CHAPTER 2
A Self-Organizing Model of Self-Esteem: Trait and State Self-Esteem as Dynamically Connected Across Nested Time Scales

Abstract

The current chapter proposes a Self-Organizing Self-Esteem (SOSE) model, which provides an integrative theoretical foundation for conceptualizing and studying the dynamics of state self-esteem and trait self-esteem. The SOSE model is in contrast to the traditional approach to self-esteem, in which state and trait self-esteem are part of one construct, where state self-esteem is conceptualized as the contextual error around latent trait self-esteem. In contrast, the SOSE model posits that trait self-esteem and state self-esteem are distinct constructs that occur on two interconnected time scales. The model outlines how their nature, as well as their relationship with each other, can be conceptualized based on a primary process of bottom-up emergence, where trait self-esteem is an emergent macro-level product of state self-esteem dynamics, and state self-esteem is an emergent meso-level product of current micro-level experiences of the self. The model also outlines a secondary process, namely, that of top-down constraint, where the emergence of the higher-order construct begins a process of constraint on lower-order interactions. Together, these form a self-organizing process. The current chapter discusses the core differences between the SOSE model and the traditional approach to self-esteem and the implications that these differences have for empirical research. [1]

[1] This chapter is based on De Ruiter, N.M.P., Van Geert, P.L.C, Kunnen, E.S. (2015). *A self-organizing model of self-esteem: state and trait self-esteem as dynamically interacting across nested time scales.* Manuscript under revision.

While it is generally accepted that self-esteem is multifaceted, with a trait element and a state element (Donnellan, Kenny, Trzesniewski, Lucas, & Conger, 2012), there are relatively few explicit accounts of how these facets are ontologically interconnected, and even fewer attempts to empirically investigate this interconnection. In the current article, we delve into the nature of the trait aspect of self-esteem (typically characterized as the relatively stable valence associated with the self-concept; Harter, 1982; Rosenberg, 1979) and the state aspect of self-esteem (typically characterized as the fleeting and in-the-moment experience of the self; DeHart & Pelham, 2007; Kernis, Cornell, Sun, Berry, & Harlow, 1993; Leary & Downs, 1995; Rosenberg, 1986), as well as the relationship between the two.

Specifically, we present a comprehensive model of trait and state self-esteem and their dynamic relationship, called the *Self-Organizing Self-Esteem (SOSE)* model. As the name suggests, our model emphasizes the process of *self-organization* as a core underlying mechanism of self-esteem (Kelso, 2000; Smith & Thelen, 2003), where self-esteem is conceptualized as spatiotemporal patterns of self-experience that arise out of many nonlinear interactions between lower-order components, and where novelty is generated by the intrinsic dynamics of self-esteem itself.

The SOSE model is in contrast with the traditional top-down approach to self-esteem, which we call the *latent-construct* model. Broadly speaking the latent-construct model suggests that trait self-esteem is a latent variable that generates measurable and context-dependent experiences of the self (i.e., state self-esteem) in a top-down fashion.

With our model, we show that self-esteem can be conceptualized as a complex dynamic system, which is any system that is composed of multiple components that interact with each other in a reciprocal and iterative way over time (Thelen & Smith, 1994; Van Geert, 1994, 2008). While some researchers have theorized about the importance of dynamics and complexity in self-esteem (for example, Delignières, Fortes, & Ninot, 2004; Kernis, Cornell, Sun, Berry, & Harlow, 1993; Markus & Wurf, 1987; Morf & Mischel, 2012; Ninot, Fortes, & Delignières, 2005; Nowak, Vallacher, Tesser, & Borkowski, 2000; Scheff & Fearon, 2004; Vallacher, Nowak, Froehlich, & Rockloff, 2002), there is currently no formal model from which the specific nature of the relationship between state self-esteem and trait self-esteem can be conceptualized.

The main aim of the current chapter is to present our SOSE model as a new account of the nature of state self-esteem, trait self-esteem, and their relationship with each other, compared to the latent-construct model. We show that the fundamental differences between the models stem from a distinction in the *causality theory* that underlies the two models, where an *emergent-causality* theory contrasts a *generative-causality* theory. Our second aim is to show that the two models also complement each other, in that they predict two different empirical approaches to self-esteem and two different kinds of research questions that, together, provide comprehensive empirical coverage of the self-esteem concept.

As the two alternative models of self-esteem discussed in the current article are models of the ontological relationship between trait and state self-esteem, it is important

that we first clarify what is meant by 'self-esteem', and more specifically, its 'trait' and 'state' characteristics[2]. We begin by outlining the difference between trait and state self-esteem from the theoretical bases of the classic Jamesian distinction between me-self and I-self (James, 1890).

2.1 The Foundation of Trait and State Self-esteem

The difference between trait self-esteem and state self-esteem is often reduced to a distinction in the level of stability and context-dependency **(**Kernis et al., 1993; Leary & Downs, 1995; Rosenberg, 1986). Trait self-esteem is seen as relatively stable and context independent, while state self-esteem is seen as highly variable and context dependent. We suggest that, while this distinction is accurate, it does not quite capture the essence of the difference between trait self-esteem and state self-esteem. To appreciate the essential difference, we suggest that the distinction between trait self-esteem and state self-esteem be framed in terms of the classical distinction between *me-self* and *I-self*. This distinction was formulated by William James (1890), and is seen as classic in self-psychology (Rosenberg, 1979) with a vast legacy in modern-day psychology (e.g., Bretherton, 1991; Butterworth, 1992; Demetriou, Kazi, & Georgiou, 1999; Harter, 1999; Hermans, 1996; Kernis, 2003; McAdams, 1996; Roeser & Peck, 2009).

The Jamesian distinction between me-self and I-self is essentially a distinction in levels of self-concept. The me-self (also known as the *self-as-object*) is "an empirical aggregate of things objectively known" about the self (James, 1890, p. 400), or the "trait labels" regarding the self (James, 1890). It is an "organization" (Mead, 1934) of self-descriptions or trait labels regarding the material-me, the social-me, and the spiritual-me (James, 1890).

The I-self, otherwise referred to as the *self-as-process* (James, 1890), is not an aggregated product of what is known about the self. Instead, it is the active *knower* of the self: the continuous and ever-changing awareness and experience of one's dynamic internal states of self-related emotions, thoughts and actions (Dickstein, 1977; Hattie, 1992; James, 1890; Mead, 1934).

In the past, I-self has been viewed as being rather elusive and inaccessible (Allport, 1961), and a "metaphysical problem" (James, 1890, p. 401). At the same time, however, Mead (1934) held that the I-self can and should be studied. McAdams (1996) offers a conceptual clarification that we believe is key to making the I-self empirically tangible. According to McAdams, readers tend to misinterpret the two Jamesian 'selves' as being two entities, where the I-self is seen as an inner self that "pulls the strings", thereby eluding scientific enquiry (Allport, 1961, p. 130). We suggest (in concordance with McAdams) that this be remedied by emphasizing the nature of I-self as an active *process*, and the nature of me-self as a *product*. In accordance with this, our working definition of me-self becomes an *aggregated product pertaining to the self that consists of an organization of stable trait*

[2] In the current article we focus on *global* self-esteem and we omit *domain-specific* self-esteem.

labels; and our working definition of I-self becomes a *dynamic process of experiencing one's immediate internal states pertaining to the self.*

Moving now from a distinction in levels of self-concept to a distinction in levels of self-esteem; 'self-esteem' is an experience of an attitude, which is either a positive or negative reaction to, or association with, the self (Gawronski, 2007; Olson & Fazio, 2009). Self-esteem, in other words, is the valence of the self-concept (Harter, 1982). Consequently, this results in two levels of self-esteem: Trait self-esteem is the valence of the aggregated and relatively stable me-self (Harter, 1982; Rosenberg, 1979), and can thus be defined as *the valence of the aggregated product pertaining to the self that consists of an organization of stable trait labels*. State self-esteem, on the other hand, is the valence of the self that occurs "at this moment" (DeHart & Pelham, 2007; Kernis et al., 1993), i.e., the I-self (Hamaker, 2012), and can be defined as *the valence of the dynamic process of experiencing one's immediate internal states pertaining to the self.*

Based on the above distinction, it is clear that the difference between state self-esteem and trait self-esteem consists of more than a difference in stability and in context dependency. The two can be seen as two qualitatively different aspects of self-esteem, where trait self-esteem is the valence of an aggregated *product* and state self-esteem is the valence of the *current process* of self-experience.

Trait self-esteem and state self-esteem, and their relationship with each other, can be conceptualized in two fundamentally different ways with regards to their nature. In the following sections, we outline the distinction between *generative-causality theory* and *emergent-causality theory* (Coan, 2010; Cramer, Waldorp, Van der Maas, & Borsboom, 2010; Schmittmann et al., 2011). Afterwards, we show how the former results in the latent-construct model of self-esteem, and the latter results in our proposed SOSE model.

2.2 Generative-Causality Theory

From a generative-causality approach, the phenomenon being studied is approached as a latent trait that resides within the individual (Borsboom, Mellenbergh, & Van Heerden, 2003; Borsboom, 2005; Coan, 2010; Cramer et al., 2010; Markus & Borsboom, 2013). The latent trait is assumed to generate, i.e., be the cause of, surface phenomena called *indicators* (Borsboom et al., 2003; Coan, 2010). As the latent variable is assumed to be the cause of each indicator, the indicators are not seen as being causally interdependent (Schmittmann et al., 2011)[3]. From this causality-theory, the latent trait is approached as an entity within the individual, where the existence of that entity does not depend on indicators of the latent trait (Borsboom et al. 2003). From a generative-causality perspective, therefore, causality is unidirectional – from the top down.

