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Explaining the “How” of Self-Esteem Development: The Self-Organizing Self-Esteem Model

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The current article proposes a theoretical model of self-esteem called the Self-Organizing Self-Esteem (SOSE) model. The model provides an integrative framework for conceptualizing and understanding the intrinsic dynamics of self-esteem and the role of the context across 3 levels of development: The macro level, which is the level of trait self-esteem, the meso level, on which we find state self-esteem, and the micro level, which is the level of discrete self-experiences. The model applies principles from the complex dynamics systems perspective to self-esteem, and can thus uniquely describe the underlying mechanism of self-esteem development based on self-organizational processes and interacting time scales. We compare the proposed SOSE model with a formalized account of the traditional approach to self-esteem, showing that the SOSE model is especially conducive to the understanding of self-esteem development in a way that the traditional approach is not—namely, in its ability to explain and predict the underlying dynamics of trait and state self-esteem, the meaning of variability, and the role of the context.

Keywords: complex dynamic systems, development, intrinsic dynamics, state, trait

Self-esteem is an exceptionally prevalent construct in modern psychology, where studies tend to emphasize the importance of increasing individuals' self-esteem (Zeigler-Hill, 2013). Fortunately for this focus, research attests to the changeability of self-esteem, confirming that trait self-esteem (i.e., typically characterized as the relatively stable valence associated with the self-concept; Harter, 1982; Rosenberg, 1979) can increase and decrease across an individual's life span (Zimmerman et al., 1997), often following normative trajectories (Orth et al., 2010). While much is known about self-esteem development in terms of its general ontogeny at the group level, perhaps the most central question regarding self-esteem development remains unanswered, namely, *how* does change actually come about in individuals?

To date, self-esteem development has been largely explained by factors *outside* of the self-esteem system, which show an association with an increase or decrease in self-esteem. For example, changes in the trajectories of self-esteem have been explained by other psychological changes such as a sense of mastery (Erol & Orth, 2011), the occurrence of life events like employment status (Orth, Maes, & Schmitt, 2015), entering a relationship (Wagner, Lüdtke, Jonkmann, & Trautwein, 2013), and most commonly by age itself (e.g., Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002). The study of self-esteem is not unique in this, as developmental studies traditionally explain the state (or value) of variable *x* as being a function of *y* (for more information see Van Geert &

Steenbeek, 2005). This form of explanation is formally called *causal interventionism*, which states that if there is some 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).¹ The psychology of development therefore tends to focus on either factors that *influence* development (where such factors tend to explain only a small portion of interindividual variation) or on the description of developmental trajectories at a group level and across the long term. What remains relatively overlooked, however, are the underlying processes of development that occur across intertwining time scales of the long term and real time (i.e., from moment to moment) and in interaction with the context. It is important that this aspect of self-esteem development receives more attention to gain a complete scientific understanding of self-esteem development. Furthermore, such an understanding of self-esteem development is necessary for more practical purposes, such as the development self-esteem interventions. If we do not understand how development actually comes within individuals, surely bringing about positive change will be difficult (Ouellette & Wood, 1998).

The general aim of the current article is to shed light on the underlying developmental processes of self-esteem development. We do so by proposing a comprehensive model that describes the *intrinsic dynamics* of self-esteem that occur at the real-time level, the long-term level, and the dynamic relationships between these developmental levels and the context. Intrinsic dynamics refer to the internally generated patterns of change, an aspect of development that is quickly gaining attention as being vital for illuminating the mechanisms that underlie what we know about (normative)

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¹ Interventionism refers to the general ability to influence another variable, and should not be confused with clinical or educational intervention.

developmental change (e.g., Gernigon, Vallacher, Nowak, & Conroy, 2015; Vallacher, Van Geert, & Nowak, 2015).

The proposed model, outlined in detail in the following sections and described globally here, is called the *Self-Organizing Self-Esteem* (SOSE) model, and it is based on validated principles of the complex dynamic systems perspective (Thelen & Smith, 1994; Van Geert, 1994, 2008). At the core of our model is the process of *self-organization* (Kelso, 2000; Smith & Thelen, 2003), which is a basic principle of the complex dynamic systems perspective. With self-organization, coherent and robust phenomena—such as hurricanes or flocking behavior of birds or fish—emerge from the interactions between smaller components, without an executive agent. An example of self-organization is molecules interacting to form cells (Misteli, 2001). Self-organization thus results in higher-order coordination or order that is more than the sum of the lower-order parts. We suggest that the same self-organizational processes that give rise to many phenomena in the physical world also give rise to the ‘order’ that characterizes self-esteem. Where molecules interact to form cells, we suggest that the basic elements of self-esteem are self-related experiences that occur in daily life. Thus self-related experiences such as thoughts, feelings, and actions, interact over time to promote the emergence of a higher-order experience of the self: self-esteem.

Based on this conceptualization, we posit that self-esteem is the product of self-organization, instead of being the product of an executive agent. We suggest that this is not a one-step process, but a continuous process of progressive self-organization. Higher-order phenomena thus become lower-order phenomena for yet higher-order phenomena, resulting in nested levels of self-esteem phenomena. The resultant system of self-esteem phenomena according to the SOSE model thus consists of a *micro level*: moment-to-moment self-relevant experiences (such as distinct thoughts, feelings, or actions), a *meso level*: state self-esteem (typically characterized as the coherent yet fleeting experience of the self; Rosenberg, 1986), and a *macro level*: trait self-esteem. Finally, the emergence of higher-order phenomena results in top-down constraint upon the interactions among elements at lower levels, resulting in a continuous and bidirectional relationship between the various nested levels of self-esteem phenomena.

Although some researchers have theorized about the role of various principles from the complex dynamic systems perspective in self-esteem (e.g., 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 complex dynamic systems model of self-esteem that explicitly conceptualizes the nature of state self-esteem, trait self-esteem, and the interaction between the two and the environment that gives way to development. The SOSE model provides this integrative conceptualization.

As one of the most prevalent constructs in psychology, there is of course a plenitude of old and new models of self-esteem. However, these other models tend to either introduce an alternative function of self-esteem (such as terror management; Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004) or an additional definition of self-esteem (such as *optimal* vs. *contingent* self-esteem; Kernis, 2003). With the proposed model, our aim is not to simply add to the abundance of theoretical models regarding

self-esteem, but to integrate what is known about self-esteem with principles of complex dynamic systems.

Throughout the current article, we show that the SOSE model can predict and explain how trait self-esteem and state self-esteem interact, what the ontology of this relationship is, how it brings about development at the trait self-esteem level and at the state self-esteem level, what the role of the context is at the state and trait self-esteem level, how the flow of state self-esteem is determined, and what the meaning of variability is at different time scales. As such, the SOSE model can substantially contribute to the study of self-esteem development by illuminating the underlying processes of self-esteem, and can therefore explain *how* development of self-esteem comes about. Moreover, because the SOSE model can explain many aspects of self-esteem development, it also has the potential to integrate studies that have a more isolated focus, thus providing a strong theoretical framework that is necessary for a more theoretically coherent study of self-esteem. Finally, although our model refers to self-esteem, it can be applied to virtually any psychological phenomenon that is thought to have a trait element and a state element.

We begin with a formalization of the traditional conceptualization of trait self-esteem, state self-esteem, and their relationship with each other and the context, where we hope to illustrate why this traditional perspective on—and empirical approach to—self-esteem restricts the potential to understand the underlying intrinsic dynamics of self-esteem, thereby limiting the study of self-esteem development itself. Afterward, we outline the mechanisms of our proposed SOSE model and how these mechanisms differ from the traditional model of self-esteem development. We then summarize why the reconceptualization can potentially liberate the study of self-esteem from some of the restrictions posed by the traditional conceptualization.

Formalizing the Traditional Approach to Trait and State Self-Esteem

Most psychological constructs—including self-esteem—are traditionally conceptualized as latent traits that reside within the individual and generate daily experiences of that latent trait (*generative causality*, see Borsboom et al., 2003; Coan, 2010). Causality is thus assumed to be top-down, originating at the level of the trait, that is, trait self-esteem (see Borsboom, 2008; Salmon, 1978).

In line with this, trait self-esteem is traditionally seen as the core of self-esteem; an individual's stable *baseline level* (Rosenberg, 1986), or resting level, in the absence of contextual information (Leary & Downs, 1995). In contrast, state self-esteem is seen as “contextually-based self-esteem,” or a *barometer* that fluctuates around this baseline as a function of current contextual cues (Kernis et al., 1993; Leary, Tambor, Terdal, & Downs, 1995; Rosenberg, 1986). From this *baseline-barometer* approach, the daily experiences (i.e., state self-esteem experiences) are assumed to reflect the nature of the latent trait, and the latent trait is assumed to be the ‘true’ level of self-esteem (*reflective measurement models*; see Borsboom et al., 2003; Cramer, Waldorp, Van der Maas, & Borsboom, 2010). Furthermore, fluctuations in daily state-like experiences are conceptualized as temporary deviations from the trait level (e.g., Alessandri, Caprara, & Tisak, 2012; Hamaker et al., 2007; Kenny & Zautra, 1995), and a deviation from the level

of the trait is assumed to be caused by the current context. As such, it is presumed that there is no *process causality* between these daily experiences themselves (see Schmittmann et al., 2013), meaning that state self-esteem experiences across time are not thought to give rise to subsequent state self-esteem experiences at a later point. Instead, state-like experiences across time are conceptualized as distinct moments that result in temporal fluctuations that have no further internal structure than the structure of error or unexplained variance. We will refer to this conceptualization of state experiences as *contextualized error*. Such a conceptualization of the trait–state relationship is deeply rooted in 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 (contextual or measurement) error (see Lord & Novick, 1968). A formalized model of the traditional top-down approach to trait and state self-esteem, and the role of the context, as demonstrated in the baseline-barometer perspective of self-esteem, is illustrated in Figure 1.

