being should be clearly defined and logically independent from well-being outcomes.**

The dimensions which refer to well-being outcomes are clearly defined in the bottom two quadrants as external outcomes, or utility of life, and internal outcomes, or appreciation of life. The dimensions of well-being are logically independent from variables considered as predictors of well-being, which are the top two quadrants. This is a consequence of the clear distinction between life chances and life results.

The components of the system are represented in the life-ability of the person quadrant. These components represent aggregate of components or subsystems. For example, *mental health* is a high-level construct that includes several components, like affective and cognitive components, for instance. The aggregate of *mental health* is suitable from a typological perspective. However, a high-level aggregate like mental health is not very informative as an explanation for well-being: the informative value would greatly increase with detailed information on which aspects of mental health are functional, dysfunctional, or anything in between. The components in the life-ability quadrant are diversified and comprise other aggregates such physical health, knowledge, skills, and art of living, which could also be understood as preferences (Veenhoven, 2000).

The four qualities of life framework (Veenhoven, 2000) lists several components or subsystems which compose the system, like *physical health*, *mental health*, *knowledge*, and *skill*. The framework also proposes that some of their attributes, like *physical health* can be *positive* (e.g., energetic and resilient) or *negative* (e.g., free of disease) (Veenhoven, 2000). The four qualities of life system components encompass a broad range of factors that can influence well-being and could be further expanded by decomposing its subsystems (e.g., splitting *mental health* into components). However, the component of *choice* or variants (e.g., volition, will) are not in the list of components.

As components in a system are typically subsystems, the components listed in the life-ability quadrant could be perceived as a list of subsystems, which themselves are made of components. Thus, the components of a well-being system in the four qualities of life framework can be further decomposed in components at a lower level of analysis. This categorization of well-being dimensions and concepts is useful as it allows the development of a comprehensive inventory of well-being components and comprise a broad range of life domains.

***Principle 2*: The system boundary should be clearly defined, distinguishing within-system variables from environment variables.**

The four qualities of life framework identifies input and output variables by distinguishing between life chances and life results. Veenhoven (2000) suggests that from a systems theory point of view, the matrix displays the input, throughput and output, as presented in table 3.

	Outer quality	*Inner quality*
Chances	Input	Throughput
Results	Output: External effects (input for other systems)	Output: Feedback (for system maintenance)

Table 4. Comparable concepts in systems theory. The distinction is made that input comes from the environment as it is in the outer quality column. There is also an external output which goes back to the environment, and an internal output used for system maintenance. Adapted from "The four qualities of life: Ordering concepts and measures of the good life," by R. Veenhoven, 2000, Journal of Happiness Studies, 1, p.8.

The perspective used is similar to the person-system. The use of a system theory comparator table helps to clarify the function of variables in each quadrant viewed from a system perspective. The comparator table further distinguishes between external inputs (liveability of environment), external outputs (utility of life), internal throughputs or processes (life-ability of the person), and internal outputs (appreciation of life) (Veenhoven, 2000).

However, the life-ability quadrant labelled *throughput* in the comparator, which in systems terms refers to processes, while the items listed relate to system components. Throughput in systems theory define system processes which transform inputs into outputs (Katz & Kahn, 1978). The processes are not defined in this model as this is a typological approach, which will be discussed in the process section. Hence, the label in the upper right quadrant should read *system components* or *subsystems* to be in line with systems theory terminology. Despite this, the clear delimitation of the boundary leads to four distinct categories which are useful to well-being research and applications. This enables a distinction between the variables which can be changed from outside the system, the variables which are within the system, and the variables which represents the consequences of the interactions between system components and the environment.

As has been discussed in the second principle sections of the engine and quality of life frameworks, the system boundary used in both instances is equivalent to the person-system. The four qualities of life framework (Veenhoven, 2000) defines more precisely the factors which are in the system from the factors which belong to the environment by defining *inner* and *outer* qualities of life. Veenhoven suggests that there are *inner* well-being outcomes and *outer* well-being outcomes. Interestingly, Jayawickreme and colleagues suggest that there two types of inputs: endogenous inputs (within-system inputs) and exogenous inputs (inputs from the environment). The two models are complementary since the former suggests two levels of outputs while the latter suggest two levels of inputs. The combination of both models would make a more comprehensive framework in terms of levels of analysis.

***Principle 3*: The level of analysis of the model should be defined for greater comprehensive explanation and integration with other disciplines.**

The four qualities of life model can be seen to provide a useful framework for the integration of various disciplines. The distinction of inner or outer qualities and life chances or results affords a framework to place well-being concepts from various disciplines related to well-being in relation to one another. For example, the outer qualities column relates to external variables which are primarily the concern of policy makers, economists and sociologists. The input variables (e.g., water quality, equality, national wealth, access to education) can be affected by public policies and social interventions to improve the well-being of groups of individuals. The effects of those interventions can be observed by assessing related output variables which would fit in the two bottom quadrants (e.g., being a good citizen, voluntary contribution, satisfaction with job).

In contrast, variables in the life-ability quadrant are of interest to health practitioners and psychologists and can be assessed to highlight deficits and guide individualized interventions. The classification of variables in these four categories of life quality is inherently integrative and can be useful to well-being research and applications.

***Principle 4*: A comprehensive theory of well-being should explain the processes that contribute to the observed stability of well-being.**

As a typological approach, the four qualities of life framework does not provide an explanation for well-being. The reason for that is that a simple linear causal relationship is assumed by using a static classification model: input (liveability of environment) interact with system components (life-ability of the person) to cause the output (utility of life and subjective appreciation of life). This linear causal chain assumes that stability of outputs is caused by stable inputs. In other words, it assumes that stable inputs will cause stable well-being dimension, and stable well-being dimensions are caused by a stable environment.

