

The Dynamics of Self-Esteem in Adults Over a 6-Month Period: An Exploratory Study

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ABSTRACT. In this exploratory study, the authors examined the dynamics of self-esteem in 8 adults over a 6-month period. Each participant (M age = 29.4 years, $SD = 7.9$, $SEM = 2.8$) completed a single item from the Physical Self Inventory (G. Ninot, M. Fortes, & D. Delignières, 2001) using a 10-cm visual analog scale (horizontal line), twice a day between 7:00 and 9:00 a.m. and between 7:00 and 9:00 p.m. Time series analyses, including autocorrelation and autoregressive integrated moving average (ARIMA) procedures, showed that global self-esteem dynamics were neither stable, stationary, nor random. The ARIMA procedures indicated that this perceived dimension functioned as a moving average (0, 1, 1) without a significant constant, thus suggesting a short-term dynamic adjustment. This pattern is a typical signature of a complex system submitted to several constraints and not an indication of personality trait or state.

Key words: ARIMA, dynamic adjustment, dynamics, instability, self-esteem

SELF-ESTEEM AND PERCEIVED PHYSICAL SELF can function as either *traits* or *states*. A *trait* is stable over time and across situations, whereas in the case of a *state*, circumstances can raise or lower the evaluation of perceived dimensions. Recently, time series analyses based on several repeated observations have been shown to be one of the best perspectives for resolving this type of ambiguity (Nezlek & Plesko, 2001; Nowak, Vallacher, Tesser, & Borkowski, 2000; Robins, Hendin, & Trzesniewski, 2001). To determine more clearly whether these dimensions function as a *trait* or a *state*, therefore, we analyzed the intra-individual dynamics of global self-esteem, as assessed twice daily, in adults over a 6-month period.

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If self-esteem functions as a trait (Burke, Kraut, & Dworkin, 1984; Cooper-smith, 1967; Epstein, 1979; McCrae & Costa, 1994; Mortimer, Finch, & Kumka, 1982), the inferred model will be based on the thermodynamic principle of energy conservation and the homeostatic principle of steady state. For example, if a positive or negative event influences self-esteem, then these models emphasize self-conservation, the progressive return to a basal level with brief oscillations, or oscillations around a reference value (linked exclusively to random variability due to measurement error). Abundant empirical evidence indicates that global self-esteem is resistant to change.

According to dispositional theories, a *trait* is considered as a relatively stable and individual-specific generalized tendency to behave in a certain way (for review, see Strelau, 2001). The literature shows the stability of global self-esteem, especially in adults (McCrae & Costa, 1994; Mortimer et al., 1982). Consequently, the correlational literature is replete with evidence of associations between self-esteem level and systematic behaviors or psychological reactions. For example, people with low self-esteem often report episodes of depression (Butler, Hokason, & Flynn, 1994). They report more negative emotions and are more sensitive to negative events (Dutton & Brown, 1997; Epstein, 1992). They are more concerned by and with social evaluations (Baumgardner, 1990). Conversely, individuals with high global self-esteem often present a socially conformist image of themselves (Francis, 1997). They are generally characterized by higher levels of sociability, impulsivity (Eysenck & Eysenck, 1963), and emotional stability (Francis).

If we consider self-esteem as a *state* (Butler et al., 1994; Cattell, 1973; Leary, 1990), then the perceived dimensions could be considered short-term histories, changing randomly in response to life events (mathematically, short-term autocorrelations). According to situational theories (Leary), changes reflect dependence on endogenous and exogenous variations. Recent research has emphasized the variability of the self (Kernis, 1993; Nezlek & Plesko, 2001; Nowak & Valacher, 1998; Nowak et al., 2000) and subjective well-being (Headey & Wearing, 1989) and has confirmed Markus and Wurf's (1987) supposition about the interest of self-concept dynamics.

State self-esteem seems to function as a subjective marker that reflects an individual's social standing in a particular setting (Leary, 1990). People with unstable self-esteem, whether low or high, show more extreme emotional and behavioral reactions to events involving other threats to self-esteem. For example, the variability of perceived dimensions reveals central information about depression (Greenier et al., 1999; Kernis, Grannemann, & Mathis, 1991), quality of life changes (Barge-Schaapveld, Nicolson, Berkhof, & de Vries, 1999), and behavior (Kernis, Grannemann, & Barclay, 1989). Individuals with unstable self-esteem more often experience anger and hostility (Kernis et al., 1991). Stability of self-esteem moderates the relation between level of self-esteem and depression (Kernis et al., 1991).