Because the latent trait is approached as an unobservable entity, the measurement of the underlying entity depends on measurements of the indicators that are thought to be

[3] Causal independence should not be confused with statistical independence. Indeed, the causal independence does not preclude the possibility of statistical independence in a population. However, any statistical dependence between indicators is separate from the assumptions accompanying causal independence.

generated by the underlying entity. Therefore, this causality model implies a *reflective measurement model*, where indicators of the latent variable are thought to reflect the state of the latent variable (see Borsboom et al. 2003; Cramer, Waldorp, Van der Maas, & Borsboom, 2010; Van der Maas et al., 2006).

While the indicators are seen as a product of the underlying latent trait, they are also influenced by the current context. The current context is approached as being independent from the latent variable, however. Therefore, the influence that the context has on the indicators is seen as measurement error regarding the underlying latent trait. This conceptualization follows the basic axiom of standard psychometric theory, which posits that there is a true underlying level of a latent variable, and that this true score is subject to error, which is by definition independent from the true score (Lord & Novick, 1968). Figure 1 illustrates the generative-causality model (Borsboom et al., 2003; Coan, 2010; Markus & Borsboom, 2013)[4].

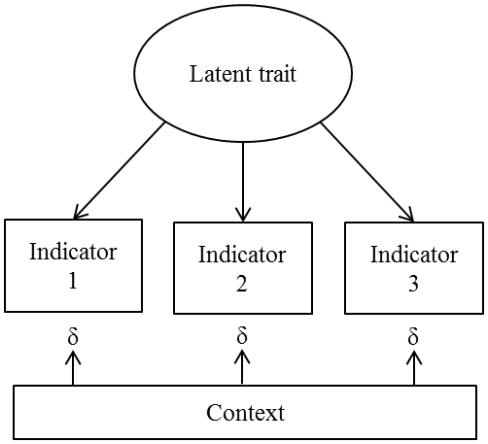

Figure 1. A generative model of causality. The downward arrows indicate the unidirectional top-down causal relationship between the latent variable and the indicators. The upward arrows indicate the influence that the current context has on the indicators. The δ symbols indicate the error caused by the context.

[4] In a typical generative-causality model, the latent variable is at the bottom while the indicators are at the top. We chose to depict the model the other way around so as to emphasize the top-down conceptualization, where the latent-variable is the cause of the indicators.

2.3 Nature of self-esteem from a generative-causality approach: latent-construct self-esteem.

A generative model of causality corresponds with the traditional way that most psychological constructs, including self-esteem, are approached (Borsboom et al., 2003; Coan, 2010), which we call the *latent-construct model* of self-esteem. From this model, the latent trait in Figure 1 is trait self-esteem, which is thought to exist as a latent variable that differs between individuals (Hamaker, Nesselroade, & Molenaar, 2007). The indicators in Figure 1 include, but are not limited to, successions of state self-esteem, which are generated by (and therefore reflect) the latent trait self-esteem (Cramer, Sluis, Noordhof, & Wichers, 2012) (e.g., Marsh, 1996; Tafarodi & Swann, 2001; Tomas & Oliver, 1999). Finally, as portrayed by the indictors in Figure 1, state self-esteem is influenced by transient contextual factors (e.g., Kernis, 2005; Leary, Tambor, Terdal, & Downs, 1995). It is clear that, from a latent-construct model of self-esteem, state self-esteem is not a separate phenomenon from trait self-esteem. Instead, it is the temporary deviation from the true level of trait self-esteem (e.g., Alessandri & Caprara, 2012; Hamaker et al., 2007; Kenny & Zautra, 1995).

This conceptualization of self-esteem is clearly problematic when attempting to consolidate it with the Jamesian framework of me-self and I-self. From a latent-construct model of self-esteem, state self-esteem and trait self-esteem are essentially the same construct, but the former is the context-dependent version. This conceptualization does not correspond with the qualitative distinction between me-self and I-self that results in two separate concepts, where the former is a product and the latter is a dynamic process (see Section 1).

The conceptualization of trait self-esteem and state self-esteem as the context-independent and context-dependent versions (respectively) of the same concept is reflected in the methodological attempts to capture state self-esteem. The typical differentiation of a state measure from a trait measure is that, for trait self-esteem, participants are instructed to respond based on their feelings “in general”, while for state self-esteem, they are instructed to respond based on their feelings “at the moment” (e.g., Heatherton & Polivy, 1991; Kernis, 2005; Zeigler-Hill & Showers, 2007). The differentiation refers only to a difference in the time-span across which the self is assessed (i.e., now, or in general). Both assessments ultimately require the *objectification* of the self as a product, and therefore, reflect the valence of the me-self (quite literally, an assessment of the *self-as-object*) (Harter, 1999; Rosenberg, 1979). State self-esteem is measured as a snapshot of the me-self, rather than as a process of current self-experience. Because of this, we argue that a typical state self-esteem measurement likely captures the me-self in the current moment, and a trait self-esteem measurement captures the me-self in general.

As a result of the dominant latent-construct model, therefore, self-esteem research has predominantly focused on self-esteem as a characteristic of the me-self (Van Halen, 2002). The consequence of essentially leaving out the I-self is that our understanding of self-esteem is one-sided (James, 1890; H Markus & Wurf, 1987; Mead, 1934), where the

dynamics of self-experience as an in-the-moment process are largely omitted. From a Jamesian standpoint, it is essential that researchers consider these process dynamics in order to study I-self. However, this is made virtually impossible in the latent-construct approach. In the section *SOSE model: Implications for research*, we describe how it is possible to assess state self-esteem as a continuous process of self-experience.

2.3.1 Latent-construct model: implications for research

In this section we outline what the concrete implications are of adopting the core underlying assumptions of the latent-construct model.

Latent-construct model: trait self-esteem research.

The first assumption of the latent-construct model (as described above) is that the latent variable, which differs between individuals, is the common within-individual cause for the production of indicators (*common causal antecendent*; see Borsboom, 2008; Reichenbach, 1956; Salmon, 1978).

This has a large implication for trait self-esteem research, namely, that differences between individuals regarding trait self-esteem (either cross-sectional differences or developmental differences) must be explained by factors *outside* of the self-esteem system (as opposed to the internal dynamics of the self-esteem system itself). This form of explanation is called *causal interventionism*, which states that if there is some formal or material intervention on – or manipulation of – a causally relevant (and usually trait-like) variable, there will be a change in the value of another variable (Woodward, 2007) [5]. For example, a change in average self-esteem level has been explained by a statistical manipulation of variables such as gender, personality, or family characteristics results (e.g., Baldwin & Hoffmann, 2002; Birkeland et al., 2012; Deihl et al., 1997). Below, we outline the two advantages of adopting a latent-construct model perspective in trait self-esteem research, both of which involve causal interventionism.

The first advantage refers to the description of *central tendencies*, which are statistical measures that identify a single score as representative of an entire distribution (most commonly, means, modes, and medians). Research that focuses on central tendencies aims to determine what is normal for a given population. This is then usually compared to what is normal for another population, so as to provide relativity. In comparing the central tendencies between two populations, causal interventionism is central, where the statistical manipulation of a factor predicts a difference in trait self-esteem between the two populations. What is statistically manipulated may be a binary difference in group membership, such as gender (where boys score slightly higher on self-esteem measures than girls on average; Kling, Hyde, Showers, & Buswell, 1999), or a continuous difference in a characteristic, such as weight (where higher weight is associated with slightly lower self-esteem on average; Miller & Downey, 1999). The latent-construct model is therefore useful for

[5] Interventionism refers to the general ability to influence another variable, and should not be confused with clinical or educational intervention.

determining population differences in trait self-esteem levels, and for predicting these differences based on differences in another population characteristic (i.e., gender, or weight).

The second advantage of the latent-construct model is related to the development of trait self-esteem, where the model allows for the quantification of changes across time with regard to central tendencies of trait self-esteem. This is done by gathering repeated measures across the long term. Depending on the amount of repeated measures, and therefore the kind of statistical analyses that are possible, linear (e.g., Wagner, Lüdtke, Jonkmann, & Trautwein, 2012; Zimmerman, Copeland, & Shope, 1997) and curvilinear development can be captured (e.g., Baldwin & Hoffmann, 2002; Birkeland et al., 2012). Therefore, the latent-construct model is also useful for providing a picture of the broad ontogeny of trait self-esteem across the lifespan (Thelen & Smith, 1994), established by findings of changes in average levels of self-esteem across time. This has been especially fruitful is revealing that trait self-esteem does in fact demonstrate change across the long term, and that it is not stable across the lifespan as researchers once thought (Erol & Orth, 2011; Harter & Whitesell, 2003; Trzesniewski, Donnellan, & Robins, 2003; Zimmerman et al., 1997).

In order to explain differences in developmental trajectories, individual differences regarding other population characteristics are explored, thereby relying on causal interventionism once again, where the statistical manipulation of a factor predicts a difference in trait self-esteem trajectories. For example, common factors that are thought to explain differences in trajectories are age (Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002); although many researchers have also found that age itself does not predict differences in global self-esteem levels (Mullis, 1992; Pullmann, Allik, & Realo, 2009), and gender (Block & Robins, 1993).

Aside from the abovementioned advantages, the latent-construct model also has disadvantages with regard to self-esteem research. Generally speaking, the main disadvantage is that temporal causality of trait self-esteem cannot be explained. While the model does explain group differences in trait self-esteem and possible trajectories of development, the underlying mechanism of change itself is not addressed (Van Geert, 2014), and instead, remains latent (Schmittmann et al., 2011). Indeed, from the latent-construct perspective, causality originates with the latent construct, although the latent construct is unobservable (Salmon, 1998b). As a result, the latent-construct model cannot answer questions such as: *how* do changes in trait self-esteem actually come about across the long term?