The point to be made here is that a linear approximation, a simple cause and effect relationship, is implicit in a categorical approach as used in the four qualities of life. A comprehensive explanation for well-being could be added to the model by describing the dynamic interactions between the variables that cause stability and change.

***Principle 5*: A comprehensive theory of well-being should explain the processes that contribute to change well-being to a new stable state.**

As has been argued in the previous section, the four qualities of life model does not propose an adequate explanation for the changeability of well-being, which is expected from a typological approach. The components are adequately categorized but the dynamical processes are missing to further develop the four qualities of life framework into a theory. This model could be expanded into a comprehensive explanation for lasting well-being change by addressing the dynamic interactions between the components and the system inputs. The main limitation to building a well-being theory from the four qualities of life framework is that it is missing a description of the dynamic processes.

Summary of Chapter 4

The four qualities of life model provides a useful framework for the classification of well-being concepts and dimensions. It distinguishes input variables, from the causal side of well-being, from well-being outcomes. Thus, they are logically independent. This categorization is useful to categorize well-being concepts from multiple disciplines and provides an integrative framework potentially enabling an agreed use of well-being terminology between various disciplines.

The four qualities of life framework could potentially be extended into a theory of well-being by modelling the dynamic processes describing the interactions between the variables and how they contribute to the stability or changeability of well-being.

Chapter 5

Discussion, Limitations, and Future Research

The results of the preceding analysis suggest that the well-being system framework with its five principles for theory building can be useful for developing a comprehensive explanation for well-being, including a theoretical explanation for a lasting purposeful change. The basic assumption is that well-being is a phenomenon resulting from interactions between components in the person-system and with the environment. Since a set of components in interactions between themselves and with the environment is the definition of a system (e.g., Bertalanffy, 1968a), it is presumed that well-being can be modelled as the outcome of system processes.

Principle 1: Defining System Components.

In chapter 2 of this analysis, the system structure property was defined as the description of the system: what it *is*. If well-being is a system outcome, defining the system's structure through its components, boundary, and level of analysis can be useful to hypothesize a model about *how* these elements interact with input to contribute to well-being outcomes. From a systems perspective, this enables the components of a system which might explain well-being to be logically independent from well-being outcomes, as discussed in chapter 2.

The results of the analysis of the component section of chapter 2 revealed that cognitive and affective components can by hypothesized as some of the components of a well-being system. In chapter 3, the engine of well-being emphasized the component of choice. The well-being model example at the end of chapter 2 was constructed using affective and cognitive system components and the component of choice. Thus, the example illustrates that a potential comprehensive explanatory model of well-being can be built using choice (or volition) with affective and cognitive components. However, whether those three types of components represent elements of a natural well-being system would need to be demonstrated in future research.

The results of the analysis in chapter 2 with the example at the end reveal that defining the basic components of a well-being system is useful since it enables a deductive explanation of well-being outcomes can be made using components, their attributes, and their interactions. As the components are part of the structural aspect of the system, they should be the same for all humans. The attributes, however, can be changed. Component attributes are of interest to researchers who aim to develop interventions to change well-being outcomes.

Attributes can be modelled as variables (Dubin, 1978) which contribute to well-being and could also potentially be used as attributes of measurable well-being dimensions (e.g., positive or negative). Listing component *types*, like affective and cognitive, is useful, but the components themselves should also be defined to contribute to an explanation of the system's behaviour. In the example of well-being model built with the five principles at the end of chapter 2, there are no total number of components. The graphical representation showed 3 components, but there could be more. If the conceptual system intends to represent the well-being natural system, the number of components of the model should correspond to the number of natural components hypothesized or observed. The same applies to the attributes: they should represent observable or deductable attributes of well-being.

As per the results of the analysis, if choice, affect and cognition are hypothesized as basic components of the system, future research could investigate the relationship between these components and well-being outcomes.

Principle 2: Defining System Boundary.

The results of the analysis suggest that defining the boundary is useful since it further distinguishes types of variable by their function: input variables, component attribute variables, processes variables, and outcome variables. The significance in distinguishing the boundary is that it determines what type of change (e.g., trait-like, state-like) a variable is related to. As has been discussed in the changeability principle section of chapter 2, state-like change depends on input variables while trait-like change depends on system alteration or system optimization, hence variables that pertain to components' attributes or system processes.

The two types of change are thus related to different types of interventions. Input variables related to changes in the environment, volitional or not. Consequently, policy makers and economists can use input variables to increase well-being in individuals. This has been discussed in the boundary principle section of both chapter 3 and 4 as both the engine of well-being and the four qualities of life framework successfully integrate various disciplines pertaining to input variables (e.g., economy, sociology, ecology). As has been mentioned at the beginning of chapter 2, this was one of Hagerty and colleagues' (2001) reasons for recommending a systems approach to well-being theories.

Change in input variables are also used in individual psychological interventions. For example, as mentioned in the level of analysis section of chapter 2, self-determination theory suggests that if the nutrients for satisfying the basic psychological needs are available within the context, the individual can derive well-being outcomes. Thus a clinical intervention based on self-determination theory would focus on altering the context so that it can provide the nutrients, thus inputs, to satisfy basic psychological needs (Ryan & Deci, 2017).