The Traditional Model of Self-Esteem in Empirical Research

The (possibly implicit) use of the abovementioned model in standard self-esteem research is evidenced by three common practices that are adopted in studies involving state self-esteem. First, repeated measures of state self-esteem are often aggregated to eliminate the contextual ‘noise’ (i.e., the variability of within-individual measures of state self-esteem) so that the ‘true level’ of trait self-esteem can be obtained for each individual (DeHart & Pelham, 2007; Kernis et al., 1993). This empirical approach illus-

trates the core assumption of the traditional approach: the existence of a true level of self-esteem in the form of a point-like property with random fluctuations. By averaging across repeated measures, the goal is therefore to remove the random fluctuations (i.e., state self-esteem variability) and to obtain the point-like property (i.e., trait self-esteem score).

Second, while the *average* score across repeated measurements of state self-esteem is assumed to represent the true underlying level of trait self-esteem itself, the *standard deviation* is thought to reflect a true underlying bandwidth of these random fluctuations (e.g., Oosterwegel, Field, Hart, & Anderson, 2001). This is often used as a measure of the stability of the underlying true level, referred to as *self-esteem stability* (Kernis, Grannemann, & Barclay, 1989). For a standard deviation to be informative, fluctuations must be symmetrical around the mean level. This kind of variability is typical of random variation that does not have an inherent structure. Hence, the (implicit) assumption that is adopted when self-esteem stability is investigated by means of a standard deviation is that state self-esteem variability resembles random contextualized noise, and that neighboring state self-esteem scores are assumed to be discrete experiences of self-esteem that do not demonstrate process causality or meaningful patterning.

Third, the cause of changes in state self-esteem levels is commonly studied in test-retest designs, where the change in state self-esteem level from one moment (i.e., the ‘test’) to the next (i.e., the ‘retest’) 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). This illustrates that changes in state self-esteem from one moment to the next are commonly attributed purely to changes in the current context, rather than to process causality between neighboring state self-esteem experiences themselves. Moreover, this approach also assumes uni-directional causality, in the direction of context to state, such that state self-esteem is assumed not to have an influence on the current context.

Why a Traditional Model of Self-Esteem Is Limiting

We argue that the abovementioned traditional conceptualization of the trait–state relationship of self-esteem is limiting to the study of self-esteem development for three main reasons. One, it negates the true 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). Contrasting this, from the traditional baseline-barometer perspective, state self-esteem would be expected to fluctuate in response to the environment. Therefore, each state self-experience would be expected to be *intrinsically* independent from the previous, with any causal dependence stemming from an extrinsic dependence between environmental events. The intrinsic variability would thus resemble random temporal variability with a stable bandwidth, according to the traditional perspective. It has, however, been empirically proven that this is not the case. Indeed, the temporal structure of state self-esteem variability is not random (contextualized noise), but instead, it is an iterative process that demonstrates process causality, resulting in intrinsic dynamics both across real-time (i.e., from second to second; De Ruiter et al.,

Figure 1. Formalized model of the traditional approach to self-esteem. The downward arrows indicate the unidirectional top-down causal relationship between latent trait self-esteem and experiences of state self-esteem. The upward arrows indicate the influence that the current context has on experiences of state self-esteem. The δ symbols indicate the error caused by the context, representing the deviation of the state self-esteem level from the trait self-esteem level.

2015) and across the long-term (Delignières et al., 2004; Fortes, Delignières, & Ninot, 2004).

It is important to note that, by emphasizing the need to acknowledge process causality of state self-esteem and the resulting intrinsic dynamics of state self-esteem variability, we are not suggesting that the environment has no influence on state self-esteem. Indeed, the complex dynamic systems perspective states that change in a variable is a function of the previous state of that variable *plus* the potential change in another variable (Van Geert & Steenbeek, 2005). In fact, the complex dynamic systems perspective suggests that a psychological process is embedded in a context to the extent that there is cyclical causality between the process and the context, where they are both a function of each other (Steenbeek & van Geert, 2013). The point here is that, in negating the existence of the basic intrinsic dynamics of state self-esteem, studies that follow the traditional model of self-esteem are left to conceptualize change in state self-esteem (and thus its variability) purely as a function of the immediate context (as a distinct factor). Therefore, although it remains vital that we investigate the immediate influence of context on state self-esteem change, we should not be restricted to *only* studying state self-esteem change from this paradigm. Although it is helpful to determine which external (i.e., contextual) factors influence temporal change in self-esteem, it is also necessary to *understand* how this temporal change actually happens (Van Geert, 2014).

The second reason why the traditional model of self-esteem is limiting to the study of self-esteem development is that the traditional model cannot explain the development of trait self-esteem based on internal processes (i.e., dynamics within the self-esteem system; DiDonato, England, Martin, & Amazeen, 2013). As was shortly described earlier, trait self-esteem development (or rather, a specific trajectory of development) is commonly explained by other psychological or environmental factors (see earlier examples). The underlying mechanism of trait self-esteem change itself is not addressed (Van Geert, 2014), and remains theoretically latent (Schmittmann et al., 2013). This is because of the traditional assumption that causality within the self-esteem system (i.e., between trait and state self-esteem) is thought to be only top-down, originating with trait self-esteem. The traditional self-esteem paradigm does not embrace the idea of bottom-up causality from state self-esteem to trait self-esteem. This is problematic as it cannot explain, and is contradicted by, many studies showing that development across the long-term stems from short-term variability of state-like components 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). These studies show that developmental change across the long term requires within-individual variability of lower-order components (Thelen & Smith, 1994), such that an individual must first be able to explore new (self-experiential) behavior across the short term to develop across the long term.

It is important to note here too that we do not wish to imply that it is unimportant to determine factors that predict increases, decreases, or specific developmental trajectories of trait self-esteem across the long term. Instead, the study of trait self-esteem development should not be limited to only that, given the abundance of studies indicating that underlying mechanisms of trait develop-

ment *can* indeed be understood by zooming in on bottom-up processes that begin with short-term variability of lower-order states.

Finally, studies that focus on predicting between-individual differences in developmental trajectories of trait self-esteem based on external factors tend to do so by examining development at the level of the population, based on averages across individuals (Van Dijk & Van Geert, 2007). This is disadvantageous for *understanding* developmental processes, as development is an inherently individual process (Van Geert, 2014). Unless the condition of *ergodicity* holds, findings from group-level studies tend not to correctly 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 to average individual trajectories together to identify developmental trajectories hinders the understanding of self-esteem development. Although this empirical approach is not theoretically inherent to the traditional model of self-esteem, it is an empirical byproduct of assuming that meaningful variability is predominantly interindividual (rather than intraindividual), as a function of the differences between participants' latent traits. This results in a focus on means and standard deviations (i.e., *central tendencies*), as seen in the previous section, and the observed differences between groups of individuals. As within-individual variability is thought to be noise (where only the *magnitude* of that noise is seen as informative, as the level of stability of trait self-esteem; Kernis et al., 1993), within-individual studies of development tend to be avoided when the traditional model is adopted (DiDonato et al., 2013).

Formalizing the Self-Organizing Self-Esteem (SOSE) Model of Trait and State Self-Esteem

In this section we systematically describe the various aspects of the SOSE model (portrayed in Figure 2), starting with the ontology of trait self-esteem from the SOSE model, moving on to the processes and mechanisms that result in the development of trait self-esteem. Afterward, we describe the ontology of state self-esteem, followed by the processes and mechanisms that result in the development of state self-esteem.

Trait Self-Esteem as a Landscape of Attractor States

The SOSE model approaches trait self-esteem as person-specific tendencies or habits with regard to self-experience that demonstrate a certain level of predictability and stability of self-experience. From a complex dynamic systems approach, such tendencies or habits can be referred to as *attractor states* that make up a larger *attractor landscape* (Van Geert, 1998). Hence, the SOSE model refers to person-specific *trait self-esteem attractor states*, and the *trait self-esteem attractor landscape*. An attractor state is a higher-order pattern of thought and behavior that is specific to a system, and that a system is drawn to, thereby "attracting" the system away from other potential states and allowing for coherence and order (although the nature of this order need not be "attractive"). These attractor states can occur within systems of many kinds, such as individuals (e.g., personality traits), dyads (e.g., interaction norms within friendships), and

Figure 2. The self-organizing self-esteem model. The three nested levels of self-esteem development: trait self-esteem at the macro level of development, state self-esteem (SE) at the meso level of development, and positive or negative self-experiences at the micro level of development are bidirectionally connected with each other and with the immediate context. Vertical lines illustrate *self-organization* between nested levels, and horizontal lines indicate *iterative development* within the levels.

groups (e.g., societal norms). The concept of attractor states has been studied in the context of many kinds of psychological phenomena, such as depression (Cramer et al., 2010) extraversion (Cramer, Sluis, Noordhof, & Wichers, 2012), emotional habits (Lewis, 2000), interaction styles between two individuals (Fogel, 1993; Granic & Patterson, 2006), strong beliefs regarding morality (Kim & Sankey, 2009), forms of sentence formation in early language (Bassano & Van Geert, 2007), or the general intelligence factor (Van der Maas et al., 2006).² The specific proposition that a property of *self* demonstrates attractor-state behavior has also received support (Vallacher et al., 2002).