This general disadvantage can be further explained by two more specific disadvantages of the model. First, because causality is thought to originate with the latent trait (top-down causality), and not with the 'indicators' of that trait (bottom-up causality), trait self-esteem development is not explained by *internal* processes (i.e., dynamics within the self-esteem system) (DiDonato, England, Martin, & Amazeen, 2013). This is problematic for understanding the causal mechanism of development itself as research shows that development across the long term stems from short-term variability of the surface phenomena (i.e., the 'indicators') related to the psychological construct in question (e.g., Bassano &

Van Geert, 2007; Collins, 2006; Lichtwarck-Aschoff, Hasselman, Cox, Pepler, & Granic, 2012; MacDonald, Nyberg, & Bäckman, 2006; Smith & Thelen, 2003; Van Geert & Van Dijk, 2002). Indeed, significant change across the long term requires an individual to first be able to explore new behavior across the short term (i.e., short-term variability; Thelen & Smith, 1993). Therefore, for self-esteem to develop across the long term, surely it must first show short-term variability; otherwise, how can something that itself does not change be expected to bring about change (Borsboom et al., 2003; Chakravartty, 2005)? This bottom-up process of causality, however, is not included in the latent-construct model.

The second specific disadvantage stems from the fact that the latent-construct model commonly generates studies that focus on central tendencies of populations, such as averages (Van Dijk & Van Geert, 2007). For developmental studies, this means that development is explored based on averaging individual scores together and then examining how these averages increase or decrease across time. This is disadvantageous for understanding developmental processes, as development is an inherently individual process (Van Geert, 2014). Therefore, investigations of self-esteem development should not be done at the group level. Should the condition of *ergodicity* hold, however, then group-level studies can be conducted in order to describe individual developmental processes. Ergodicity requires group homogeneity and stationarity (see Molenaar & Campbell, 2009; Molenaar, 1994, 2004), which rarely hold for human developmental processes (Molenaar, 2004, 2008). Therefore, the tendency for researchers to average individual tarjectories together in order to focus on group differences is an inherent hinderance for *understanding* the development of self-esteem.

Latent-construct model: State self-esteem research.

In this section, we refer to the following assumptions of the latent-construct model: first, that the indicators are thought to be generated by the latent trait, and therefore, that they are not thought to be causally interdependent (Schmittmann et al., 2011); second, that the indicators are also influenced by the current context.

The first implication that the above assumptions have for state self-esteem research is that state self-esteem measures are used as an indicator for the underlying trait self-esteem level. Additionally, given that the indicators are thought to be influenced by the current context, it is assumed that the influence of the context must first be eliminated in order to ensure that state self-esteem will validly reflect the trait self-esteem score (Kernis et al., 1993). As a result, studies that stem from the latent-construct model obtain repeated measures of state self-esteem across time (thereby including many different contexts). Next, the repeated measures are collapsed in order to calculate central tendencies of trait self-esteem (cancelling out the 'noise' that is caused by the changing contexts; DiDonato et al., 2013).

Specifically, two central tendencies of trait self-esteem are often calculated based on repeated measures of state self-esteem. The first is the mean level of state self-esteem, which is thought to reflect the true level of trait self-esteem (e.g., DeHart & Pelham, 2007). The second is the standard deviation of the repeated measures, which is thought to reflect

the level of *self-esteem stability* (Kernis et al., 1993), which is conceptualized as a between-individual disposition related to trait self-esteem, where a larger standard deviation implies a higher level of instability (e.g., Franck & De Raedt, 2007; Kernis et al., 1993, 1989; Oosterwegel, Field, Hart, & Anderson, 2001). This does not imply that such studies are not valuable. Indeed, studies regarding self-esteem stability have been fruitful in revealing that there are important between-individual differences with regard to the level of self-esteem stability. For example, low self-esteem stability (i.e., high standard deviation of state self-esteem) is associated with negative characteristics, such as paranoia (Thewissen et al., 2007) and anger arousal and hostility (Kernis et al., 1989).

The second implication of the latent-construct model is that resulting studies emphasize the predictive role that different contexts have on state self-esteem change. This is because the model assumes that state self-esteem is predominantly generated by latent trait self-esteem, and that a *change* from one state self-esteem experience to the next is attributed to the context that caused the change. State self-esteem at t_n is thought to be connected to state self-esteem at t_{n+1} because they reflect the same underlying level of trait self-esteem, or that they – with the presence of contextual forces – reflect deviations from the same underlying trait self-esteem. (De Ruiter, Den Hartigh, Cox, Van Geert, & Kunnen, 2014).

This is illustrated by the dominant theory of state self-esteem: the Sociometer Theory of self-esteem, where trait self-esteem is viewed as the resting state of self-esteem in the absence of contextual information, and where state self-esteem fluctuates around this resting level of self-esteem as a function of the contextual cues (Leary & Downs, 1995; Leary, Haupt, Strausser, & Chokel, 1998; Leary, 1999). In line with this perspective, extant studies most commonly study the role of the context on state self-esteem change by adopting a test-retest design, where the change in state self-esteem level from one moment to the next is explained by an experimental manipulation of the immediate context (e.g., Baccus, Baldwin, & Packer, 2004; DeHart & Pelham, 2007; Grumm, Nestler, & Von Collani, 2009; Guay, Delisle, Fernet, Julien, & Cal, 2008).

The above implications are disadvantageous because they negates the ontological nature of state self-esteem as a process in and of itself, where a process is defined by its *iterative* nature, such that a state is both the function of the previous state (i.e., t_{i-1}) and the input for the next state (i.e., t_{i+1}) (Van Geert & Steenbeek, 2005). This ontological nature has been demonstrated for state self-esteem as a process developing in the current moment (De Ruiter et al., 2014) and as a long-term process (Delignières et al., 2004; Fortes, Delignières, & Ninot, 2004). However, the latent-construct model conceptualizes change in state self-esteem as a function of the immediate context, which contradicts the (empirically supported) notion that state self-esteem is an iterative process that demonstrates intrinsic change. The latent-construct model therefore does not *explain* temporal changes in state self-esteem (Van Geert, 2014), but instead, it predicts them based on external (i.e., contextual) factors. Moreover, in negating the nature of state self-esteem as a process, the concep-

tualization of state self-esteem from a latent-construct model does not reflect the conceptualization of I-self from the Jamesian perspective, which is of a dynamic (iterative) *process*.

In summary, any studies that utilize state self-esteem measures do so in order to obtain indicators of trait self-esteem or to gain information regarding the effect of the context on state self-esteem. This results in a gap regarding studies of self-esteem development: developmental studies focus on the development of trait self-esteem, and not state self-esteem. We suggest that this gap is not inherent to the study of self-esteem, but instead, that its presence is indicative of the need for additional – currently absent – theory regarding state self-esteem dynamics.

In the following section we introduce the SOSE model, which is based on an emergent-causality perspective and a complex dynamic systems perspective. We show that this new model of self-esteem is capable of explaining temporal causality of both trait self-esteem and state self-esteem, which (as described above) cannot be explained from the latent-construct model. In doing so, we also show that the SOSE model allows the gap to be filled regarding studies about state self-esteem development.

2.4 Emergent-Causality Theory

The conceptual counterpart of a generative-causality approach is an *emergent-causality approach* (Coan, 2010; Schmittmann et al., 2011). From this perspective causality is bi-directional, rather than unidirectional. In the emergent-causality approach, causality begins as a bottom-up process. As a result, *temporal* causality is self-generational as opposed to external (as is the case in the latent-construct model), such that temporal causality is explained by the intrinsic dynamics of a phenomenon (Coan, 2010; Markus & Borsboom, 2013), which we will explain in this section.

Bottom-up causality means that surface phenomena (which were referred to as 'indicators' in the previously described latent-construct model) interact with each other to form a coherent network, and from this network an emergent *construct variable* is created[6] (which was referred to as a 'latent variable' in the latent-construct model) (Howe & Lewis, 2005; Lewis & Granic, 1999; Smith & Thelen, 2003). The emergent-causality approach is portrayed in Figure 2 (Borsboom et al., 2003; Coan, 2010; Markus & Borsboom, 2013). In the figure, three intrinsic processes are distinguished (A, B, and C), which we will describe in succession below. When discussing an emergent-causality perspective, we will refer to the surface phenomena as 'lower-order components' and to the construct variable as a 'higher-order' construct variable.

[6] In the current chapter, the term "construct" in the context of the emergent-causality theory is used to refer to psychological phenomena that are emergent by nature.

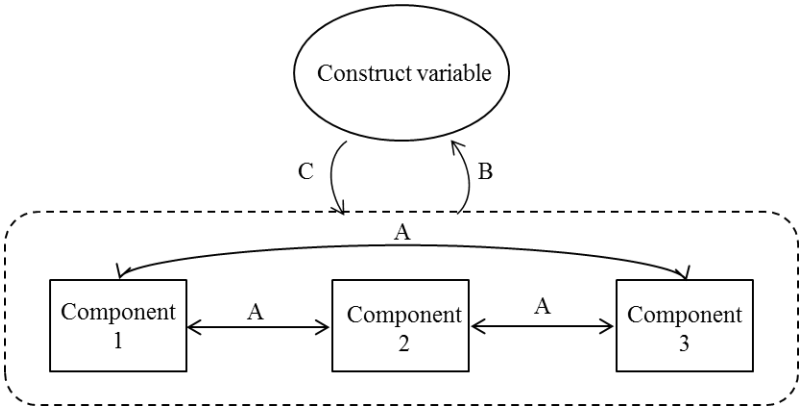

Figure 2. An emergent-causality model. Feedback loops between components (A) result in the emergence (B) and maintenance (C) of a construct variable.