The boundary definition also has implications on well-being outcomes measures. There are two types of well-being measurements: those aimed at measuring individual well-being to assess the efficiency of interventions or individual progress (e.g., Diener et al., 2010; Watson et al., 1988), and those aimed at monitoring collective well-being (e.g., public policy, workplace, national social indicator) (e.g., Forgeard et al., 2011; Hagerty et al., 2001). Some instruments measure well-being variables without distinguishing whether the item measures are input or output variables, hence the variables are not as informative as they could be (Hagerty et al., 2001). If positive change in well-being is the objective of the measurement, then the definition of the boundary is useful to clarify if the item measured is an input or an outcome.

It can thus be concluded that a clear boundary definition and its consequences on the functionality of variables measured implies more precise and informative well-being measurements.

Principle 3: Defining System Level of Analysis.

The level of analysis principle can be helpful to provide a framework for both the differentiation and the integration of various disciplines related to well-being. As discussed in the structure section of chapter 1, the environment of one system is a system itself, and the components of a system are also systems themselves (Bertalanffy, 1968b). Some processes occur at the same level of analysis (e.g., Mischel & Shoda, 1995; Rusk et al., 2017), while some other processes occur between levels (top-down and bottom-up processes) (Kozlowski et al., 2016; Kozlowski & Klein, 2000) as mentioned in the system structure section of chapter 1.

One of the implications of a well-determined level of analysis is that it enables a multilevel approach. A multilevel approach enables the study of emergence: an independent phenomenon or property is cause by the components at a lower level of analysis and “is amplified by their interactions, and manifests as a higher-level, collective phenomenon” (Kozlowski & Klein, 2000, p. 55) thus it involves bottom-up processes. An emergent property is what is meant by saying that *the whole is greater than the sum of its parts*. An emergent phenomenon, property, or state cannot be reduced. It must be observed at the whole system level as it cannot be observed or measured by making the summation of the system’s components or attributes (Kozlowski & Klein, 2000). Emergent phenomena require a multilevel approach to be modelled accurately (Kozlowski & Klein, 2000). Well-being, or some of its aspects, could be investigated as a potential emergent phenomenon.

New methodologies involving computer simulations developed in organizational psychology (Kozlowski, Chao, Grand, Braun, & Kuljanin, 2013; Kozlowski et al., 2016; Weinhardt & Vancouver, 2012) could potentially be applied to such a model of well-being as an emergent phenomenon. This is a possible new avenue for well-being research which would potentially enable modelling the organized complexity of well-being through computer simulations. As the well-being system framework enables the construction of a deductive explanatory model for well-being, the deductions could be formulated in a computer program language. The use of such methods would enable the potential formalization of a well-being theory. The example of a well-being model built on the five principles given at the end of chapter 2 could potentially be formalized and tested through a computer simulation. Examples of other types of computer simulations using a dynamical approach have been provided in the appendix.

Another implication of the results of this analysis is that genetic factors of well-being can relate to psychological factors of well-being through the definition of their levels of analyses. As discussed in the level of analysis section of chapter 2, while there is ample evidence that genetic factors influence well-being (e.g., Bartels & Boomsma, 2009; Lykken

& Tellegen, 1996; Nes et al., 2006), the processes by which genetic factors influence well-being dimensions are largely unknown (e.g., Røysamb et al., 2014). A structural system representation of genetic components on a different level of analysis from cognitive and affective components, for example, could assist in building and testing a well-being model to help the disciplines involved in integrating their research findings. For instance, recent findings (Baselmans et al., 2017) from epigenetics relating to the methylation of genes (gene expression turned on or off) seem significantly relevant to a comprehensive theory of well-being. The study found that identical twins with discordant well-being levels were found to have different methylation patterns in certain groups of genes. These findings could be a step toward a genetic explanation for a set-point or set-point range. Potentially, if the multilevel processes between the genetic factors and psychological factors for well-being can be modelled with the five principles, it may be possible to hypothesize a deductive explanation to potentially 'turn off' or 'turn on' certain genes relating to well-being.

In brief, the implications of potentially formalizing a theory of well-being modelled as an emergent phenomenon and of potentially integrating genetic factors into a well-being model are significant. The possible implications of future well-being theories capable of unifying research findings of other disciplines through an explanatory model goes far beyond the process of integrating them through typological frameworks.

Principle 4: Explanation for Well-Being Stability.

As discussed in the stability section of chapter 2, the next two principles relate to explanations for stability and change, which require the description of system processes since either stability or change should be assessed in relation to a dynamic environment. The system process property enables an explanation of system outcomes: *how* the system works. The well-being system framework suggests that a comprehensive theory of well-being should include an explanatory model for the remarkable stability of well-being. Current well-being models explaining its stability aspect are based on a closed system model like homeostasis or the existence of a set-point or set-point range (e.g., Cummins, 2010). These concepts relate to cybernetic models which are based on the laws of classical mechanics where a linear causal chain is assumed: effects are predictable (e.g., Ashby, 1961). As discussed in the stability section of chapter 2, psychological processes are complex and dynamic, so a homeostatic or set-point model can only provide an incomplete explanation or an approximation for why well-being remains stable despite a constantly changing environment.