The complex dynamic systems perspective specifies that an individual is drawn to attractor states because those states require a relatively small amount of energy (Kunnen & Van Geert, 2012; Thelen & Smith, 1994), similar to how practicing a habit is easier than expending energy on alternative sets of behavior or thought (Ouellette & Wood, 1998). In the field of psychology, “energy” can refer to effort, motivation, attention, and so forth. Furthermore, a relatively small amount of effort is needed because each attractor state provides a set of intrinsic constraints on the variability of lower levels (i.e., the meso and micro levels) of development, thus resulting in a “pull” toward that state.

In the SOSE model, lower levels of self-esteem development refer to state self-esteem (on the meso level) and components of self-experiences (on the micro level). Therefore, we suggest that trait self-esteem attractor states provide order and coherence of self-experience due to their constraint on the variability of state self-esteem and self-experiences. The intrinsic constraints and pull of attractor states is commonly illustrated by an epigenetic landscape consisting of valleys and a moving ball, as portrayed in Figure 3 (Haken, 1997; Kunnen & Van Geert, 2012; Lichtwarck-Aschoff & Van Geert, 2004; Vallacher & Nowak, 2000; Van Geert, 1994). In Figure 3, the valleys constrain the movements of

the ball. An attractor state constrains the variability of lower levels of development in the same way. For the SOSE model specifically, a valley illustrates the set of constraints provided by trait self-esteem attractor states, and the current position of the ball illustrates state self-esteem. The moment-to-moment flow of state self-esteem is thus illustrated by the ball’s movements.

Let us take, for example, an individual who has developed a tendency to experience himself in a negative manner (i.e., a negative trait self-esteem attractor). How this individual experiences himself when he is confronted with a situation that will likely elicit some kind of experience of the self is largely dependent on the nature of his trait self-esteem attractors. If this individual receives a moderately high test result in school, for example, his self-experience in that moment will be pulled toward the nature of his trait self-esteem. So, because he has developed a negative trait self-esteem attractor, the self-experiential response that will take the least amount of energy will be a negative one, and his state self-esteem in that moment will likely be negative (e.g., he may attribute the high grade to the test being easy, and feel unintelligent and demotivated). Furthermore, because he experiences negative state self-esteem, his negative trait self-esteem attractor state will be triggered, and it will require energy (i.e., effort, motivation, etc.) to remove his state self-esteem from the constraints of that negative trait self-esteem attractor. The mechanisms that underlie the various processes that make up this illustration are systematically described in more detail in the following sections.

² This list of “attractor” conceptualizations in psychology is by no means exhaustive. In the complex 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.

Figure 3. Trait self-esteem attractor landscape: An attractor landscape of coexisting attractor states depicted as a landscape of valleys. Each valley illustrates a set of constraints that correspond with a distinct quality of trait self-esteem, whereas the ball's movements illustrates the trajectory of state self-esteem in real-time.

Basin of Attractor Dynamics

The conceptualization of trait self-esteem as “attractor states” that are part of an “attractor landscape” is useful because it can clarify what the dynamics are between trait self-esteem and state self-esteem across various time scales as well as the role of the context at these various time scales. More specifically, the movement of the ball in relation to the valleys is a useful metaphor for determining the nature of the constraints that each trait self-esteem attractor has on state self-esteem variability and development. We therefore draw on this metaphor throughout the article. The constraint that attractor states have on microlevel variability is typically referred to as *basin of attractor dynamics* (Van Geert, 1994). Basin of attractor dynamics relate to the *width* and *depth* of each attractor state (i.e., each valley) in Figure 3 in relation to the movements of the ball and to other valleys. Generally speaking, the width of a valley illustrates the total set of conditions under which the system will be drawn to the attractor state. The wider the attractor the greater that set of conditions, and thus the easier it is for the ball to fall into that attractor state. The depth of a valley illustrates how hard it is to escape from the attractor state, and thus how strong the constraints are that act upon the variability of state self-esteem. These characteristics of an attractor landscape are central to the complex dynamic systems perspective, and have successfully explained outcomes from the spatiotemporal dynamics of the brain and its relation to behavior (Kelso et al., 1992) to early socioemotional development (Lewis, Lamey, & Douglas, 1999). We describe how the *width* of attractor states determines the developmental trajectory of an individual's self-esteem in the section “The top-down aspect of developmental self-organization: Developmental constraints on state self-esteem.” We describe how the *depth* of the attractor states determines the effect of contextual forces upon state self-esteem in the section “The role of real-time negative feedback loops.”

Long-Term Development of Trait Self-Esteem Through Self-Organization

Here we describe how the development of trait self-esteem is conceptualized from the SOSE model. The development of trait self-esteem comprises both a bottom-up aspect of self-organization (i.e., from the direction of state self-esteem to trait self-esteem) and a top-down aspect of self-organization (i.e., from the direction of trait self-esteem to state self-esteem), such that it is a bidirectional process (see Figure 4). This bidirectional process is often referred to as *circular causality* between levels of development (Haken,

1997), and has been established in other areas of psychology such as mental illness from the critical-neuroscience perspective (see Fuchs, 2012) or the Flex3 model of socioemotional flexibility (see Hollenstein, Lichtwarck-Aschoff, & Potworowski, 2013). This aspect of the SOSE model is illustrated by the vertical lines between state self-esteem and trait self-esteem in Figure 2. We refer to this bidirectional process as *developmental self-organization*, that is, the process of self-organization that occurs across the long term, allowing trait self-esteem to emerge in the first place and to further develop.

The Bottom-Up Aspect of Developmental Self-Organization: The Emergence of Trait Self-Esteem

Trait self-esteem, as a landscape of attractors, is rigid yet malleable, such that the movements of the ball (in Figure 3) have a continuous formative effect on the structure of the landscape. A valley within the attractor landscape can be created across the long term if the ball rolls to that particular position of the landscape frequently enough, resulting in a relatively entrenched valley (Granic & Patterson, 2006). The same principle is applied in neuroscience (where it is called the Hebb rule), explaining how neural networks become increasingly stable across time due to the repeated activation of a particular cellular connection, whereby the resulting pattern of neural activity becomes increasingly predictable and stable (Linsker, 1988). In this way, a trait self-esteem landscape begins to take shape when qualitatively similar experiences of state self-esteem (e.g., negative or positive) recur across time, either in the same or different situations. This illustrates the bottom-up effect that the variability of state self-esteem has on the development of trait self-esteem.

From this conceptualization, state self-esteem has a primary role in the ontology and development of trait self-esteem. More specifically, the SOSE model stresses the *iterative* nature of state self-esteem, where state self-esteem output feeds forward, so that it becomes the input for the following state self-esteem iterations (indicated by the horizontal lines at the meso level of Figure 2). This is in stark contrast with the traditional assumption that causality within the self-esteem system is purely top-down (originating at the level of trait self-esteem), and that the nature of state self-esteem variability is that of contextually based noise that fluctuates within a stable bandwidth around a baseline level.

In support of the bottom-up component of the SOSE model, De Ruiter et al. (2015) showed that the temporal variability of ado-

Figure 4. Developmental self-organization: bidirectional causality between state self-esteem (at the meso level of development) and trait self-esteem (at the macro level of development).

lescents' state self-esteem is significantly different from the kind of variability that would occur if there was a stable baseline and bandwidth. Instead the authors found what was originally found by Delignières et al. (2004), namely, that individuals' state self-esteem develops in an iterative fashion, resulting in a form of structured temporal variability that is characterized by “dynamic memory.” This means that all preceding points of the process are embedded in the historical context of the system (Delignières et al., 2004), demonstrating the intrinsic dynamics that occur at the state self-esteem level.

The conceptualization of qualitatively new *states* accumulating and leading to the long-term development of *traits* has recently been proposed as a key mechanism in the development of personality as well. Although not explicitly stemming from a complex dynamic systems approach, the TESSERA framework for personality development attributes long-term personality development to repeated state-like sequences of contextual triggers and responses (Wrzus & Roberts, 2016). In self-esteem research, studies have shown that iterations of state self-esteem across the long term do indeed result in the emergence of predictable higher-order patterns (Fortes et al., 2004; Ninot et al., 2005), indicating macrolevel order. Furthermore, this is in accordance with William James' (1890) classic distinction between me-self and I-self, where self-as-process (also known as the *I-self*) is an active process (McAdams, 1996) that gives rise to the emergence of self-as-object (also known as the *me-self*), as an “organization” (Mead, 1934) of self-descriptions (James, 1890). The Jamesian perspective on self can therefore be reformulated in terms of the principle of emergence, where self-as-object can be seen as a higher-order quality of self that emerges out of the self-as-process.