In the emergent-causality approach, the interactions between components are central to explaining the existence of the construct variable and individual differences thereof. The underlying mechanism is *feedback loops*, where each component influences and is influenced by other components within the system until they become linked (Lewis, 1997; Van Geert, 1994). Feedback loops within a system means that the system's output feeds back into the system, becoming the new input for the system. The system's behavior is thus dependent on its own output, creating intrinsic dynamics.

Feedback loops can be either *self-amplifying* or *self-stabilizing*[7], and these processes can occur between lower-order components, as well as between lower-order components and higher-order constructs. Feedback loops between lower-order components are portrayed in Figure 2 as "A" processes. We describe these here before describing the feedback loops between levels at a later moment (portrayed as "B" and "C" in Figure 2).

Self-amplifying feedback loops are the mechanism by which the interactions between components enhance particular changes. For example, a change in Component A triggers change in Component B, which then triggers more change in Component A, etc. This feedback process allows the system to adapt and to change, for example in response to changes in the environment (Granic & Patterson, 2006). In this way, self-amplifying feedback loops reflect a system's progressive tendency, as change is promoted. Specifically, these feedback loops allow for the introduction of novelty into the system; novelty that "prepares and establishes a future state of development" (Van Geert, 1998, p. 637).

Micro-level feedback loops are consistently found in areas of perception (Haken, 2006), neural networks in the brain (Bullmore & Sporns, 2009) and in movement (Kelso et al., 1981; Thelen, Ulrich, & Wolff, 1991). Additionally, Carver and Scheier (2002) describe

[7] Note that 'self-amplifying feedback loops' are commonly referred to as *positive* feedback loops, and 'self-stabilizing' feedback loops are commonly referred to as *negative* feedback loops.

how numerous everyday processes, from actions to shifts between goals, can be explained by a similar process, where one action influences another until a qualitatively distinct outcome arises that was unintended. Carver and Scheier's descriptions are consistent with the empirically validated occurrence of *perception-action loops*, where perceptions of the external world continuously influence an individual's actions as he or she moves, and where such loops explain the emergence of novel behavior (Thelen, 1990). Self-amplifying feedback loops are also found at the micro level between individuals. For example, these feedback loops can be seen in the one-upmanship that occurs during deviant talk within antisocial dyads (Dishion, Spracklen, Andrews, & Patterson, 1996), and it has been argued that they underlie the coercive cycle involving cognitions, emotions, and behavior between parents and their children (Granic & Patterson, 2006).

Self-amplifying feedback loops can enhance either similar or dissimilar connections between components. For similar connections, change (increase or decrease) in a component results in the same type of change (increase or decrease) in the component itself or another component. As this cycle continues, the network of components transforms from a collection of differentiated components to a congruent and integrated network (Lewis & Junyk, 1997). For example, in Figure 2, Component 1 changes positively, which leads to positive change in Component 2 and 3, which then leads to more positive change in Component 1, etc.; resulting in a coherently positive state self-esteem. In contrast, for dissimilar connections, change in a component results in the opposite change in the component itself or another component. This can trigger a cycle in which the components become increasingly disparate in their values, resulting in an incongruent network of components with regard to their values.

In contrast to self-amplifying feedback loops, self-stabilizing feedback loops are the mechanism by which the interactions between components minimize deviations and changes, leading to conservation of their stable states (Van Geert, 1998). In Figure 2, for example, the activation of Component 1 decreases change in Component 2 and 3, and the dampening of Component 2 and 3 subsequently reduces the change in Component 1. The result is that change is generally constrained, so that the components are brought back to their initial states preceding the self-stabilizing feedback loops.

Examples of such inhibitory cycles are frequently found in circuits in the brain. For example, excitatory pathways from the frontal cortex trigger inhibitory effect on the striatum, the globus pallidus, and the thalamus (Masterman & Cummings, 1997). Moreover, it is suggested that self-stabilizing feedback loops underlie self-regulatory behavior such as autonomic regulation, attention regulation, and affective regulation, and that the self-stabilizing feedback loops allow for the interruption of ongoing behavior and the redeployment of resources to other tasks (Thayer & Lane, 2000, p. 214). This highlights the protective function of self-stabilizing feedback loops in the face of negative experiences, a stance that is further described by Kappas (2011) regarding the self-termination of negative emotions. Furthermore, Carver and Scheier (1990), suggest that micro-level self-stabilizing feedback loops occur at the behavioral level, where they underlie the steps that are taken

during conscious self-regulation needed to decrease the discrepancy between where individuals are with respect to a (continuous-action) goal and the achievement of that goal, i.e., goal pursuit (Carver, 2006).

The next process described in the emergent-causality model, portrayed in Figure 2 as the "B" process, is triggered through self-amplifying feedback loops specifically. This process refers to the emergence of a higher-order state, called the *construct variable*. The construct variable spontaneously emerges as a result of the self-organization of lower-order components. It is important to emphasize that it is the dynamics between the components, and the self-amplifying reactions that emerge, that give rise to the higher-order construct variable (Nowak, Vallacher, & Zochowski, 2005). The construct variable is thus not the result of an exogenous driving force, nor is it the result of the individual components themselves (Thelen & Smith, 1994; Van Geert & Steenbeek, 2005). This process is often seen in human systems, such as the emergence of coordinated inter-limb movement (Kelso et al., 1981), visual pattern recognition (Haken, 2006), and self-evaluation (Vallacher & Nowak, 2000). All of these examples are of higher-order constructs that emerge out of interactions between lower order components (i.e., movement, perception, and self-narratives, respectively).

Once a construct variable emerges, it sets off self-stabilizing feedbacks loops between itself and the network of lower-order components. Through these inter-level self-stabilizing feedback loops, the construct variable *constrains* the network of lower-order components through a process of non-rigid top-down fixation (Haken, 2006), thereby triggering self-stabilizing feedback loops between the lower-order components and decreasing the possibility of further change at the lower level. This process is portrayed in Figure 2 as the "C" process. An example of higher-order construct variables constraining the variability of lower-order input is the acquisition of native language in infants. The emergence of native language (L1) acquisition (i.e., the higher-order variable) has a constraining effect on children's ability to discriminate phonetic contrasts between languages (i.e., lower-order components). Before L1 acquisition, infants' speech-perception abilities are broad, and this ability eventually becomes constrained by the infants' L1 acquisition (Best, 1991).

Similarly, the process of higher-order constraint also explains *fossilization* in second language acquisition (L2). The initial misperception of unfamiliar sounds becomes entrenched in individuals' L2 speech through frequent repetition, decreasing the variability of pronunciation in L2 speech and making it difficult for the individual to correct mispronunciations in L2 (De Bot, Lowie, & Verspoor, 2007).

Due to the interaction between self-amplifying and self-stabilizing feedback loops (Figure 2, see A, B, and C), the emergent construct variable is constituted as *softly assembled*. This means that it is not a static aggregate variable that, once formed, is no longer ontologically dependent on its lower-order components. Instead, it is a dynamic, local, and temporal phenomenon, which has no existence independent from its lower-order components (Thelen & Smith, 1996). For example, if the self-stabilizing feedback loops between lower-order components (Figure 2, see A) are perturbed beyond their self-stabilizing limits,

the composition of the components in the lower-order network will be changed, resulting in the emergence of a qualitatively *new* construct variable. For example, referring back to our language-acquisition illustration above, although adults demonstrate far less of an ability to perceive phonetic organization of unfamiliar speech, this ability remains somewhat open – allowing for L2 acquisition in adulthood; demonstrating that the constraining effect of language acquisition is not absolute, nor permanent (Best, 1991). Instead, a bi-directional effect continues even after the higher-order construct (language, in this case) has emerged.

2.5 Nature of self-esteem from an emergent-causality approach: Self-Organizing Self-Esteem (SOSE) model.

The fundamental characteristics of the emergent-causality approach (see above) have previously been theorized as fundamental to the self, where the self has been conceptualized as a system of global self-properties that spontaneously self-organize out of basic components (Nowak et al., 2000). Our proposed Self-Organizing Self-Esteem (SOSE) model complements this basic conceptualization, but further specifies how the dynamic interaction between processes of bottom-up emergence and top-down constraint underlie the specific nature of state self-esteem and trait self-esteem, and their relationship with each other.

The first general proposition made in the SOSE model is that the underlying the nature of state and trait self-esteem is similar: they are both conceptualized as softly-assembled constructs that emerge from a network of lower-order components, stemming from an emergent-causality approach (Cramer et al., 2012; Thelen & Smith, 1994). Both state self-esteem and trait self-esteem are thus conceptualized as higher-order constructs.

We suggest that the two are *nested* high-order constructs, however, such that trait self-esteem is of a higher order than state self-esteem. The highest-order self-esteem construct is called the *macro-level* construct, which is trait self-esteem[8]. Next, state self-esteem is nested within trait self-esteem, and it is called the *meso-level* construct. Finally, at the very lowest level are the building blocks for subsequent levels of self-esteem: the discrete positive and negative self-related experiences ("self-experiences"). We call these the *micro-level* constructs. Each self-esteem level is thus an emergent product of the previous sub-levels.

The distinction between the three levels stems from a distinction in the time span across which developmental self-organization occurs. We distinguish between *developmental self-organization* and *real-time self-organization*. The former refers to the process of self-organization that allows the emergent phenomenon to come into existence in the first place. The time scale across which developmental self-organization occurs differs for state and trait self-esteem (see below). Real-time self-organization, on the other hand, is the self-organization that allows the emergent phenomenon to manifest itself and be experienced by

[8] For the sake of simplicity, we first describe the SOSE model in its most basic form, in terms of there being just one trait self-esteem construct variable. In the section *Dynamic inter-level coupling: Circular causality between state and trait self-esteem* we incorporate the possibility of multiple self-esteem constructs into the model.

the individual, once it has developmentally self-organized. As experience occurs in the present moment, real-time self-organization thus occurs in the present moment (across seconds and minutes) for both state self-esteem and trait self-esteem.