Some the most convincing initial claims in favour of set-point theory as an explanation for well-being stability came from empirical studies on the effect of major life events (Brickman et al., 1978). Many subsequent studies showed similar results. For example, those who experience the death of a spouse go back very close (within about 0.15 points) to pre-event level of life satisfaction within 7 years (Lucas et al., 2003). Even positive events seem to have no long-term effect on life satisfaction levels. For example, most people were found to adapt to marriage regaining pre-event level of life satisfaction within 2 years on average (Clark & Georgellis, 2013; Lucas et al., 2003). Even shortly after the birth of a child, life satisfaction was found to go back to baseline (Clark & Georgellis, 2013). However, some events seem more difficult to recover from, such as divorce (Lucas, 2005), disability (Lucas, 2007), unemployment (Lucas et al., 2004), and especially with repeated unemployment (Luhmann & Eid, 2009) where life satisfaction decreases and remains at a significantly lower level in a significant proportion of individuals. This led to the claim that the well-being set-point can be changed. However, studies showing a sustained decrease in life satisfaction do not necessarily entail a change of set-point. As has been discussed in the changeability section of chapter 2, a sustained decrease in life satisfaction may also be interpreted as a homeostatic failure (Cummins, 2010). Therefore, an adequate well-being model for stability should explain why most people get back or very close to their initial well-being level (e.g., Lucas et al., 2003) and why a significant minority stabilize at a new well-being level (e.g., Headey, Muffels, & Wagner, 2013; Lucas et al., 2004). Most importantly, such a model should hypothesize how a purposeful and lasting positive change can be made.

The set-point perspective implicitly uses a linear causation approach where the stability of well-being is presumed to be dependent on the stability of inputs: A stable environment contributes to the stability of well-being. Consequently, the main limitation in such an approach is that significant perturbations in inputs, for example due to a major negative life event, should necessarily cause a significant perturbation in outputs. However, major life events do not affect everyone the same way. A study conducted by Mancini, Bonanno, and Clark (2011) showed that there are important individual differences in how individuals react to a major life event. Some individuals are mostly unaffected by major life events, some almost completely recover, while others never completely return to their initial well-being level (Mancini et al., 2011). The effect of major perturbations to inputs does not cause reliable predictable outcomes: A significant minority of people reacts differently from the majority (Headey, Muffels, & Wagner, 2014). Hence an adequate explanation for the stability of well-being should explain why most people get back or very close to their initial well-being level and why a significant minority never regain their initial well-being level.

The current framework can assist in providing an explanation for stability that does not contain the limitations of a linear causation approach as set-point theory. What the present analysis contributes is that system stability can be modelled with a dynamical systems approach, as illustrated in the example at the end of chapter 2. From a dynamical system perspective, the tendency of a dynamical system to return to a stable state can be explained as an attractor (Thelen & Smith, 2006). As discussed in the dynamical systems perspective in chapter 1, living systems have several equilibrium points, or attractors. This stands in contrast to a linear set-point perspective. Stability can also be modelled as a steady state (Bertalanffy, 1968a). A dynamical systems model for stability such as an attractor or a steady state opens up more possibilities for future research than a limiting model like the set-point model.

As stability is not maintained as efficiently for all individuals (e.g., Mancini et al., 2011), the well-being system framework also implies that an explanation should be provided for the individual factors which affect stability and resilience. Further research is required to develop a theoretical model which explains the entire spectrum of well-being stability (Headey, 2010).

As mentioned in the introduction, an implication of a dynamical approach for stability is that it can bring a change of paradigm for the well-being research tradition (Headey, 2010). The set-point paradigm has been said to hinder research progress on the changeability of well-being (Headey, 2010). The strongest argument in favour of the set-point paradigm is the genetic heritability aspect (Lykken & Tellegen, 1996) as mentioned in the introduction. However, in the previous section discussing the level of analysis, the genetic factors are taken into consideration in the current framework as a different level of analysis influencing well-being outcomes. Hence, the set-point theory can be replaced by the current framework.

Principle 5: Explanation for Well-Being Changeability.

As discussed in the changeability section of chapter 2, a comprehensive theory of well-being should hypothesize an explanation for a purposeful well-being improvement and a theoretical explanation on how to stabilize the new state (e.g., new steady state, attractor). Both models reviewed in chapter 3 and 4 lack an explanation for a purposeful lasting change of well-being since they are intended as classification systems rather than explanatory frameworks. The engine of well-being and quality of life frameworks could be developed in comprehensive theories of well-being by adding a dynamic model to explain both stability and change.

The results of the analysis in the changeability section of chapter 2 were that the explanation for a stable new improvement implies the explanation for stability, as a persistent change implies that the new stable state becomes the new normal. Thus, it implies a trait-like change, as defined in that section. The analysis showed that a trait-like change requires an alteration of the system. The synergistic change model (Rusk et al., 2017) discussed in the changeability section of chapter 2 is an example of theoretical model for a trait-like change. The synergistic change model hypothesizes that lasting change requires activating a synergistic mechanism by implementing a change in all the five system components of the model to produce an amplifying effect toward the desired outcome. This is theorized to lastingly alter the system processes.

The well-being system framework contributes to an explanation for well-being changeability by suggesting that if a theory were to satisfy the first four principles, it would contain the ingredients to build an explanatory model for lasting change. The understanding of the dynamic processes which maintain well-being in a steady state is useful to explain how a new stable state can be achieved. Using the first four principles, for example, a deductive explanation for well-being could be constructed with the components and their attributes, the boundary, the dynamic multilevel relationships, and the processes that enable the system to maintain a relative stability. This has been illustrated by the example at the end of chapter 2. This deductive approach also enables the logical and formal testing of a potential theory. Once hypothesized, such a model could be simulated to explore what kind of processes would allow to shift the system to a new stable state and what components, attributes, inputs, or processes need to be modified to do so.

The main contribution of a dynamic changeability model as proposed is that interventions for a persistent purposeful positive change can be deductively designed and tested. In other words, interventions could be designed to change the set-point, in the language of the previous paradigm. If a conceptual well-being model using the five principles represents the natural well-being system well, then a deductive explanation can lead to forming predictions on well-being outcomes. New interventions can then be designed or improved using that model.