Multistability of Trait Self-Esteem

Individuals can experience the recurrence of qualitatively different kinds of state self-esteem across time. For example, although an individual may repeatedly experience positive state self-esteem, thereby developing a trait self-esteem attractor state that is characterized by positive valence, the same individual may also repeatedly experience negative state self-esteem, thereby developing another distinct trait self-esteem attractor that is characterized by negative valence. The individual can therefore be pulled toward multiple trait self-esteem attractors; each with their own basin of attraction dynamics (i.e., differing in width and in depth), such that each trait self-esteem attractor has its own unique set of constraints on the individual's experience of the self in the moment. In this way, our model allows for potentially contrasting qualities of trait self-esteem within individuals, such that trait self-esteem is proposed to be multistable, illustrated by a landscape consisting of multiple valleys in Figure 3. This contrasts the traditional approach to trait self-esteem as a single baseline level of self-esteem. Multistability is an established principle of a complex dynamic systems approach, which has been applied to individual or dyadic systems (Granic, O'Hara, Pepler, & Lewis, 2007; Hollenstein & Lewis, 2006; Kunnen & Van Geert, 2012; Lewis, 2000; Thelen & Smith, 1994; Van Geert, 1994). We therefore expect that individuals will not have only one attractor state that they are always pulled toward (i.e., one ‘fixed-point’ attractor). Instead, most trait self-esteem landscapes will be characterized by multiple attractors of self-evaluation.

It is important to distinguish multistability of trait self-esteem from the conceptualization of multiple ‘domains’ of self-esteem (e.g., high self-esteem in sports, but low self-esteem in school). The existence of multistability of self (stemming from multiple attractor states) is not simply a different way of saying that there are multiple domains of self-esteem. Within the SOSE model, an individual can be pulled toward different self-evaluations within the same context. The trait self-esteem attractor states thus need not be domain specific. At the same time, this does not exclude the possibility that a trait self-esteem attractor may emerge out of iterations of state self-esteem across time within a given context. A trait self-esteem attractor landscape is thus not limited to a collection of context-specific evaluations (as individuals may have competing self-evaluations that they gravitate toward within the same context), yet this does not exclude the possibility that the landscape may include context-specific attractors. Therefore, the model of multiple domains of self-esteem can be theoretically subsumed under the current model of multiple attractors of trait self-esteem within a landscape.

The occurrence of multiple attractor states of self-conceptions, resulting in multistability, has been shown empirically for real-time self-evaluative narratives (Wong, Vallacher, & Nowak, 2016) and for trait self-esteem attractor states that are manifested during dyadic interaction (De Ruiter, 2015), and it corresponds with the conceptualization that individuals can have multiple self-concepts (Harter, 1982; Marks-Tarlow, 1999; Markus & Nurius, 1986; Nowak et al., 2000; Vallacher et al., 2002), me-selves (from the classic Jamesian perspective; James, 1890), or multiple qualities of personality traits (Nowak et al., 2005).

It is important to stress that, from the SOSE model, the quality of an individual's trait self-esteem cannot be reduced to an additive collection (such as the average value) of the various attractors within the landscape. Instead, it is the system of attractor states and their relationship toward each other that characterizes the individual's trait self-esteem. The malleable nature of the trait self-esteem attractor landscape illustrates that if one trait self-esteem attractor state changes, this will affect the structure of the entire attractor landscape (and thus the other attractor states within the landscape). Moreover, the idea that an individual's state self-esteem is pulled between multiple trait self-esteem attractor states is necessary to conceptualize how state self-esteem dynamics can be characterized in different ways. Specifically, if individuals have multiple attractor states (i.e., multiple fixed-point attractors), the dynamics of the movement between these attractors can vary. The dynamics may be ‘oscillatory’ by nature (where the individual repeatedly moves between the various attractors), or ‘chaotic’ by nature (in that the movements between attractors is seemingly random, although a deterministic equation can still lie at the heart of this randomness) (Van Geert, 1994). Furthermore, while the SOSE model predominantly concerns the mechanisms of self-esteem attractor states, self-esteem dynamics can be governed by both a pull toward preferred attractor states, and by a push away from states (as demonstrated in Wong et al., 2016). The latter refers to repellers, which are states that are avoided, represented by the hills in the landscape in Figure 3. These between-individual differences provide a promising line of research, where researchers can explore how between-individual differences in such dynamics correspond with differences in functionality. Wong et al. (2016), for example,

found that individuals whose self-evaluation dynamics were characterized by stronger repellors had lower self-concept clarity.

The Top-Down Aspect of Developmental Self-Organization: Developmental Constraints on State Self-Esteem

Once a trait self-esteem attractor landscape is formed, the landscape is able to constrain the trajectories of lower-levels of development (at the meso and micro level). This is the top-down aspect of 'developmental' self-organization, and it is the way in which the behavior of state self-esteem can be understood in relation to trait self-esteem. According to the basin of attractor dynamics, the width of each valley (in Figure 3) determines how probable it is that the ball (i.e., state self-esteem) will roll into that particular attractor state (the meaning of the "depth" of attractor states is described in the section "The role of real-time negative feedback loops"). A wider attractor state provides a larger range of initial conditions that will pull the ball toward that specific attractor state. For example, consider an individual with a very narrow trait self-esteem attractor state that is characterized by negative valence. For this individual, only a small range of contextual cues will result in the activation of negative self-esteem. Perhaps these cues are limited to a context (e.g., criticism from a parent) or to a type of cue (e.g., affective cues, like feeling embarrassed or anxious). If these specific cues are experienced, the individual will 'fall into' the negative attractor state, but if other conditions that are equally 'negative' are experienced (e.g., peer rejection), the individual will not fall into the attractor state and negative state self-esteem will not be experienced. In contrast, if the individual's negative trait self-esteem attractor is very wide, many different contexts, or types of cues, will lead to the same negative trait self-esteem attractor and state self-esteem will be more frequently experienced as a consequence. The existence of (wide) trait self-esteem attractor states thus results in top-down *developmental constraints* on the trajectories of state self-esteem, such that state self-esteem is more likely to move toward the points in the landscape occupied by wider trait self-esteem attractors.

Subsequently, given that attractor states that are frequently visited become increasingly entrenched (Granic & Patterson, 2006), the occurrence of strong top-down constraints on state self-esteem will reinforce the bottom-up development of those particular attractor states, demonstrating the continuous bidirectional causality of developmental self-organization.

The occurrence of constraints provided by trait self-esteem attractor states corresponds with ideas about stability of self-evaluations. Self-verification, for example, where individuals select and transform social feedback to confirm their self-conceptions (Swann & Read, 1981) can be explained by the SOSE model. The following characteristics of this motive can be reframed in terms of the SOSE model: the fact that self-verification is a "motive," that many different types of social feedback are interpreted as confirmation of the same self-conception, and that this motive promotes stability of self-evaluations. Specifically, the SOSE model suggests that individuals are 'motivated' to self-verify because they move toward the points of the self-esteem landscape that have stronger top-down constraint, that is, deeper attractor states, as these states require the least amount of energy to maintain. Second, many different types of social feedback are

interpreted as confirmation of the same self-conception because wide attractor states ensure that many initial conditions lead to the same attractor state. Third, the self-verification motive promotes stability of self-evaluations because the corresponding attractor state becomes increasingly entrenched each time that the individual selects or transforms relevant feedback from the current context (i.e., the bottom-up aspect of self-organization), thereby developing a stronger "pull." However, just as the SOSE model suggests that individuals' self-esteem is multistable, rather than characterized by just one baseline level of self-esteem to which they repeatedly return, the model also suggests that individuals are (potentially) 'motivated' to verify multiple self-conceptions, as they are pulled toward multiple self-esteem attractor states within the self-esteem landscape.

Transitional Periods of Development and Context Sensitivity

Whereas wide trait self-esteem attractor states characterize a relatively entrenched trait self-esteem attractor landscape, narrow trait self-esteem attractor states can be expected to characterize a relatively undeveloped trait self-esteem landscape during transitional periods of an individual's life. Transitional periods can be brought on by a large new influence, or an accumulation of new influences, referred to as a *perturbation*. A perturbation is a temporary input of energy that drives the system toward an alternative state, thereby affecting the stability of a system. This can be compared to the ball being pushed out of a given attractor state and into the direction of other positions on the attractor landscape (see Figure 3). Whether or not the change actually results in a perturbation is determined by the amount of force provided by the new influence relative to the amount of energy needed to move the ball from its current position on the attractor landscape. During early adolescence, for example, people experience maturational changes, increased cognitive abilities, new societal demands and roles, and new romantic and peer relationships. During late adulthood and old age, people experience a new set of changes related to children moving out of the home, retirement, and the death of loved ones. Both of these periods can be seen as transitional periods. From the SOSE model, the force provided by life events during adolescence and late adulthood exceed the constraining force provided by the existing trait self-esteem attractor landscape. As such, the life events result in a perturbation of the self-esteem system. Note that we are referring to large-scale perturbations here, and the long-term effect that they can have. Perturbations can occur at various scales, however, and they can thus have effects at various timescales. Perturbations on a microlevel scale are discussed later, in the section "The interplay between intrinsic dynamics and the immediate context: determining the flow of state self-esteem."

During transitional periods, large and long-lasting perturbations make it markedly more difficult for an individual to return to old trait self-esteem attractor states. As a result, the individual's state self-esteem variability will be relatively unconstrained, and will thus demonstrate a large amount of variability and low levels of stability. This is consistent with studies showing that self-esteem stability is low during periods that typically involve many changes, including periods from childhood to early adolescence, and from midlife to old age. In contrast, people tend to experience relatively

few changes during midlife, as their social roles, careers, and relationships are often stable themselves (relative to other periods across the life span). Accordingly, self-esteem is relatively stable during midlife (Trzesniewski, Donnellan, & Robins, 2003). This is comparable with the TESSERA framework of personality development, where the authors suggest that periods of plasticity in personality across the life span can be attributed to an increase in the amount of novel triggering situations that can elicit personality state intensities outside one's usual range (Wrzus & Roberts, 2016).