Regarding the time span of developmental self-organization, trait self-esteem (i.e., the macro level) self-organizes out of iterations of state self-esteem that span a longer period of time (e.g., in developmental psychology, weeks, months, or years). State self-esteem (i.e., meso level) self-organizes out of the momentary network of self-experiences that span real-time (e.g., the present moment, across seconds and minutes). Self-experiences (i.e., micro level) also emerge in real-time. However, they are distinct from state self-esteem because they strictly refer to the discrete experiences themselves (e.g., an emotion, or a thought) that emerge in reaction to current experiences, rather to the entire network of experiences or an emergent property.

While trait and state self-esteem develop across different time scales, both are manifested in the present moment, i.e., in real-time. The micro-, meso-, and macro-level thus all have the potential to self-organize into experience in real-time. Because of the distinction in time scales regarding developmental self-organization, the two higher-order properties (i.e., state and trait self-esteem) differ in their level of complexity and stability, and therefore, in the nature of their manifestation in real-time.

The second proposition made in the SOSE model is that the three levels of self-esteem dynamically interact via processes of bottom-up emergence and top-down constraint, also stemming from an emergent-causality approach. The macro-, meso-, and micro-levels of self-esteem are thus bi-directionally connected, creating a larger self-esteem system. While trait self-esteem emerges out of iterations of state self-esteem, it therefore also constrains current and future iterations of state self-esteem. Likewise, while state self-esteem emerges out of the current network of self-experiences, it also constrains current and future iterations of self-experiences. The basic SOSE model, including the three levels of self-esteem and the bi-directional relationships between them, is portrayed in Figure 3. In the following sections, we outline self-organizational processes that give way to state self-esteem and to trait self-esteem.

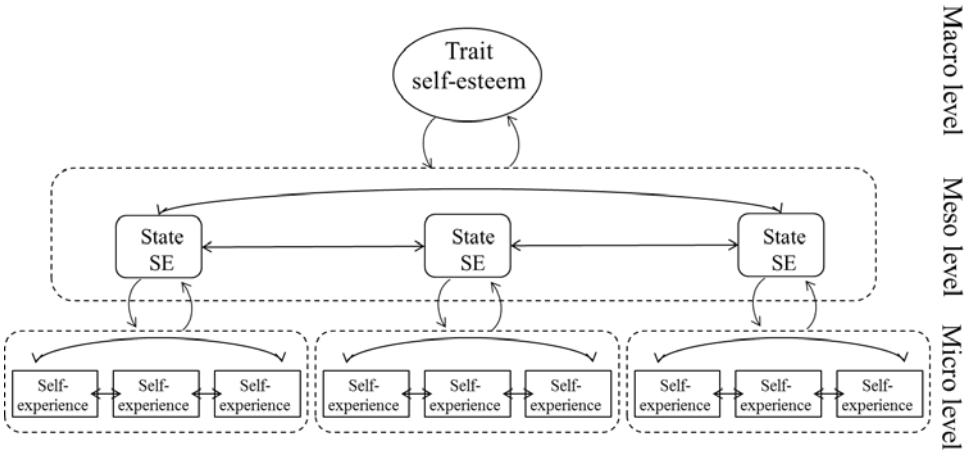

Figure 3. The Self-Organizing Self-Esteem model. Trait self-esteem, state self-esteem (SE), and positive or negative self-experiences form the macro, meso, and micro levels of self-esteem, respectively. The three nested levels are bi-directionally connected.

2.5.1 Self-experiences emerge into state self-esteem.

State self-esteem develops across real-time, where the lower-order input includes the fleeting self-related experiences. We suggest that these include self-directed feelings, autonomous (and heteronomous) behavior, and self-directed thoughts (Epstein & Morling, 1995; Marks-Tarlow, 1999; Nowak et al., 2000; Scheff & Fearon, 2004; Stipek, Recchia, Mcclintic, & Lewis, 1992; Vallacher et al., 2002). As the SOSE model posits that self-experiences are the first level of lower-level input, feelings, behavior, and thoughts pertaining to the self can be thought of as the basic ingredients for the emergence of meso-level, and therefore, also macro-level self-esteem constructs.

It is no surprise that self-directed affect is central for self-esteem, as global self-esteem has even been referred to as an "affective construct consisting of self-related emotions", and as "the way that people feel about themselves" (Kernis, 2003), "feelings of affection for oneself" (Brown & Marshall, 2001; Brown, 1993; Dutton & Brown, 1997) and "a general fondness and love for oneself" (Brown & Marshall, 2001).

While self-affect may be an integral aspect of self-esteem, the two concepts are not the same (Heatherton & Polivy, 1991; Heppner et al., 2008; Nezlek, 2005). Global self-esteem is richer and more complex than just self-affect. Indeed, aside from an individual's emotional experience of him- or herself, his or her behavioral experiences of him- or herself are also central to self-esteem (Allen, Hauser, Bell, & O'Connor, 1994; Deci & Ryan, 1995; Savin-Williams & Jaquish, 1981). The behavioral experience of the self is reflected in autonomy, which includes having confidence in one's decisions and goals, perceiving that one has control and responsibility for one's own goals, and believing that one is capable of

making decisions and goals (Noom, Dekovic, & Meeus, 2001). Autonomy has been found to be strongly connected to daily self-esteem (Heppner et al., 2008).

The last family of self-experiences that are included as lower-order input for state self-esteem are self-related cognitions. Cognitions are the most commonly utilized components of self-esteem in research, reflected by the nature of questions used in self-esteem questionnaires, such as "I am able to do things as well as most other people", or "I take a positive attitude toward myself", used to capture self-esteem (Rosenberg, 1989).

In accordance with an emergent-causality approach, the SOSE model posits that self-experiences that occur in real-time influence each other, such that they are reciprocally interconnected. If these experiences continue to influence each other, the components enter feedback loops. As described in the previous section, these feedback loops can be self-amplifying or self-stabilizing. The SOSE model suggests that the type of feedback loops that arise determine whether a higher-order self-esteem construct emerges at the meso level (i.e., state self-esteem). *Self-amplifying* feedback loops specifically prepare and establish the future state of development by stimulating the emergence of a higher-order construct variable (Van Geert, 1998). Self-amplifying feedback loops are therefore the mechanism that explains how an individual's momentary experience of self can change from a dispersion of emotional, cognitive, and/or behavior experiences pertaining to the self to a full-blown positive or negative experience of the self in that moment.

It is important to highlight that this process is suggested to be more than a simple accumulation of self-experiences. Rather than the self-experiences occurring simultaneously, or independently from each other, it is pivotal that these experiences are conceptualized as influencing each other. A change (or the initial emergence) of one self-experience thus brings about change in another self-experience. When these iterative changes enter a cycle, a feedback loop is said to occur. The self-experiences thus form a complex dynamic system at the micro level, such that the components interact with each other, resulting in an emergent property at the meso level (i.e. state self-esteem).

In contrast to self-amplifying feedback loops, self-stabilizing feedback loops do not trigger current self-experiential components to enter a cycle of continuous change, and thus, to the emergence of a higher-order construct that is state self-esteem. Instead, self-stabilizing feedback loops conserve the quality of each self-experiential component, resulting in the inhibition of state self-esteem emergence. For example, the emergence of an emotion (e.g., pride) dampens a self-experiential behavior (e.g., self-assertion) or inhibits it from emerging in the first place, which then dampens the emotional experience of pride, etc., thus preventing the emergence of a higher-order state self-esteem experience. In summary, while self-amplifying feedback loops amongst self-experiences trigger the emergence of state self-esteem, self-stabilizing feedback loops hinder the emergence of state self-esteem.

Given the occurrence of self-amplifying feedback loops, the type of connections (i.e., similar or dissimilar) between the self-experiential components will determine the nature of the emergent state self-esteem as *internally coherent* or *internally incoherent*.

When similar connections between components of self-experience are self-amplified, the emergent state self-esteem will reflect a coherent state of self-evaluative experience. For example, an emotional experience of the self (e.g., pride) triggers a consistent behavioral expression (e.g., being proactive), which then amplifies the experience of pride and triggers a positive thought regarding the self (e.g., "I'm happy with myself right now"). During self-amplifying feedback loops involving similar connections, one experience regarding the self therefore generates a similar experience regarding the self with regards to the positivity or negativity of the experience. Lewis (1995) suggests that a similar process of micro-level self-organization explains how individuals develop real-time appraisals of situations. He argues that conceptions of external situations, resulting emotions, and attention, continuously interact, fueling each other through self-amplifying feedback loops, finally giving rise to a coherent appraisal of the situation (Lewis & Junyk, 1997; Lewis, 1995).

As components of self-experience can be either positive or negative in *valence* (e.g., pride versus shame, respectively), coherent state self-esteem will also be characterized as either positive or negative with regard to its valence, where the former is a positive experience of the self and the latter is a negative experience of the self.

In contrast to the self-amplification of similar connections between components, feedback loops can also amplify dissimilar connections between self-experiences. This would result in incoherent state self-esteem where the valence of self-experiences oppose each other. For example, a positive behavioral experience (e.g., offering to be team captain) triggers a negative emotional experience (e.g., shame), which then amplifies the behavioral component (i.e., suggesting a new name for the team as well), thereby amplifying the negative emotional experience (i.e., self-contempt). The cycle that emerges creates a higher-order experience of the self in that moment that is characterized as both positive *and* negative.