Limitations and Future Directions

The system perspective applied to building a comprehensive theory of well-being also implies some limitations: (1) a dynamical system approach can alienate readers; (2) only a selection of dynamical system models was reviewed; and (3) there is no consensus to define well-being dependencies. Each of these are addressed below.

Firstly, merging a dynamical system approach with psychological concepts is often unfamiliar for many researchers (Gelfand & Engelhart, 2012). The familiar mechanical and predictable usual *cause and effect* is replaced by laws of organized complexity in dynamical systems, which may involve many components and their nonlinear interactions, including multiple feedback loops, two-way causality, and feedforward mechanisms, for instance (e.g., Ashby, 1961; Bertalanffy, 1968a; Thelen & Smith, 2006). Dynamic models are complex representations which are challenging to grasp (Gelfand & Engelhart, 2012). One possible way to circumvent these challenges is to use modelling and computer simulations (Kozlowski et al., 2013; Vancouver & Weinhardt, 2012; Weinhardt & Vancouver, 2012). Several models exist for dynamic systems. For example, dynamical systems theory, network theory, and complexity theory are subfields of mathematics and computer science which focus on modelling complex system dynamics which can offer many conceptual, graphical, and formal tools. Additionally, some reviews of dynamic system concepts can be useful in untangling dynamical approaches and terminologies (e.g., Thelen & Smith, 2006). Even though a dynamical approach is more challenging to use and understand than a typological approach, it provides a potential model that can be tested while the typological approach aims mainly at integrating concepts. Therefore, dynamical approaches are very useful but authors presenting them should define any potentially confusing terminology or concepts.

Secondly, multiple dynamical system variants exist but only a subset were reviewed in the analysis. The emphasis in this thesis has been on a selection of dynamical systems models (e.g., steady state, open system, organismic), but there are many variants of dynamic system models which should also be considered for problems of organized complexity. For example, several dynamical system models have been applied to different fields of psychology, each with their unique terminology and descriptions: open system (Katz & Kahn, 1978), dynamical system (e.g., Nowak et al., 2005; Shoda et al., 2002), organismic approach (Ryan & Deci, 2017), multilevel approach (Kozlowski & Klein, 2000), complex adaptive system (e.g., J. H. Miller & Page, 2009; Smaldino, Calanchini, & Pickett, 2015), complex dynamical system (e.g., Wichers, Wigman, & Myin-Germeys, 2015), and network analysis (e.g., Borsboom & Cramer, 2013; Cramer et al., 2012). Despite the potentially confusing terminology, all these dynamical system frameworks have enabled the formalization of psychological theories. Assessment of these alternate approaches may entail further contributions and open new avenues for well-being research.

Thirdly, the lack of consensus on conceptualizing well-being influences and dependencies can cause confusion and hinder communication, thus cause a barrier to implement a systems approach such as this one. For instance, there are inconsistencies on defining a well-being system boundary, what is *in* or *out* of the system, or how *bottom-up* and *top-down* should be interpreted. For example, an interpretation of *top-down* approach to subjective well-being was proposed by Diener (1984) to mean that "a global propensity to experience things in a positive way" (p.565) can influence life satisfaction. This includes personality factors, which are usually claimed as *traits* or *predispositions*. This interpretation has been adopted by many subjective well-being researchers (Brief, Butcher, George, & Link, 1993; Headey & Muffels, 2017; Headey, Veenhoven, & Wearing, 1991). While genetic factors are deemed by some to be a cause of those predispositions influencing well-being through bottom-up processes (Bartels & Boomsma, 2009), as genetic factors can be considered as more deeply embedded within the person-system. Some other researchers have interpreted *top-down* as a cognitive route where aspiration levels are seen to affect well-being (Sheldon & Lyubomirsky, 2012), which is the foundation of the happiness prevention model discussed earlier. It can be noted that these interpretations are compatible: it is all relative to the (sometimes lacking) definition of system boundary. For example, affect could be seen as a more deeply embedded level of analysis than cognition and personality for a system explaining life satisfaction, which is itself imbedded within the well-being system. Other researchers have noted the problem of two-way causation where bottom-up "domain satisfactions influence well-being" and top- down models "well-being influences domain satisfactions" have been hypothesized (Headey & Wearing, 1992, p. 62) and observed (Headey & Muffels, 2016). In scholarly literature, the use of *top-down* and *bottom-up,* for example, is not always consistent with the systems theory interpretation of the terms, which can lead to confusion. The current analysis and resulting five principles provide a framework through which this confusion could be resolved, as top-down is equated to inputs passing from the environment into the system at all levels of analyses and bottom-up is defined as outputs or outcomes, thus exiting the system.

The well-being system framework aims to increase systems theory adoption by suggesting conceptual elements (e.g., components, boundary, dynamic stability processes) useful to build explanatory models that can help narrow the gap between empirical conceptualisations and a comprehensive theoretical explanation of well-being. The framework is consistent with more general theory building methodologies suggesting that theories themselves are dynamics systems (Bunge, 1967; Dubin, 1978). This analysis contributes to suggesting a framework for building and potentially formalizing a comprehensive theory of well-being through deduction explanations following the five principles. Such a theory's internal coherence could then be tested and refined by using dynamical mathematical tools or computers to simulate different scenarios (Kozlowski et al., 2013; Weinhardt & Vancouver, 2012). The next step of development of this framework should include a precise definition of what well-being dimensions represent in such a framework, leading to developing a comprehensive assessment of well-being to complement a comprehensive explanatory framework.