It is important to emphasize the *relative* lack of intrinsic constraints here. During transitional periods, the individual can be expected to experience less intrinsic constraints on state self-esteem variability compared with other periods across the life span, rather than a total lack thereof. It is unlikely (although not impossible; see Van Dijk & Van Geert, 2007) that a transitional period will ever result in a total lack of intrinsic constraints, as time is required for the individual to develop new trait self-esteem attractor states that accommodate the new source of perturbation. Until new attractor states are sufficiently entrenched, the old attractor states will coexist with the newly forming attractor states, and the individual can still occasionally visit old attractor states (Van Dijk & van Geert, 2007). Thus although some trait self-esteem attractor states become deeper as they are increasingly visited across the long term, others become simultaneously shallower as they are infrequently visited across the long term (Lichtwarck-Aschoff, Hasselman, Cox, Pepler, & Granic, 2012). Therefore, like any habit, it is unlikely that old patterns are immediately abandoned for new ones. Because of this, the self-esteem system will likely retain a certain level of stability, even during a transitional period. This also highlights why the multi-stable nature of trait self-esteem cannot be reduced to an additive collection of the various attractors within the landscape, as the development of one trait self-esteem attractor state will affect the structure of the entire attractor landscape.

The overlap between increasingly shallow old trait self-esteem attractor states and increasingly deep new ones is consistent with the few studies that have explicitly examined the rank-order level of stability of trait and state components of self-esteem, showing that trait components account for a large amount of between-individual differences in self-esteem assessments during adolescence (Donnellan, Kenny, Trzesniewski, Lucas, & Conger, 2012; Wagner, Lütke, & Trautwein, 2016). This means that, even during transitional periods such as adolescence, trait self-esteem demonstrates more rank-order stability than state self-esteem, which can be explained by the conceptualization of “old” trait self-esteem attractor states that are not immediately abandoned. Moreover, these studies also found that autoregressive stability increased as more time had passed. For example, Donnellan et al. (2012) found that, although a connection exists between the ‘autoregressive trait’ component at age 13 and 14, this connection almost completely disappears at age 32. This is also consistent with the conceptualization that the passing of increasingly more time allows for new trait self-esteem attractors to become more entrenched until eventually the new attractor states virtually replace old ones.

During a transitional period, state self-esteem variability will thus be relatively high, such that the individual is ‘free’ to explore novel behavior and components of new selves (Kroger, 2000;

Lichtwarck-Aschoff, Van Geert, Bosma, & Kunnen, 2008) on new positions of the trait self-esteem attractor landscape. This corresponds to the introduction of new microlevel components into the system, reinitiating the bottom-up process of developmental self-organization in a new direction and thus the development of new trait self-esteem attractor states. The emergence of entirely new trait self-esteem attractor states results in much more substantial change than the slow evolution of existing trait self-esteem attractor states. According to the SOSE model, therefore, the most substantial changes in self-esteem quality should occur during transitional periods, while new trait self-esteem attractor states emerge. This is confirmed by studies showing that developmental change in self-esteem across the life span tends to be sharpest during adolescence and late adulthood, where self-esteem drops dramatically compared with the more gradual increases in self-esteem seen during midadulthood (Robins et al., 2002).

The SOSE model thus explains findings from existing studies that adopt a traditional model of self-esteem development. The model also predicts that individuals will be more sensitive to new contextual cues during transitional periods. This is because the old attractor states become increasingly narrow and shallow as they are infrequently visited, so that a smaller amount of energy (i.e., effort, motivation, etc.) is needed to remove state self-esteem (i.e., the current position of the ball) from the now weaker trait self-esteem attractors (i.e., the valleys). It is therefore easier for new influences to set the developmental trajectory of an individual's self-esteem in a new direction. This is indeed the case during adolescence, for example, where adolescents' demonstrate an increased susceptibility to extreme political movements and ideologies (Bhui, Sokratis, & Jones, 2012; Rekker, Keijsers, Branje, & Meeus, 2015). Because adolescence is a period in which a temporary decrease in intrinsic constraints is experienced, the trajectory of an adolescent's self-esteem development is open to new sources of influence. The SOSE model would thus suggest that the adherence to extreme political movements provides a new ‘source’ of self-esteem, such that the development of an individual's self-esteem is more influenced by this new external influence than it would have been before the onset of the transitional period.

Moment-to-Moment Development of State Self-Esteem Through Real-Time Self-Organization

In the previous sections we illustrated that state self-esteem and its flow can be illustrated by a ball that moves around in an attractor landscape (see Figure 3), and that the ball rolling into a valley within the landscape signifies that the trait self-esteem attractor state represented by that valley is triggered. Once triggered, the individual's state self-esteem flow will experience the constraints provided by the trait self-esteem attractor state in real-time. These constraints give way to a temporarily coherent and stable experience of the self in real-time. We suggest that the experience of these top-down constraints and the resulting coherence and stability, is the experience of state self-esteem.

Whereas ‘developmental’ self-organization, described in the previous section, gives way to the long-term development of the trait self-esteem landscape, ‘real-time’ self-organization involves the interaction between state self-esteem and the existing trait self-esteem landscape across real-time. Both levels of development are referred to as “self-organization” because of the bidirectional

(bottom-up and top-down) interaction between macro- and meso-levels of self-esteem.

For real-time self-organization, the top-down aspect (from trait self-esteem at the macro level to state self-esteem at the meso level) largely determines the trajectory and variability of state self-esteem from moment to moment. The bottom-up aspect (from self-experiences at the micro level to state self-esteem at the meso level) gives rise to the emergence of the state self-esteem experience in the first place.

The conceptualization of real-time self-organization allows the SOSE model to expand upon the traditional conceptualization of state self-esteem as a 'reaction to the current context' (Kernis et al., 1993; Leary, Tambor, Terdal, & Downs, 1995; Rosenberg, 1986) by suggesting that the flow of state self-esteem is an active process involving continuous bidirectional interactions between micro and macro levels of self-esteem on the one hand, and continuous interactions with the current context on the other hand. We describe the bottom-up aspect of this relationship, followed by the top-down aspect, below.

The Bottom-Up Aspect of Real-Time Self-Organization: The Emergence of State Self-Esteem

We posit that state self-esteem, like trait self-esteem, is an emergent phenomenon that self-organizes out of the interactions between lower-order components. As a fleeting experience of the self (Rosenberg, 1986), this self-organizational process occurs from moment-to-moment, that is, at the meso level of development. State self-esteem is thus a locally and temporarily self-sustaining pattern of self-experience, emerging out of much more fleeting and discrete self-experiences at the micro level. This is indicated by the vertical lines between the self-experiences and state self-esteem experiences in Figure 2.

Following general self-esteem theories, these microlevel self-experiences can include self-directed emotions, such as pride or embarrassment (Brown, 1993; Brown & Marshall, 2001; Dutton & Brown, 1997), actions that either indicate confidence in one's self or the lack thereof, that is, actions related to autonomy (Allen, Hauser, Bell, & O'Connor, 1994; Deci & Ryan, 1995; Savin Williams & Jaquish, 1981), or self-related thoughts (e.g., "I am able to do things just as well as most other people"; Rosenberg, 1986). Components of self-experience can thus be affective, behavioral, and cognitive, and they can be positive or negative in valence (e.g., pride vs. shame, respectively). As components of self-experience can be either positive or negative in valence, the emergent 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 (for an example of how this can be empirically studied, see De Ruiter et al., 2015).

The Role of Real-Time Positive Feedback Loops

How do discrete and fleeting emotional, behavioral, and cognitive experiences give way to a coherent and temporarily self-sustaining pattern of self-experience? The SOSE model posits that microlevel self-experiences influence and are influenced by each other across real-time. This is illustrated by the horizontal lines

between the self-experiences in Figure 2. Through this influence, the components become linked, entering feedback loops (Lewis, 1997; Van Geert, 1994). Feedback loops can be either positive or negative. Positive feedback loops enhance change, while negative feedback loops dampen change. A balance between the two is necessary for a system to be functional (see Van Geert, 1998 for more on the dynamics between the two, where they are referred to as *progressive* and *conservative* change, respectively). Positive feedback loops result in the actual emergence of state self-esteem, and are thus described here, while the negative feedback loops allow for temporary stability of state self-esteem, and are described in the following section.

Positive feedback loops are the mechanism by which the interactions between components (here, self-experiences at the micro level) enhance particular changes. For example, a positive emotional experience of the self (e.g., pride) triggers a consistently positive action (e.g., being proactive), which then amplifies the experience of pride and triggers an additional positive self-experience, such as a positive thought regarding the self (e.g., "I'm doing well"). During positive feedback loops, one experience regarding the self therefore generates a similar experience regarding the self with regards to the positivity or negativity of the experience. In this way, positive feedback loops give way to 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).

Positive feedback loops thus allow an individual's experience of the self to—first—adapt and to change (e.g., in response to changes in the current context; Granic & Patterson, 2006), and—second—to move toward a temporarily consistent state. Once the positive feedback loops are established, the network of self-experiential components thus transforms from a collection of differentiated experiences to a congruent and integrated network (Lewis & Junyk, 1997). This is consistent with Nowak et al.'s (2000) model of self-structure. The authors suggest that the self-evaluative system is characterized by a "press for integration," which allows for internal consistency among subsets of self-evaluative components. This proposition, in turn, is in line with the well-established need for internal consistency (Festinger, 1957). Although this process can occur across the long term and the short term, the emergence of state self-esteem depends on *real-time* positive feedback loops. Positive feedback loops across the long-term are similar in nature, although they occur across a larger amount of time and result in a longer lasting integration of components. For example, Cramer et al. (2012) refer to positive feedback loops to describe how personality emerges as a consistent network of behaviors. The authors suggest that components of personality interact with each other and with the context, giving way to the emergence of predictable codependencies among components (e.g., liking to be around people, therefore seeking others' company, and developing social skills). These codependencies eventually result in a network of personality components, which is a source of stability.