While the self-amplification of dissimilar connections between self-experiences is theoretically possible, it is likely that these processes will be quickly corrected for in most situations and for most individuals, given the well-established need for internal consistency (Festinger, 1957). Correction involves the perturbation of the current network by introducing a new internal factor into the network, which corrects for the opposing self-experience. For example, returning to the illustration above where an individual has a positive behavioral experience while feeling shame, the individual may perturb the feedback loops between the dissimilar connections by convincing him or herself that the emotional experience of shame is not justified (e.g., a thought such as "I deserve to behave like a leader"). As a result, self-amplifying feedback loops will allow the self-experiential network to adapt to the newly introduced component, thereby starting a new self-amplifying feedback loop between the coherently positive components, and causing the incoherent component (i.e., shame) to die out. This is in accordance with Nowak et al.'s (2000) model of self-structure, in which a 'press for integration' is assumed, implying that self-amplifying feedback loops involving similar connections between components of a given network are dominant.

2.5.2 State self-esteem emerges into trait self-esteem.

The SOSE model posits that trait self-esteem is an emergent property of iterations of state self-esteem. State self-esteem therefore has a primary role in the nature of trait self-esteem in our proposed model. This is in contrast to the traditional latent-construct approach in which state self-esteem has an incidental role, as the variability around the baseline level of trait self-esteem.

A pivotal assumption in the SOSE model therefore is that temporal changes of state self-esteem are iterative by nature, which – as mentioned earlier – has been empirically validated both across real-time (De Ruiter et al., 2014) and across the long-term (Delignières et al., 2004). At the meso level, therefore, state self-esteem output feeds forward, so that it becomes the input for the following state self-esteem iterations.

Based on the iterative development of state self-esteem, the SOSE model suggests that preferred higher-order structures of self-experience self-organize, i.e., trait self-esteem. Studies have shown that iterations of state self-esteem across the long term do indeed result in the emergence of predictable macro-level patterns (Delignières et al., 2004; Fortes et al., 2004; Ninot et al., 2005). These studies have found that the macro-level patters are characterized by a balance between self-preservation and adaptation (Fortes et al., 2004), and by fractal properties (Delignières et al., 2004). Without going into the details of what these properties entail, the studies demonstrate that structure emerges across the entire time series of states self-esteem measures and that this structure is recursive. Furthermore, the idea that trait self-esteem emerges out of iterations of state self-esteem is in sync with James' (1890) perspective that the I-self is responsible for the emergence of the me-self.

Some self-esteem researchers have argued that global trait self-esteem is an emergent property of aggregated domain-specific self-esteem across *domains*, instead of global state self-esteem iterations across *time* (e.g., Marsh, 1993a; Pelham & Swann, 1989; Shavelson & Bolus, 1982). We suggest that global self-esteem does not emerge exclusively from domain-specific self-esteem across contexts. In support of this, we refer to Harter's (1982) discussion of the meaning of *general self-worth*, in which she states that “judgments concerning one's overall self-worth are not inferred from the summation of responses to items tapping a wide array of specific abilities and attributes” (Harter, 1982, p. 88). At the same time, the emergence of trait self-esteem from iterations of state self-esteem across time does not exclude the possibility that this emergence can occur both across and within different contexts. The important distinction, therefore, is simply that emergence occurs across *time*.

Next, just as emergent state self-esteem at the meso level triggers self-stabilizing feedback loops that constrain the changes that occur between self-experiences at the micro level (i.e., top-down constraint), the SOSE model suggests that the emergence of trait self-esteem activates top-down self-stabilizing feedback loops between the macro level and the meso level. The bottom-up emergence of trait self-esteem therefore triggers a circular loop of causality, where the top-down constraint from trait self-esteem to state self-esteem feeds back up into trait self-esteem through self-stabilizing feedback loops. In this way, trait self-

esteem emerges and is maintained through bottom-up and top-down feedback loops between the meso level and the macro level.

In the following section we elaborate on the nature of the trait self-esteem construct as posited in the SOSE model. Our conceptualization of the nature of trait self-esteem stems from a complex dynamic systems perspective (Thelen & Smith, 1994; Van Geert, 1994, 2008). Based on the principles of this perspective, we suggest that trait self-esteem is much more than a static variable that characterizes how 'high' or 'low' an individual's self-esteem is. Instead, it is a complex structure that is dynamically interconnected with its lower-order components (i.e., with state self-esteem), and that this interconnection characterizes trait self-esteem. In our elaboration, we introduce the possibility of multiple trait self-esteem construct variables into the SOSE model.

2.5.3 Dynamic inter-level coupling: circular causality between state and trait self-esteem.

From a complex dynamic systems perspective trait self-esteem can be conceptualized as an *attractor state.* An attractor state is a highly absorbing state to which a system frequently returns, and for which a small amount of energy is required in order to maintain that position (Kunnen & Van Geert, 2012; Thelen & Smith, 1994). It can be compared to a pattern to which a system is drawn (Van Geert, 1998), though the attractor state need not be 'attractive'. In other fields of psychology developmental acquisitions such as a depression (Cramer et al., 2010) extraversion (Cramer et al., 2012), emotional habits (Lewis, 2000), an interaction styles between two individuals (Fogel, 1993; Granic & Patterson, 2006), strong beliefs regarding morality (Kim & Sankey, 2009), or the general intelligence factor (Van der Maas et al., 2006) are conceptualized as attractor states[9]. In order to stress that trait self-esteem can best be conceptualized as a highly absorbing state to which a system frequently returns, we will hereafter refer to trait self-esteem as a *trait self-esteem attractor*. The proposition that a property of self demonstrates attractor-state behavior has received empirical support, albeit for properties of self that are related to, but not the same as, trait self-esteem (Vallacher et al., 2002).

The conceptualization of trait self-esteem as an attractor state underlies the distinction between the manifestation of state self-esteem and trait self-esteem yet further. Specifically, while state self-esteem and trait self-esteem are both conceptualized as being higher-order emergent properties that self-organize out of lower-order interactions, the nature of these higher-order constructs is not the same. As is described in this section, only trait self-esteem is conceptualized as an attractor state. Attractor states describe developmental acquisitions that require a larger period of time for developmental self-organization (i.e., months or years), thereby developing the propensity to self-maintain across a large period of time (Thelen & Smith, 1994). Attractor states thus result in continuity across time. Trait

[9] This list of "attractor" conceptualizations in psychology is by no means exhaustive. In the dynamic systems literature, the amount of trait-like concepts that are conceptualized as "attractors" is much more extensive than what we mention here, but such an exhaustive list is beyond the scope of our illustrative list.

self-esteem is such a developmental acquisition. Trait self-esteem is traditionally thought to be relatively stable (Harter, 1982; Rosenberg, 1979). From the proposed perspective, the 'stability' of trait self-esteem can be referred to as 'continuity', which we suggest is a function of the self-maintaining attractor states that are frequently experienced across time.

In contrast, state self-esteem is not an attractor state. Instead, it is a fleeting emergent property. State self-esteem itself cannot be an attractor state because state self-esteem requires only seconds and minutes for developmental self-organization. State self-esteem is thus the higher-order construct that developmentally self-organizes *at the current moment* (DeHart & Pelham, 2007; Kernis et al., 1993), rather than across a larger period of time. Each succession of state self-esteem – as an emergent phenomenon itself – is thus a new iteration based on the previous iterations of the entire process. The different iterations are not the same phenomena, however. While the same *trait* self-esteem attractor is thus repeatedly revisited across time, *state* self-esteem at t_x is not revisited at t_{x+n}. State self-esteem at t_x and t_{x+n} may be similar in quality to each other (due to the fact that they are iterations of previous successions of state self-esteem, and due to the constraint that trait self-esteem has on the direction of state self-esteem development), but they are not the same phenomenon.

Continuing from the complex dynamic systems conceptualization, self-organizing systems have the potential to develop multiple attractor states. Together, these attractor states form the larger *attractor landscape* that characterizes the potential tendencies of an individual relevant to a phenomenon. This means that individuals are characterized by multistability (Granic, O'Hara, Pepler, & Lewis, 2007; Hollenstein & Lewis, 2006; S. Kunnen & Van Geert, 2012; Lewis, 2000; Thelen & Smith, 1994; Van Geert, 1994).

In accordance with this principle, the SOSE model suggests that individuals have the potential to develop multiple trait self-esteem attractors. Each one is thus a distinct high-order quality of trait self-esteem. From this perspective therefore, high and low trait self-esteem are not necessarily mutually exclusive within individuals. The SOSE model thus expands on the traditional conceptualization of trait self-esteem as a single baseline level, by introducing the possibility that trait self-esteem is multi-stable. While individuals may have one (positive or negative) trait self-esteem attractor (as was demonstrated by Vallacher and Nowak, 2000), individuals have the potential to develop more than one trait self-esteem tendency. This possibility has been suggested earlier by theorists with respect to properties of the self (Marks-Tarlow, 1999; Nowak et al., 2000; Vallacher et al., 2002).

Each trait self-esteem attractor is the result of a distinct quality of state self-esteem iterations across time. For example, while an individual may repeatedly experience positive state self-esteem, thereby developing a predominantly positive trait self-esteem attractor, the same individual may also repeatedly experience negative state self-esteem, thereby developing another distinct negative trait self-esteem attractor.

Adopting the 'attractor' terminology in describing trait self-esteem from the SOSE model does more than simply replace the traditional self-esteem terms with new ones. This is because the behavior and development of attractors, and the larger attractor landscape

that they form, can be predicted by *basin of attractor* dynamics (Van Geert, 1994). In order to illustrate these dynamics, an epigenetic landscape is helpful, portrayed in Figure 4 (Haken, 1997; Kunnen & Van Geert, 2011a; Lichtwarck-Aschoff & Van Geert, 2004; Vallacher & Nowak, 2000; Van Geert, 1994). The epigenetic landscape portrayed in Figure 4 consists of valleys and a moving ball. The valleys represent various trait self-esteem attractors and the ball represents state self-esteem.