Conclusion

This thesis contributes a deductive explanatory framework for building theories of well-being by describing what well-being *is* and *how* it works from a systems perspective. This framework suggests to first define a system structure with its components, boundary, and level of analysis. Using those structural elements, an explanatory model can then be constructed by hypothesizing on the dynamic system processes that contribute to the observed stability of well-being, and to a theoretical explanation of a lasting well-being improvement. This thesis proposes five principles describing these structural and process system properties as a guide to building an explanatory model for well-being.

The present analysis applied these five guiding to two well-being frameworks which has highlighted some of their strengths and weakness and enabled to suggest some potential future development to extend them into comprehensive models of well-being. Thus, this explanatory framework applied to well-being can also highlight the limitations of current well-being theories and guide future theory development. This thesis opens avenues for future research by importing in the field of well-being research methodologies using a system approach successfully in other fields.

The current analysis implies that finding the laws of organization of a dynamic well-being system can be hypothesized by applying this framework, which could lead to explain how to lastingly improve well-being and stabilize the new state. This could then be used for intervention design or optimization of existing interventions. The present analysis contributes a new paradigm that can replace set-point theory and its variants.

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Appendix

Graphical Example for the Components Principle

Principle 1: The components of a system explaining well-being should be clearly defined and logically independent from well-being outcomes.

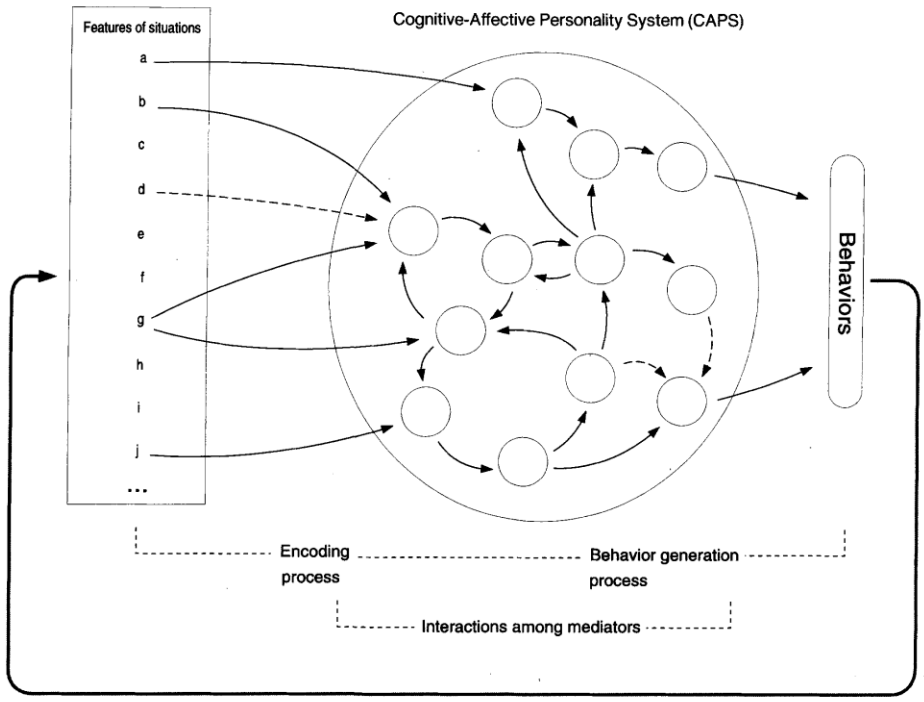

Figure 2- The CAPS model shows the affective and cognitive system components and their interactions. Adapted "A cognitive-affective system theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure," by W. Mischel, and Y. Shoda, 1995, *Psychological Review, 102,* p. 254. Copyright 1995 by the American Psychological Association.

An example of application of principle 1 is Mischel and Shoda's (1995) cognitive-affective personality (CAPS) model. The CAPS model represents personality as a system of cognitive and affective components in interrelation between themselves and with the environment. In the CAPS model, the input is defined as *features of situations* and the output is defined as *behaviours* (refer to fig. 2). This system of affective and cognitive components forms the personality structure unique to the individual and represents the invariant aspect of the individual across situations. The CAPS model is a good example of a system made of clearly defined types of components, the cognitive and affective units. Those system components are logically independent of well-being outcomes, which are represented by behaviours in the diagram on figure 2. This model thus satisfies the first principle of the well-being system framework. Some of the benefits of clearly defined components which are logically independent of well-being outcomes include being able to hypothesize about the mechanics of the interactions between system components and with the environment and suggest potential causal explanations for behaviour. This has enabled the authors to run computer simulations of the model and suggest an explanation for stable patterns of behaviour across different situations based on a dynamical system approach (Shoda et al., 2002), which will be described in more detail as an example of principle 4.

Graphical Example for the Boundary Principle

Principle 2: The system boundary should be clearly defined, distinguishing within-system variables from environment variables.