The conceptualization that positive feedback loops give rise to the emergence of a new and coherent state is similar to Lewis' (1995) explanation of 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 positive feedback loops, finally giving rise to a coherent appraisal of the situation (Lewis & Junyk, 1997; Lewis, 1995). Additionally, Carver and Scheier (2002) describe 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). Positive feedback loops are also found between individuals during real time. For example, they 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 (Granick & Patterson, 2006). Furthermore, the same process has been empirically shown to underlie the emergence of other state-like phenomena in human functioning, such as coordinated interlimb movement (Kelso et al., 1981), visual pattern recognition (Haken, 2006), networks in the brain (Bullmore & Sporns, 2009), and stepping movements during infancy (Thelen, Ulrich, & Wolff, 1991).

It is important to emphasize that it is the dynamics between the components (which are codependent on the current context), and the resulting positive feedback loops, that give rise to the higher-order state (also referred to as *interaction-dominant dynamics*; Van Orden, Holden, & Turvey, 2003). The emergence of state self-esteem is thus not the passive result of an exogenous driving force, nor is it the result of the individual components themselves (Thelen & Smith, 1994; Van Geert & Steenbeek, 2005), which would correspond to the traditional approach to self-esteem.

The Top-Down Aspect of Real-Time Self-Organization: Constraining State Self-Esteem

We suggest that the nature of state self-esteem is partly informed by the trait self-esteem landscape, and more specifically, by the nature of an individual's widest trait self-esteem attractor states. Recall that wide trait self-esteem attractor states mean that many conditions of self-experiences will lead to the activation of the respective attractor state, which will then constrain the subsequent self-experiences, resulting in temporary stability of state self-esteem. For example, if an individual has a wide negative trait self-esteem attractor, many conditions will lead to the activation of that attractor state and will result in a relatively stable negative state self-esteem flow. For such an individual, it is likely that neutral, or even positive, contextual cues will result in negative self-experiences, as a negative attractor state is easily triggered due to the attractor width. Moreover, when triggered, this negative attractor state provides constraints that correspond with the nature of the attractor state, that is, negative self-experience. The flow of everyday self-experiences is thus largely influenced by a constant pull in the direction of wide trait self-esteem attractor states, and thus the intrinsic dynamics of the self-esteem system itself.

The self-experiential response that individuals have to relatively ambiguous contextual cues is therefore largely influenced by the nature of the trait self-esteem attractors that are triggered. This is similar to the effect that *biases* have on interpreting ambiguous

information. For example, Penton-Voak et al. (2013) found that adolescents who had a more aggressive disposition (i.e., they have wide attractor states for aggressive behavior) were more inclined to interpret ambiguous faces as more angry than friendly. Thus many initial conditions lead to an experience of contextual information that is consistent with the wide attractor state.

The Role of Real-Time Negative Feedback Loops

We described above how positive feedback loops underlie the bottom-up process of real-time self-organization. Self-organization is a bidirectional process, however. Here we describe how negative feedback loops in real-time underlie the top-down (constraining) aspect of real-time self-organization.

Negative feedback loops *minimize* deviations and changes amid interactions between components, leading to conservation of their stable states (Van Geert, 1998). Negative feedback loops are therefore necessary for the integration of self-experiential components to be experienced as a temporarily stable state by inhibiting excessive changes of self-experiential components. Without negative feedback loops, the lower-order self-experiential components would continuously adapt and change and would never reach any level of stability and order.

This can be illustrated by the epigenetic landscape in Figure 3. Recall that the ball's movements are state self-esteem variability, and that state self-esteem will move toward the points of the landscape that require the smallest amount of energy. While the act of *moving toward* an attractor state involves positive feedback loops, such that coherency of self-experiences is created by enhancing changes, *falling into* a particular attractor state triggers negative feedback loops. When a specific trait self-esteem attractor is triggered, real-time variability of state self-esteem will be constrained through a process of nonrigid top-down fixation (Haken, 2006). At this point, the *depth* of the attractor state becomes the most relevant source of constraint on state self-esteem. As can be seen in Figure 3, the depth of the trait self-esteem attractors corresponds with the amount of energy needed for state self-esteem to move out of that particular valley once it is visited, where higher points require more energy (Van Geert, 1994). As such, deeper attractor states result in the onset of relatively strong negative feedback loops, thereby constraining lower-order changes and variability of self-esteem. For example, if a deep positive trait self-esteem attractor is activated, negative feedback loops are triggered. Positive state self-esteem will then remain momentarily stable even if a new self-experiential component is introduced (i.e., an internal perturbation), such as a negative thought about the self. The potentially perturbing effect of the negative thought is thus dampened by the negative feedback loops, such that it does not bring about further changes in the current network of positive self-experiences.

Although real-time negative feedback loops have not been empirically studied for state self-esteem processes, examples of similar inhibitory cycles can be found in other human processes. One such example is in circuits in the brain, where excitatory pathways from the frontal cortex trigger inhibitory effect on the striatum, the globus pallidus, and the thalamus (Masterman & Cummings, 1997). It is also suggested that negative feedback loops underlie self-regulatory behavior such as autonomic regulation, attention regulation, and affective regulation, and that they allow for the

interruption of ongoing behavior and the redeployment of resources to other tasks (Thayer & Lane, 2000). This highlights the protective function of negative feedback loops in the face of negative experiences, for example, a stance that is further described by Kappas (2011) regarding the self-termination of negative emotions. Furthermore, Carver and Scheier (1990), suggest that microlevel negative 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, that is, goal pursuit (Carver, 2006).

The Interplay Between Intrinsic Dynamics and the Immediate Context: Determining the Flow of State Self-Esteem

The flow of everyday self-experiences is undoubtedly influenced by the current context. As such, individuals feel good or bad about themselves in response to contextual cues, where theory suggests that this is because a need, such as a need for social acceptance (*Sociometer Theory*; Leary et al., 1995), autonomy, competence, or relatedness (*Self-Determination Theory*; Ryan & Deci, 2000), is momentarily fulfilled. For example, when a father compliments his daughter (inducing a feeling of competence in the child) or hugs her (inducing a feeling of relatedness or acceptance) during a conversation, the valence of her microlevel self-experiences will likely be positive, and thus also her emergent state self-esteem.

The SOSE model adds that, although the current context influences the flow of daily self-experiences, this occurs in interaction with the intrinsic dynamics of self-esteem. First, the model suggests that there is an ongoing bidirectional interaction between the self-esteem system and the context (Steenbeek & Van Geert, 2007), as indicated by the vertical lines between self-experiences and the context at the micro level of Figure 2. Moreover, the state of the current context will also feed forward to the next state of the context (illustrated by the horizontal lines between the contexts at the micro level of Figure 2). State self-esteem is therefore not characterized by a dependency on the current context, but by *codependency*, such that the context depends upon the emergence of state self-esteem (i.e., it is partly created by the individual's current state self-esteem), and the individual's state self-esteem is partly dependent on the current context. Furthermore, the nature of this bidirectional interaction is dependent on the nature of the previous states of both self-esteem and the context. Returning to the above example of how a father's actions may influence the child's state self-esteem, the association between the parent-child context and the child's state self-esteem depends not only on the current parent-child context (e.g., the father complimenting the child), but also on the previous states of that context. Imagine that the iterative development of this parent-child relationship has led to a negative relationship. The current context is thus embedded in this negative historical context, such that the same action (i.e., a compliment) may be interpreted as ironic rather than as genuine, thereby influencing the child's state self-esteem in a negative way rather than a positive way. Moreover, although the compliment (i.e., context) may result in the child's state self-esteem becoming negative at the current moment, the compliment itself is also a result of the previous state of the child's state self-esteem. In this illustration, the parent may have given an ironic compliment to the

child because the child's previous state of state self-esteem was positive, where the disingenuous compliment is an attempt to undermine her. This example illustrates that the relationship between context and state self-esteem should be considered from the framework of bidirectional influence between the context and state self-esteem and the historical context of these two. This aspect of the SOSE model is in line with an *enactive approach* to the mind (McGann, De Jaegher, & Di Paolo, 2013), which takes the codependency between person and context even further and sees the mind (and in extension, self-esteem) as emerging and existing dynamically in a relationship between an individual and his or her (social) environment.

Second, the extent to which an individual's self-experience is influenced by the current context is dependent on the amount of top-down constraint provided by the trait self-esteem attractor landscape, and thus the strength of negative feedback loops at the meso and micro levels. We described earlier how relatively undeveloped trait self-esteem attractor landscapes allow for more long-lasting perturbations to occur and to redirect the long-term developmental trajectory of state self-esteem. Although perturbations can be long lasting (such as a new relationship or the onset of puberty), they can occur across many time scales. Changes in the current context are referred to as real-time perturbations (Hollenstein et al., 2013), which have momentary influences on the variability of state self-esteem, rather than long-lasting influences. These can be as small as adjustments made to one's own body posture that create a more assertive and confidence stance, or a smile from a passing stranger. If the force from real-time perturbations does not exceed the real-time constraining force (i.e., the negative feedback loops) provided by activated trait self-esteem attractors (where deeper attractor states provide more constraining force), the corresponding flow of state self-esteem experiences will not be interrupted. In other words, the ball in Figure 3 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. However, if the real-time perturbation is stronger than the trait self-esteem attractor state (e.g., the individual gives himself a pep-talk or removes himself from the current negative context), state self-esteem will be able to escape the negative trait self-esteem attractor, giving way to momentary variability and a real-time transition into another existing trait self-esteem attractor. Trait self-esteem attractors therefore provide the negative feedback loops that make state self-esteem resistant to real-time perturbations.