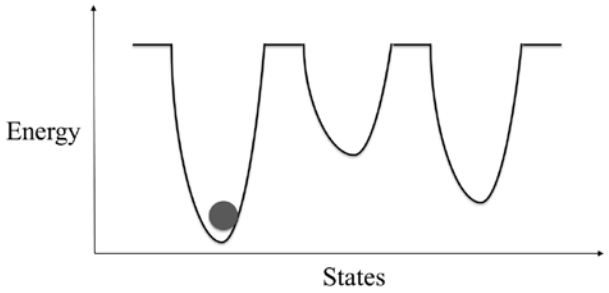

Figure 4. An attractor landscape of coexisting attractor states depicted as a landscape of valleys. Each valley illustrates a trait self-esteem attractor, while the ball illustrates the trajectory of state self-esteem.

In Figure 4, it is important to note that neither the ball nor the landscape is static. The ball moves through the landscape, and the movement of the ball slowly shapes the landscape. The *y*-axis is the depth of the attractor states. The depth refers to the amount of energy needed for the ball to move from one position to another, where higher points require more energy. When in a valley, the ball will remain at the bottom of the valley until it is perturbed. Thus deeper valleys require larger perturbations in order to move the ball out of the valley. The *x*-axis of the landscape is the width of the attractor states. The wider the valley, the larger the range of initial conditions that will lead to that specific attractor, such that the ball is more likely to roll into a wider valley (*basin of attractor* dynamics; Van Geert, 1994). Each valley refers to a qualitatively distinct trait self-esteem attractor (e.g., differing in valence).

The dimensions of the valleys govern the movement of the ball. These principles explain both the real-time behavior of trait self-esteem and state self-esteem, and their long-term development. We begin by describing the dynamics that dictate the real-time relationship between the micro, meso, and macro level of state self-esteem (self-experiences, state self-esteem, and trait self-esteem, respectively).

First, the dimensions of the valleys dictate how the trait self-esteem attractors will manifest themselves and be experienced in real-time in relation to state self-esteem. To illustrate this, consider an individual with two trait self-esteem attractor states, such that the individual's attractor landscape includes two valleys that differ in their width, where the wider valley is characterized by negative valence and the narrower valley is characterized

by positive valence. As the negative trait self-esteem attractor is wider, there are more initial conditions that will lead to its self-organization in real-time, meaning that many negative self-experiences will trigger self-amplifying feedback loops between the micro, meso, and macro level.

Imagine that the individual is doing a performance and experiences a negative thought such as "I'm making a fool of myself". This will then trigger the beginning of a self-organizational process of the negative trait self-esteem attractor. This starts with self-amplifying feedback loops at the micro level, where additional negative self-experiences will be triggered, such as embarrassment. As the micro-level feedback loop continues from second to second, a full-blown higher-order state self-esteem will emerge that is characterized by negative valence – the ball in Figure 4 is set into motion, as it were. As self-amplifying feedback loops between levels continue, the emergence of negative state self-esteem activates the existing negative trait self-esteem attractor – the ball in Figure 4 rolls into the valley that corresponds with negative trait self-esteem.

The activation of the negative trait self-esteem attractor (i.e., the ball rolling into a specific valley) then triggers a top-down process of self-stabilization. As a result, the individual cannot easily break the negative state self-esteem experience. Small perturbations introduced by the individual, for example adjustments of body posture that create a more assertive stance, are corrected for by the self-stabilizing feedback loops, such that the higher-order negative state self-esteem experience is not disturbed. In other words, the ball in Figure 4 can roll up onto the inside edge of the attractor, but if this effort is too small it will be in vain, as the ball rolls back to the deepest point of the attractor. Only when a sufficiently strong perturbation occurs (e.g., applause from the audience) will the self-stabilizing inter-level feedback loops be broken. This then frees the ball from the valley, allowing a new process of self-amplifying feedback loops to begin at the micro level. For example, if the individual then experiences a positive emotion pertaining to the self, such as pride, this will then amplify other positive self-experiences until the positive trait self-esteem attractor is triggered, thereby constraining further changes of self-experiences, and maintaining the positive state self-esteem experience. The above bi-directional relationship between trait self-esteem and its lower-order components explains how macro-level trait self-esteem attractors can self-organize in real-time, resulting in their real-time manifestation and experience.

Next, regarding the long-term development of trait self-esteem, in Figure 4 the landscape is rigid yet malleable, such that the movements of the ball have a formative effect on the structure of the landscape. A valley can be created across the long-term if the ball rolls to that particular position of the landscape frequently enough. A valley becomes deeper each time that the ball revisits that position. Given that the ball rolls to the position that requires the least amount of energy, valleys that become more entrenched increase the likeliness that the ball will roll into that valley. The developmental outcome of the valley (i.e., the attractor states) therefore constrains future real-time outcomes (Granic & Patterson, 2006). This illustrates, first, the process of iterative development of state self-esteem that

results in long-term development at the macro level (described in the previous section regarding the SOSE model). This metaphor also illustrates, the self-stabilizing feedback loops between the macro level and meso level, in which the macro level inhibits the long-term development of new trait self-esteem attractor states (or the further development of existing, yet small, attractors). If a specific quality of state self-esteem is infrequently experienced, this constrains the development of a new trait self-esteem attractor.

2.5.4 SOSE model: Implications for research.

A growing number of researchers have begun to acknowledge the need to expand on the current static understanding of self-esteem and its development (Delignières et al., 2004; Fortes et al., 2004; Ninot et al., 2005; Ram, Morelli, Lindenberg, & Cartensen, 2008; Scheff & Fearon, 2004; Vallacher et al., 2002; Vallacher & Nowak, 2000). However, while this need has been clearly acknowledged, it has – as yet – not been accompanied with a comprehensive model specific to trait self-esteem and state self-esteem from which to work from. In this section, we outline how the processes described in the SOSE model can be translated to empirical research. We hope that, in doing so, we will provide researchers with a range of theory-driven directions for research aimed to increase our understanding of the dynamics of self-esteem.

Here we discuss the empirical implications of two basic principles of the SOSE model.

The first principle is that self-esteem development is *not* viewed as a sequence of discrete events (as is the case from the latent-construct model), but as a dynamic process in which a continuous process of change is the cause of subsequent continual processes of change (Thelen & Smith, 1994; Van Geert & Steenbeek, 2005). The second principle is that, if change is seen as a continuous process of causality, this process occurs *within* the phenomenon itself rather than solely by means of external influences, as is assumed in the latent-construct model, where the focus is on causal interventionism (see *Latent construct model: Implications for research*). Change, therefore, is a function of intrinsic dynamics (Vallacher & Nowak, 1997). This does not exclude the importance of the immediate environment, however. From a complex dynamic systems perspective, a system is in constant interaction with its immediate environment (Van Geert, 1994). What is important here, is that the intrinsic dynamics – i.e. the internally generated patterns of change; Vallacher, Van Geert, & Nowak, 2015 – are central to understanding self-esteem change, and development at large (Van Geert, 2014).

At the most general level, the above principles of the SOSE model accommodate the goal of understanding the mechanisms underlying phenomena, given that the causal interactions within the phenomenon itself (i.e., within self-esteem) are the focus (Salmon, 1998b). Therefore, the SOSE model provides a framework for studies that aim to understand, one, the *nature* of state and trait self-esteem, two, how *development* of state and trait self-esteem comes about (change from t_n to t_{n+1}), and three, the dynamic relationship between state self-esteem and trait self-esteem, which are discussed below.

SOSE model: State self-esteem research.

The nature of state self-esteem.

In the section *Self-experiences emerge into state self-esteem*, the first characteristic of state self-esteem emergence that was outlined concerned whether feedback loops between lower-order self-experiences are self-amplifying or self-stabilizing, and as a result, whether state self-esteem will emerge or not. The second characteristic that was outlined concerned whether self-amplifying feedback loops enhanced similar connections or dissimilar connections between self-experiences, where the self-amplification of similar connections indicates a 'press for integration' that results in coherent state self-esteem as opposed to incoherent state self-esteem. These characteristics can be assessed by observing the valence of each self-experience that is expressed in real-time relative to other self-experiences that occur simultaneously. We demonstrate how these characteristics can be assessed in empirical research in Chapter 3.

The above characteristics are not just theoretically relevant for understanding the nature of state self-esteem, but also in terms of the growing literature regarding what it means to have high self-esteem, and more specifically, whether high self-esteem is generally beneficial. A growing proposition is that high self-esteem is only really 'optimal' if it is genuine, and not if it is contingent on self- or other-regard (Deci & Ryan, 1995; Kernis, 2003; Ryan & Brown, 2003). This perspective stems from the Self Determination Theory (SDT; Deci & Ryan, 1995). From this perspective 'genuine' high self-esteem is the result of acting in accordance with one's own interests and values (Ryan & Brown, 2003). If one is acting in accordance with his/her own interests, the resulting actions are said to be *self-determined*.

To date, the above characteristic has only been explored in terms of trait self-esteem (Kernis, 2003). It has been suggested that self-esteem is not genuine when an individual misrepresents his or her self-feeling (a discrepancy between privately experienced self-feelings and expressed self-feelings), and that genuine self-esteem occurs when an individual represents his or her self-feelings in a honest way (no discrepancy between privately experienced self-feelings and expressed self-feelings; Kernis & Paradise, 2002). Given that, in the SOSE model, self-amplifying interactions between self-experiences give way to state self-esteem emergence, the type of connections that are self-amplified can indicate whether the emergent state self-esteem experience is genuine or contingent. Specifically, the emergent state self-esteem experience is likely to be genuine given coherence amongst the lower-order components (i.e., self-experiences are simultaneously similar in valence), and it is likely to be contingent given incoherence amongst the lower-order components. We demonstrate this distinction in our operationalization of state self-esteem in Chapter 3.