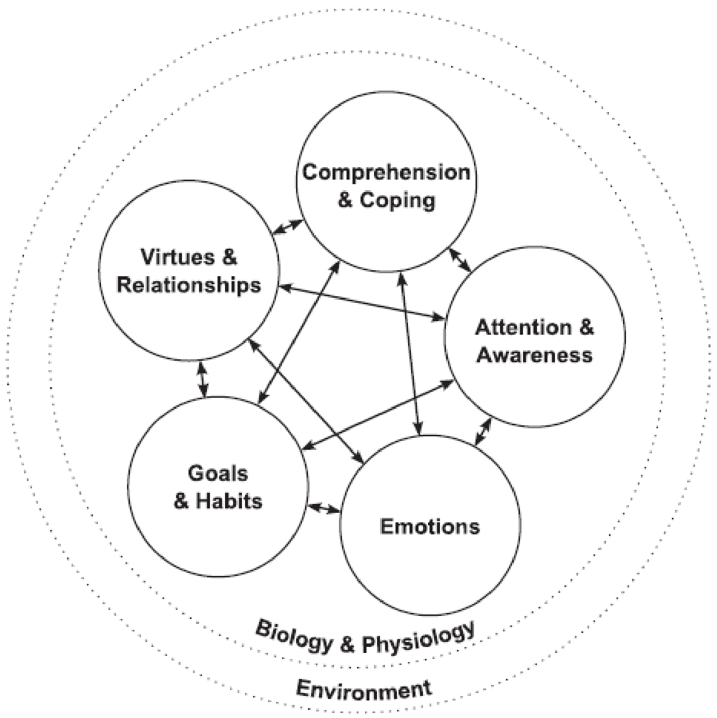

Figure 3- The synergistic change model illustrates the clear system boundary which delimitates the components of the system from the environment. Adapted from "A complex dynamic systems approach to lasting positive change: The synergistic change model," by R. D. Rusk, D. A. Vella-Brodrick, and L. Waters, 2017, *The Journal of Positive Psychology*, p.1. Copyright 2017 by the Taylor & Francis Group.

The synergistic change model (Rusk et al., 2017) argues that enduring positive change in psychological and social functioning depends on the mutual relationships between system components. The components of the system are: (1) attention and awareness, (2) comprehension and coping, (3) emotions, (4) goals and habits, and (5) relationships and virtues (fig. 3). The components are viewed as being in mutual interaction. Using this conceptualization based on dynamical systems theory, the authors make recommendations for ways to apply positive interventions to achieve sustainable positive change by altering the relationships between elements to create mutual reinforcement between components (synergistic interactions). The synergistic change model is a good example for the boundary principle as it delimitates the psychological level in mutual interaction, represented by the five components in figure 3, from the biological and physiological level, and from the external environment. The double boundary clarifies the embedded interactions between the different levels, where biology and physiology is the environment for the psychological system, and the external environment is the environment for the biological and physiological system.

Graphical Example for the Level of Analysis Principle

Principle 3: The level of analysis of the model should be defined for greater comprehensive explanation and integration with other disciplines.

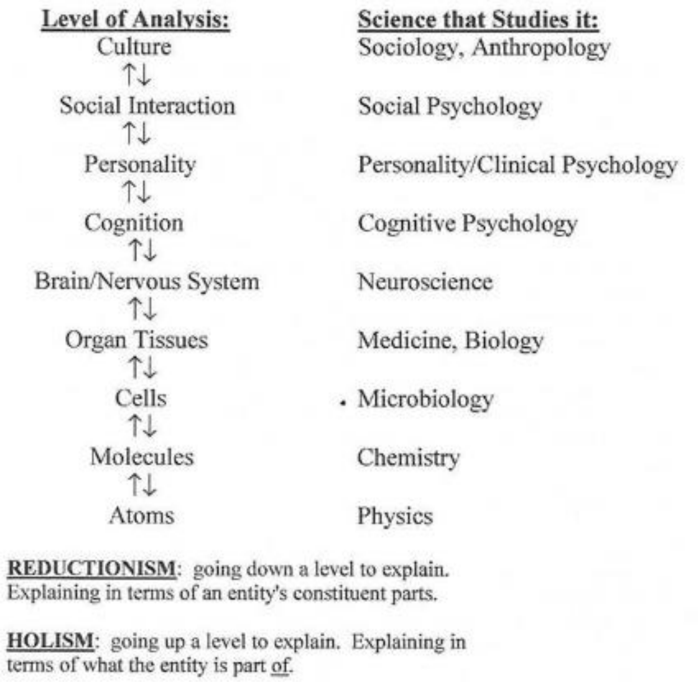

Figure 4 - Potential influences on human behaviour shows the relationships between different fields relating to well-being. Adapted from "Optimal human being: An integrated multi-level perspective," by K. M. Sheldon, 2004, Mahwah, NJ: Lawrence Erlbaum Associates.

Sheldon (2004) proposes that human behaviour results from the interactions between the multiple spheres or levels that encompass the person. He suggests that the different levels of analysis can influence human behaviour with equal weight. The collaboration between scientific disciplines is essential for understanding human behaviour where each discipline is viewed as playing a unique role and integrating with other disciplines (fig. 4). Sheldon provides a conceptual framework for future research to develop multilevel theories of optimal human behaviour and wellbeing. In figure 4, the top-down and bottom-up interactions between the various level of analyses involved in human well-being and their associated scientific discipline are illustrated to show how they all contribute to an individual's behaviour. Sheldon's conceptual multilevel framework of human behaviour is a good example of how principle 3 can be applied. Such a multilevel conceptual framework can be useful for the integration of scientific disciplines and concepts used to explain behaviour by allowing hypotheses focusing on the interactions between levels. This perspective complements principle 1 which focuses on interactions between system components and thus enables a more holistic approach to well-being and behaviour.

Graphical Example for the Stability Principle

Principle 4: A comprehensive theory of well-being should explain the processes that contribute to the observed stability of well-being.