The interplay between potential real-time perturbations from the context and an individual's trait self-esteem attractor strength has been empirically demonstrated in De Ruiter (2015). In this study, adolescent-parent interactions were observed and coded in a moment-to-moment manner. The strength of adolescents' trait self-esteem attractor states was measured as the extent to which the activation of networks of self-experiences corresponded with changes in state self-esteem levels. Individuals with stronger trait self-esteem attractor states were indeed less perturbed (with regard to the variability of their state self-esteem valence) by changes in the parents' emotional-behavioral styles during the interaction (and vice versa for adolescents with weaker trait self-esteem attractor states).

The Necessary Balance Between Positive and Negative Feedback Loops in Self-Esteem

Positive and negative feedback loops have a central role in the proposed SOSE model, functioning both within levels of self-esteem (e.g., among microlevel self-experiences) and between various levels of self-esteem (e.g., between trait self-esteem attractors and state self-esteem variability). Feedback loops at various levels govern the nature of the dynamics that occur within the self-esteem landscape. Moreover, it is the interplay and balance between positive and negative feedback loops that result in a functional self-esteem system.

Without positive feedback loops, self-esteem would be overly rigid and neither real-time flexibility nor long-term development would be possible. Moreover, a dominance of real-time negative feedback loops may inhibit the emergence of a coherent positive or negative state self-esteem experience in the first place, such that the self-experiential components are brought back to their initial states preceding the onset of the negative feedback loops. 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, and so forth, thus preventing the emergence of a higher-order state self-esteem experience. This may resemble an apathetic state experience of the self.

On the other hand, without negative feedback loops, self-esteem would be overly sensitive to perturbations and would demonstrate more random real-time variability and unimpeded long-term changes. The combination of the two kinds of feedback loops results in a profile of functional self-esteem that is characterized by adaptability and resilience.

The necessary balance between the two types of feedback loops also indicates that both can result in positive and negative self-esteem functioning if they are too dominant. Because a dominance of positive feedback loops would result in oversensitivity to internal and external input, this corresponds with *fragile self-esteem* that is highly vulnerable (Crocker & Wolfe, 2001). Fragile self-esteem can therefore be characterized by the occurrence of predominantly positive feedback loops, which would be the case if the self-esteem landscape were made up of shallow trait self-esteem attractors that have little constraint on microlevel dynamics. On the other hand, a dominance of negative feedback loops—resulting in rigidity of self-esteem—is related to unhealthy self-esteem that is characterized by defensiveness (Vonk & Smit, 2012). Rigid self-esteem can therefore be characterized by the dominance of negative feedback loops, which would be the case if the self-esteem landscape was made up of deep attractor states that have too much constraint on microlevel dynamics.

While this manuscript focuses on trait-like characteristics related to self-esteem, the SOSE model can be used to understand between-individual differences in trait-like characteristics relevant for other topics. This is true for negative phenomena related to a difficulty to change or adapt—such as depression relapse, addiction, or strong defense mechanisms—as well as for positive phenomena related to the ability to maintain stability—such as identity commitment, or resilience to negative experiences or influences. Taking identity commitment as an example, if an individual has a very deep attractor state for a commitment to his university study, this commitment will be robust against setbacks such as failed

exams. The potential influence of these setbacks would be dampened by the negative feedback loops (causing stability) between the individual's current emotional, behavioral, and cognitive components of his commitment to his study. Many phenomena related to the self can thus be understood based on (overly) deep or shallow attractor states that give way to dominant negative or positive feedback loops among and between micro- and macrolevel processes, respectively.

What the SOSE Model Can Contribute to the Study of Self-Esteem Development

The SOSE model is a new, all encompassing, theoretical paradigm that incorporates central aspects of both traditional models of self-esteem and newly emerging models that stem from the complex dynamic systems perspective. It is thus highly promising in its ability to integrate findings and models, and to predict and explain self-esteem phenomena in such a way that extends the limits of self-esteem research that follows the traditional ‘baseline’ and ‘barometer’ approach to self-esteem (i.e., trait self-esteem as a stable baseline level, around which state self-esteem fluctuates in response to the environment; Rosenberg, 1979). In this way, we have illustrated how the SOSE model can reconceptualize (and further explain) common psychological phenomena, such as domain-specific self-esteem, the need to self-verify, the way that ambiguous contextual cues influence the valence of state self-esteem, fragile self-esteem, and defensive self-esteem.

The model provides a number of theoretical innovations that allow for such reconceptualizations. The first theoretical innovation resulting from the SOSE model is the conceptualization of trait self-esteem as a landscape of multiple attractor states, rather than a single baseline. Generally speaking, this is useful as it acknowledges and can explain the complexity of human tendencies regarding self-experience. In providing a theoretical framework for why and how multistability of trait self-esteem may emerge, future studies thus have a common platform for examining individual differences and development of the multistability of trait self-esteem as well as for intraindividual variability that occurs within the multistable system.

A second pivotal theoretical innovation provided by the SOSE model is the bidirectional relationship between state self-esteem variability and trait self-esteem development. The part of this relationship that involves ‘real-time self-organization’ can explain recent findings regarding the variability of state self-esteem; for example, the finding that state self-esteem variability is not temporally random or simply a response to the current context (De Ruiter et al., 2015; Delignières et al., 2004). It can also unite these findings with others, such as the fact that state self-esteem variability is constrained by person-specific attractor landscapes regarding the ‘self’ (Wong et al., 2016). Finally, this specific aspect of the model can explain classic ideas regarding trait self-esteem. For example, positive self-esteem is commonly seen as a ‘need,’ where it is advantageous to ‘enhance’ self-esteem (Baumeister, Tice, & Hutton, 1989; Brown, 1998; Robins et al., 2002). Specifically, it is generally found that positive self-esteem is advantageous because it acts as a ‘buffer’ for emotional and cognitive processes against negative experiences (Baccus et al., 2004; Dijksterhuis, 2004; Greenberg et al., 1992; Greenwald & Farnham, 2000). Although this is broadly acknowledged, extant research has

not explicitly revealed *how* positive self-esteem acts as a buffer, aside from a common assumption that the mechanism is related to a general increase in cognitive resources (Cast & Burke, 2002). In contrast, the SOSE model can explain the buffering effect by suggesting that the ‘pull’ of trait self-esteem attractors increases the amount of energy (i.e., effort, motivation, etc.) needed for external forces to sway state self-esteem from its current position. If an individual’s trait self-esteem attractor landscape consists of predominantly positive trait self-esteem attractors, their state self-esteem will be pulled toward multiple positions of positivity. The deeper the positive trait self-esteem attractors, the less likely it is that state self-esteem will be perturbed from its positive equilibrium, thereby buffering the individual’s moment-to-moment experience against negative forces from the current context.

The aspect of the bidirectional relationship that involves ‘developmental self-organization’ between trait and state self-esteem provides a number of novel predictions for trait and state self-esteem development. First, our model predicts that large perturbations will give way to a period of high self-esteem variability and the potential for dramatic self-esteem change, which is corroborated by developmental studies of self-esteem (Donnellan et al., 2012; Robins et al., 2002). Our model goes further in describing the mechanisms underlying this, namely that the top-down constraint provided by trait self-esteem attractors decreases, giving way to increased state self-esteem variability and high contextual sensitivity. Therefore, the model predicts that the dramatic changes in self-esteem that occur during transitional periods occur because of a highly variable trajectory of state self-esteem. Second, the model predicts that, even if an individual’s trait self-esteem attractor landscape is well developed, a large enough external perturbation can result in the destabilization of the system. This destabilization will then result in a relatively unconstrained long-term trajectory of state self-esteem, and thus also a relatively high level of context sensitivity. Third, the model predicts that—during an unconstrained and contextually sensitive period—state self-esteem variability will give way to the development of new trait self-esteem attractor states within the landscape. And fourth, the model predicts that only once new trait self-esteem attractor states begin to develop will the state self-esteem trajectory begin to be constrained in its development—eventually resulting in relative stability of state self-esteem across the long term.

Together, the predicted characteristics of self-esteem development and transitional periods result in a long-term self-esteem trajectory consisting of interchanging periods of stability and variability, as the self-esteem attractor landscape continuously organizes and reorganizes. This conceptualization, including the mechanisms underlying transitional periods, corresponds with—and can help explain—findings regarding periods of self-esteem stability and instability across the life span.