Developmental processes.

The SOSE model provides a framework for studying the dynamics of state self-esteem development across real-time. This framework stems from the basic assumption that state self-esteem develops iteratively, and that temporal causality at the micro level is a

function of the continuous moment-to-moment interactions between lower-order components. From this framework, a number of empirical guidelines can be outlined. First, it is important that repeated measures of state self-esteem across time are not averaged together. In averaging repeated measures together it is possible to calculate central tendencies, but it is impossible to map the iterative changes that occur from moment-to-moment. In order to investigate temporal characteristics of state self-esteem, it is therefore necessary to keep the 'time' aspect of repeated measures intact so that the resulting *time series* can be further analyzed (see Delignières et al., 2004; Fortes et al., 2004; Ninot, Fortes, & Delignières, 2001).

Second, the SOSE model suggests that the lowest level of self-esteem, i.e., the micro-level, develops in the here-and-now. Therefore, state self-esteem is optimally measured at a high density across the here-and-now so that change can be captured as it occurs. For state self-esteem, measures should span seconds if the goal is to capture this variability. Moreover, according to the SOSE model, self-organization of state self-esteem does not occur between one moment and the following moment, but in an iterative manner across many moments. Therefore, a high frequency of state self-esteem measures is needed in order to investigate microgenetic development.

While experience-sampling methods have been used to study repeated measures of state self-esteem, the historicity of state self-esteem change is often lost as change is only analyzed between two consecutive state self-esteem measures, where each state is predicted by the previous state (Savin-Williams & Demo, 1983; Thewissen, Bentall, Lecomte, van Os, & Myin-Germeys, 2008; Udachina, Varese, Oorschot, Myin-Germeys, & Bentall, 2012), rather than by a longer process of iterations of state self-esteem (with a few exceptions, i.e., Delignières et al. (2004; 2006); Fortes et al. (2004)). It is important that the time series spans a sufficient amount of within-individual variability across time in order to capture the development that arises out of said variability (DiDonato et al., 2013).

Fourth, given that development is a continuous process of causality, state self-esteem measures should be captured indirectly, rather than by repeatedly interrupting the state self-esteem process. If the continuous process is measured by interrupting said process (as is done in the experience-sampling method), the continuity of the process cannot be measured. This is because each interruption can potentially be a perturbation to the network of self-organizing self-experiences (Cox, Hasselman, & Seevinck, 2011; Van Orden et al., 2010). If the current self-stabilizing feedback loops cannot sustain the perturbation caused by the researcher's interruption, a re-organization of the network will occur (Granic & Lamey, 2002). As a result, the state self-esteem network that is measured after the self-report is likely to be distinct from the state self-esteem network before the perturbation occurred. State self-esteem, therefore, will not be captured as a continuous process, but as discrete states separated by the external perturbations. For this reason, researchers should avoid the use of repeated self-report measures when the goal is to assess micro-level development. The above suggestions are incorporated, and thus demonstrated, in Chapter 3.

SOSE model: Trait self-esteem research.

An important contribution that the SOSE model can make to the study of the nature of trait self-esteem refers to the conceptualization that trait self-esteem self-organizes into action in real-time out of occurrences at the lower-levels of self-esteem. This thus refers to the self-amplifying feedback loops that occur in real-time between the macro level and the lower-order levels.

Broadly speaking, there are two possibilities for empirically approaching this bottom-up emergence. First, bottom-up emergence can be studied from the level of state self-esteem to trait self-esteem. This possibility requires one high-frequency time series of state self-esteem across real-time. Time-series analyses can then be used to identify trait self-esteem attractors by determining which levels of state self-esteem valence are, one, most frequently experienced, and two, experienced for the longest duration (e.g., Vallacher et al., 2002). Together, these characteristics distinguish stronger attractor states from weaker attractor states (Thelen & Smith, 1994; Van Geert, 1994).

A second way in which the emergence of trait self-esteem can be studied is by examining the processes of bottom-up emergence from the lowest level, i.e., self-experiences. This approach would require multiple time series of separate self-experiential components (e.g., one time series for emotional self-experience, another for behavioral self-experience, etc.). As above, it would be necessary to capture the continuous changes of self-experience as they occur in real-time. Observational data would lend itself to this approach, as various different qualities of self-experience (i.e., emotional, behavioral, etc.) could be subsequently quantified by, for example, coding them on a moment-to-moment basis.

As yet, the emergence of trait-like structure has only been conducted based on iterations of state self-esteem as a single time series (Delignieres et al., 2006; Fortes et al., 2004; Ninot et al., 2005), and not of multiple time series of lower-order self-experiences in real-time. Moreover, extant research has focused on the emergence of single fixed-point attractor states of self-properties (Vallacher et al., 2002), rather than multiple attractor states and the temporal structure that characterizes the moment-to-moment transitions from one attractor to another. In Chapter 4, we demonstrate how the emergence of multiple trait self-esteem attractor states can be studied, how this can be done based on multivariate micro-level data, and how variability from one attractor state to another can be captured.

Once emergent trait self-esteem attractors are measured, it is then possible to determine the characteristics of the individual attractor states and of the attractor landscape that they form. First, the strength of individual trait self-esteem attractors can be determined based on their ability to constrain lower-order variability. This thus refers to the self-stabilizing feedback loops that occur between the macro level and the meso level. Relatively strong trait self-esteem attractors can thus be identified by a relatively high level of top-down constraint on state self-esteem. Given the presence of strong trait self-esteem attractors, state self-esteem is only free to exhibit variability across real-time when it is not being constrained by an activated attractor state, or in other words, during a real-time transition from one trait self-esteem attractor to another. This is demonstrated in Chapter 4.

2.6 Discussion

The proposed Self-Organizing Self-Esteem model integrates both classical theory and new research paradigms in order to provide a framework for understanding the underlying dynamics and complexity of self-esteem and its trait and state components. Specifically, the SOSE model states that state self-esteem and trait self-esteem are distinct softly-assembled constructs that self-organize as separate self-esteem constructs, as a meso-level construct and a macro-level construct, respectively. In the SOSE model, self-organization includes the primary process of bottom-up emergence, where trait self-esteem is an emergent macro-level product of state self-esteem dynamics, and state self-esteem is an emergent meso-level product of self-experiences. Self-experiences are thus the lowest-order of self-esteem. As such, they form the micro-level of self-esteem. In general, therefore, causality originates at the level of the lower-order components.

A secondary process of self-organization in the SOSE model is that of top-down constraint, where the emergence of a higher-order construct begins a process of constraint on lower-order interactions – from the macro level to the meso level, and from the meso level to the micro level. The SOSE model thus suggests that the various levels of self-esteem are bi-directionally related.

This conceptualization is in contrast with the traditional approach to state and trait self-esteem, which we refer to as the latent-construct model. In the latent-construct model, state and trait self-esteem are seen as parts of one concept. Specifically, state self-esteem is seen as the contextual error around a latent level of trait self-esteem, making state self-esteem a primarily top-down product of trait self-esteem plus incidental and temporally independent contextual factors. From this perspective causality originates at the level of the underlying latent trait, and the relationship between trait self-esteem and state self-esteem is uni-directional.

In the current article we outlined how the SOSE model and the latent-construct model result in two opposing conceptualizations of the nature of state self-esteem, trait self-esteem, and the state-trait relationship. We interpret these conceptualizations from the classical Jamesian distinction between I-self and Me-self. We argue that, while the Jamesian distinction is widely accepted as the foundation for the study of self and self-esteem in particular, it is essentially omitted when a traditional latent-construct model of self-esteem is adopted. We argue that, from the latent-construct perspective, any study of I-self becomes a study of me-self, and we demonstrate this based on extant studies. From this vantage point, we suggest that the study of self-esteem will remain fundamentally one-sided given a reliance on only the latent-construct model.

Aside from the implications for the Jamesian distinction, we go further by outlining the specific implications that the two models have for self-esteem research in general. We showed that the latent construct model is well suited for identifying central tendencies of trait self-esteem as well as external causal factors of variations and development regarding state self-esteem and trait self-esteem. We also showed that this model is less suited for

understanding the dynamics and underlying (internal) mechanisms behind the nature of state self-esteem and trait self-esteem or their development.

We showed that our proposed SOSE model is specifically well suited for studying the dynamics and underlying internal mechanisms of both state self-esteem and trait self-esteem, as well as their relationship with each other. We suggest that, because of this, the SOSE model provides a framework for studying I-self in addition to me-self, and that it therefore remedies the one-sidedness that stems from the latent-construct model. We suggest that our SOSE model complements the traditional latent-construct approach to self-esteem by providing the theoretical means to understand and study the dynamics of self-esteem that cannot be explained or studied based on the traditional model. We pave the road for future researchers interested in carrying out research consistent with the SOSE model by outlining areas for future empirical research.

The current article opens the door to new empirical questions regarding the emergence of both state and trait self-esteem as real-time processes, the long-term process of state and trait self-esteem development, and the relationship between state self-esteem and trait self-esteem in real-time and across the long term. Our SOSE model, therefore, can be incorporated in the growing research paradigm in which the temporal dynamics of self-esteem are examined, thereby expanding on the current state of self-esteem research.

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Part II

Empirical studies regarding the internally generated patterns of real-time change of state self-esteem and trait self-esteem