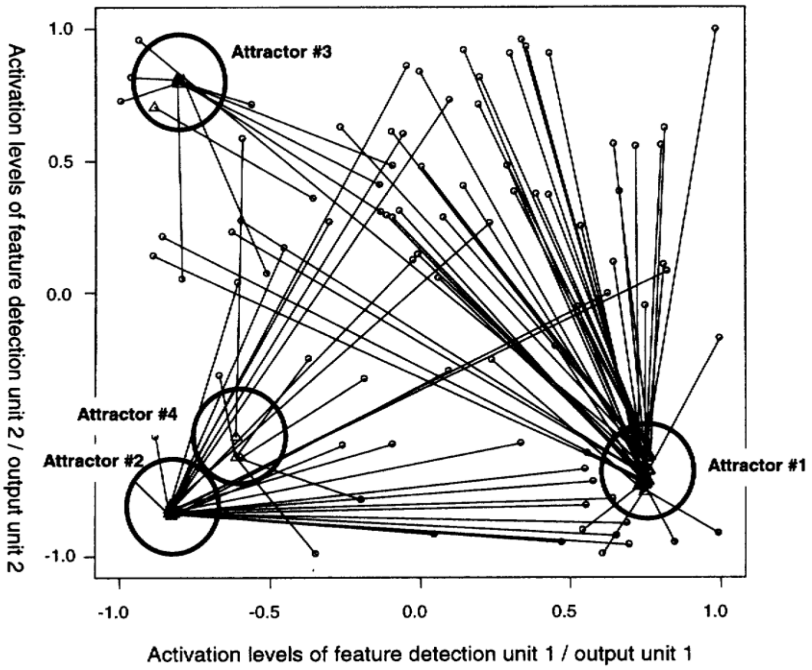

Figure 5. The CAPS model results of a computer simulation using the model of attractors to model stability. After 100 iterations of the simulation, the simulation settled in one of the 4 attractor states. Adapted from "Personality as a dynamical system: Emergence of stability and distinctiveness from intra- and interpersonal interactions," by Y. Shoda, S., LeeTiernan, and W. Mischel, 2002, *Personality and Social Psychology Review, 6,* p.320. Copyright 2002 by Lawrence Erlbaum Associates, Inc.

The CAPS model which was used as an example of the components principle, or principle 1, is also a good example of the application of the stability principle. Shoda, LeeTiernan, and Mischel (2002) extended the CAPS model to propose that subsets of cognitive and affective components forming the system can become activated by their interaction with situations or other people. The activated subsets of components can cause patterns of behaviour specific to each situation, thus suggesting a causal explanation for the stability of behaviour in similar situations which is the hallmark of personality (Shoda et al., 2002). In addition to providing a coherent explanation for persistent behaviour, Shoda, LeeTiernan, and Mischel (2002) formalized the CAPS model using a computer simulation. After 100 iterations, the simulation settled in one of 4 stable states, as shown in figure 5.

Those stable states represent subsets of behaviours and are modelled as attractors, as discussed in the stability section of chapter 2.

Graphical Example for the Changeability Principle

Principle 5: A comprehensive theory of well-being should explain the processes that contribute to change well-being to a new stable state.

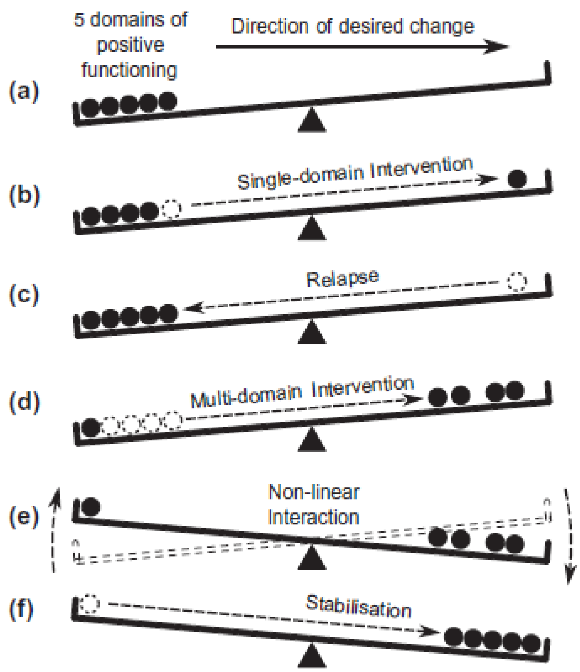

Figure 6. Nonlinear synergistic interaction between domains tips the system. Adapted from "A complex dynamic systems approach to lasting positive change: The synergistic change model," by R. D. Rusk, D. A. Vella-Brodrick, and L. Waters, 2017, *The Journal of Positive Psychology*, p.1. Copyright 2017 by the Taylor & Francis Group.

The synergistic change model proposes that for positive interventions to bring a lasting positive change, the five domains of psycho-social functioning must mutually reinforce each other synergistically. The complex dynamical system of the synergistic change model has five mutually dependent components : (1) attention and awareness, (2) comprehension and awareness, (3) emotions, (4) goals and habits, and (5) virtues and relationships. In figure 6, the five components are represented by five balls on a swing. If only one component improves, represented by one ball moving to the opposite end of the swing, the change might become undone and well-being returns to its usual stable state. The synergistic change model is based on dynamical and complex systems where synergistic interactions can cause nonlinear effects enabling the system to stabilize in a new stable state. If the mutual interactions between the five domains is strong enough, their synergy will tip the system into a new stable state thus causing lasting positive change (Rusk et al., 2017). The synergistic change model is a good example of how the changeability principle can be applied to well-being by describing dynamical processes that might enable lasting change. This model suggests a potential mechanism which can be applied to interventions by making changes in multiple domains to achieve a purposeful and positive lasting change.