To test and explore the above predictions regarding the interplay between long-term trait and state self-esteem development, researchers should ideally collect high-frequency data at both the trait level and the state level, and investigate the trait–state relationship within individuals rather than at the group level. Such studies are scarce, however. Most long-term self-esteem research still focuses on group averages of central tendencies of self-esteem processes (i.e., means, slopes, standard deviations, etc.) or characteristics of isolated levels of self-esteem development (and most commonly the level of trait self-esteem—i.e., the macro level, e.g.,

Birkeland et al., 2012; Block & Robins, 1993; Erol & Orth, 2011; Orth et al., 2010; Reijntjes et al., 2011; Robins & Trzesniewski, 2005; Zimmerman et al., 1997). One exception is Hutteman, Nestler, Wagner, Egloff, and Back (2014), who studied the development of German students’ state and trait self-esteem before, during, and after an international study exchange. This study also confirms many of the SOSE model predictions mentioned above. With regards to the second prediction above, the study exchange can be seen as a large perturbation to the students’ state self-esteem. In accordance with our prediction, this perturbation resulted in an increase in state self-esteem variability across the long term. Next, with regards to our third prediction above, the heightened long-term variability of state self-esteem predicted significant development of trait self-esteem, which can be interpreted as the formation of new (more positive) trait self-esteem attractors. And finally, in accordance with the fourth prediction above, after the study abroad (i.e., removal of the perturbing force) and after the stabilization of a new level of trait self-esteem (i.e., new trait self-esteem attractors were formed) individuals’ state self-esteem variability decreased.

As we have shown in this manuscript, our model can provide theoretical consolidation of extant research findings, and it proves a theoretical framework for researchers that hope to study the intrinsic dynamics of state self-esteem, trait self-esteem, and most importantly, the short-term or long-term bidirectional interaction between these two and the context. Aside from aiding the field of self-esteem, the SOSE model can also help in the development of new theories that integrate self-esteem with other phenomena. As such, future researchers could consider how characteristics of the SOSE model, such as bidirectional causality between lower and higher levels, feedback loops within one level of the system, or the dynamics of attractor states within a landscape, can be applied to the relationship between self-esteem and other phenomena related to the self.

For example, from the perspective that each level of self-esteem emerges as a higher-order construct that then functions as input for yet higher-order constructs, a relevant question is whether trait self-esteem gives way to yet higher-order phenomena such as personality, personal values, or psychological needs, or whether these phenomena have their own parallel nested structure of micro, meso, and macro levels. With respect to the former possibility, micro, meso, and macro levels of self-esteem could be extended to yet higher levels that are more global and more stable than self-esteem. In this case, the iterative development of trait self-esteem would give way to the long-term development of personality or basic psychological needs, and these processes would simultaneously constrain the developmental trajectory of trait self-esteem and thus also the way in which microlevel experiences inform an individual’s self-experiences. Alternatively, the latter possibility (i.e., parallel processes) would imply that individuals have separate landscapes for various self-related processes, each with their own micro, meso, and macro levels of development. In this case, it could be argued that lower-order components from separate attractor landscapes are nevertheless connected by means of coupled feedback loops (Lewis, 1995). Certain components of self-esteem may trigger certain kinds of microlevel components from other phenomena. If positive feedback loops then occur between microlevel components within the respective systems, while the microlevel components between systems are coupled, stable states

for the various phenomena would become coupled across time. For example, if for a certain individual, pride (a positive self-experience) tends to occur together with social acceptance (an in-the-moment satisfaction of a need to be accepted), these two components will become coupled across time. If these two components continuously enter their own positive feedback loops with other components from their systems, such that they both emerge into coherent ‘states,’ these states will tend to occur together in the future and will give way to the coupling of yet higher levels for the two respective phenomena. From this perspective, one would then approach self-esteem and the coupled phenomenon (e.g., personality) as separate, yet linked, networks of components. This is similar to Cramer et al.’s (2010) network perspective of comorbidity, where mental disorders are seen as networks of symptoms that become connected, and comorbidity is seen as two separate networks that are connected by means of (bridge) symptoms. From the network perspective, therefore, two (parallel) disorders emerge out of interactions between lower-order symptoms, and if these symptoms become linked, comorbidity is said to occur. Alternatively, one could also see the linked networks, not as separate phenomena, but as one large phenomenon. This would result in an expanded conceptualization of self similar to a *pattern theory of self* (Gallagher, 2013), where self is seen as a cluster concept consisting of a person-specific network of features that are related (some closely, others loosely) to traditional features of self. From this approach, the features can take on different values and different weights, allowing for the integration of various interpretations of ‘self.’ These two broad sketches of different conceptualizations (phenomena as nested within each other or parallel to each other) illustrate how the SOSE model can provide theoretical tools for the development of new theories or extensions of the SOSE model.

As such, the model makes it possible to greatly expand upon the type of questions that can be asked, and the knowledge that can be gained, regarding the ontology and processes of development of phenomena such as self-esteem. It does so by referring to the framework of complex dynamic systems, which in itself is a very general and powerful metatheory for studying processes in general by means of their intrinsic dynamics.

A number of methods can be applied to test the intrinsic dynamics of self-esteem across micro, meso, and/or macro levels as proposed by the SOSE model. Generally, intrinsic dynamics across time can be tested by collecting high-frequency self-evaluation data and applying time-series analyses. For example, the iterative nature of state self-esteem across the long-term was investigated by Ninot and colleagues by means of experience-sampling methods, where self-report measures of state self-esteem were collected multiple times per day for 512 days, and time-series analyses were applied (Delignières et al., 2004; Fortes et al., 2004). An important part of the SOSE model is the real-time dynamics that are predicted to occur between state self-esteem and trait self-esteem attractors. For this, it is necessary to capture attractor states that emerge in moment-to-moment self-evaluative data. To do this, methods that require self-report, such as experience sampling methods, do not suffice, as the very act of reporting on the momentary self-experience of one’s self would disrupt the intrinsic dynamics that are measured. To remedy this, there are two notable alternatives that have been used to date. One is the use of a ‘computer-mouse procedure’ (Vallacher et al., 2002), where participants use a mouse-controlled cursor to indicate the moment-to-

moment changes in the valence of self-evaluation based on a recording of a verbalized self-narrative. Time-series analyses can then be applied to assess which valences are most frequently experienced (related to the ‘width’ of attractor states), their duration (related to the ‘depth’ of attractor states), and the transitions between them (to assess the larger landscape structure) (Wong, Vallacher, & Nowak, 2016). Techniques such as State Space Grids (Lewis et al., 1999) and Recurrence Quantification Analysis are most commonly used to assess such characteristics of individuals’ attractor states.

Another method for assessing attractor states in real-time self-evaluative data is the collection of multivariate data of microlevel self-experiences. Data mining techniques, such as Kohonen’s Self-Organizing Maps, can then be used to capture qualitatively different networks of lower-order self-experiential components that are unique to each individual and to which that individual repeatedly returns (De Ruiter, Van Der Steen, Den Hartigh, & Van Geert, 2016). Each network is thus a separate pattern of self-evaluation to which the individual is drawn across the span of the real-time time series, which is in accordance with the complex dynamic systems perspective of an attractor state. For this kind of analysis, observational data are useful, where individuals’ behavior, verbalized thoughts, and expressions of affect within a context can be coded moment-to-moment with respect to their self-evaluative valence (e.g., De Ruiter et al., 2015). Furthermore, this approach allows for the study of perturbing effects of the context on the attractor dynamics, as the individual can be filmed within a (potentially perturbing) social context.

Conclusion

The proposed Self-Organizing Self-Esteem (SOSE) model integrates both classical theory regarding self-esteem and the complex dynamic systems perspective to provide a framework for understanding the intrinsic dynamics of self-esteem and its trait and state elements. Specifically, the SOSE model states that state self-esteem and trait self-esteem are both emergent high-order constructs that self-organize on separate levels of development within the self-esteem system, the meso level and the macro level, respectively. In the SOSE model, self-organization is central, with bidirectional causality between higher and lower levels within the system and with a codependency on the context. Lower-order levels give way to bottom-up emergence of higher-order levels, and higher-order levels constrain the interactions among components on lower-order levels. Trait self-esteem thus self-organizes out of iterations of state self-esteem, giving way to long-term development as well as real-time activation of trait self-esteem attractor states. Discrete feelings, actions, and thoughts (on the micro level) give way to the self-organization of state self-esteem, which is codependent on the context. Causality is thus not top-down *or* bottom-up, but the continuous circular causality between both.

In the current article we outlined how the SOSE model and the traditional model of self-esteem result in two opposing conceptualizations of the ontology of state self-esteem, trait self-esteem, the state-trait relationship, and the role of the context. From the traditional perspective, 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, where the context is seen as an independent variable that uni-directionally influences state self-esteem. From this perspective causality originates at the level of the underlying latent trait.

We showed that the traditional model results in the study of central tendencies of trait self-esteem (i.e., means, slopes, and standard deviations), a description of the general ontogeny of self-esteem across the life span at the group level, and an explanation of development based purely on external factors. By formalizing the traditional approach to self-esteem as a theoretical model, we were able to show that the underlying assumptions of the traditional approach do not allow for the study of the intrinsic dynamics of state self-esteem, trait self-esteem, and their temporal relationship. Moreover, we showed that new findings are emerging that do not support the traditional model of self-esteem and its assumptions.

The SOSE model is a potential remedy for the limitations posed by the traditional model of self-esteem regarding the study of self-esteem development. Our model is based on validated principles of the complex dynamic systems perspective, and can thus identify, predict, and explain the intrinsic dynamics of state self-esteem, trait self-esteem, and the building blocks of these concepts (i.e., self-experiences), which is currently not possible from the traditional model of self-esteem. As such, the SOSE model can substantially contribute to the study of self-esteem development by shedding light on the underlying processes of self-esteem, and can therefore explain *how* development of self-esteem comes about.

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