The stability of global self-perception reflects self-consistency (Epstein, 1979), with the development of feelings of unity, independence, predictability,

and control. In contrast, Marsh and his colleagues (Marsh & Byrne, 1993; Marsh & Yeung, 1998) and Amorose (2001) found that responses to global self-concept scores were unstable compared with specific physical scales. According to Watson, Suls, and Haig (2002), and Brown and Marshall (2001), global self-evaluations are more affected by mood and immediate experiences and therefore are likely to vary more over time. Unfortunately, the conclusions of these previous studies were based on theoretical supposition or longitudinal protocols with fewer than six measures performed over unequal periods (3 weeks to 18 months); moreover, some of these researchers used adolescents, who are considered to be less stable than adults (Rosenberg, 1986).

To our knowledge, no researcher has examined the day-to-day stability of self-esteem. Nevertheless, the theoretical approach, methodological principles, psychometric instruments, and statistical analyses adapted to using a psychological time series need to be appropriate.

The theoretical approach to using a time series was proposed particularly by Nowak and Vallacher (1998) regarding research in dynamic social psychology. This approach assesses not only scores of self-perception (level) as in classic research, but also variability (standard deviation or range) and intra-individual dynamics according to an iterative equation of the type: $y_t = f(y_{t-1})$, where y_t corresponds to observation at t time. The aim is to discover the principles that govern the emergence of order in complex systems over time. The behavior of systems is conceived of as an emergent property that arises from the interplay of the many elements included in the system. Recent examples can be found in the domain of interpersonal relationships based on the same assumptions (Felmlee & Greenberg, 1999; Guastello & Guastello, 1998). Self-esteem could also be considered as a complex system subjected to several constraints over time, and time series analysis might be an appropriate and highly informative means to explore some basic hypotheses about the intra-individual variability of self-esteem (Vallacher, Nowak, Froehlich, & Rockloff, 2002). Thus, an investigation of the self-esteem dynamics requires an intra-individual and longitudinal approach.

Dynamic social psychology requires standardized measures to construct time series (Nowak & Vallacher, 1998). The repeated measures need to be numerous (more than 50 observations for several time series analyses), regular, and unrelated to deep situational impact (disease, divorce, unemployment, family drama, etc.). Today, because few papers in social psychology adopt these methodological principles of time series, descriptive, ecological, and intra-individual change should be studied before researchers attempt to include different people in the same group. The dynamics of these individuals might be quite different.

Short inventories can be used to assess day-to-day dynamics. The instruments need to be short (quick assessment to maintain motivation), easy to use (i.e., single sheet of paper, weekly journal, software), sensitive (for example, visual analog scale), reliable (consistent with previous measuring instruments), and valid (predictive, concurrent). Single items measuring global self-esteem

have acceptable psychometric properties (Ninot, Fortes, & Delignières, 2001; Robins et al., 2001). A single item may provide an adequate measure of global self-esteem because most adults are schematic for this (Robins et al.). Global self-esteem is an indicator of social status in group and interpersonal contexts (Leary, 1990). Thus, it is likely to be repeatedly activated in a wide range of situations and therefore chronically accessible by adulthood (Robins et al.).

A number of statistical procedures are available to forecast time series. The autoregressive integrated moving average (ARIMA) procedures are used to analyze the internal dynamics of time series (Box & Jenkins, 1976). Recent experiments were conducted using these procedures for studies on motivation (Guastello, Johnson, & Rieke, 1999), chronic fatigue syndrome (Jason et al., 1999) and quality of life (Barge-Schaapveld et al., 1999).

If self-esteem is a personality *trait*, an intra-individual time series of daily measurements of healthy adults' global self-esteem should be relatively stable with minor random fluctuations. Mathematically, global self-esteem can be considered a fixed-point attractor. Over time, a system's dynamics display a reliable pattern. The attractor for a system may involve a specific reference value, representing a stable equilibrium. This does not mean that the system does not react to endogenous and exogenous influences. The influence tends to be short-lived so that the system quickly comes back to its attractor.

In this case, each time series should exhibit a stable and stationary pattern, including random data points around a reference value that corresponds to the individual's level of global self-esteem. The residual variability (i.e., the moment-to-moment relations between successive measures in a time series) reflects measurement errors, random events, or more commonly, white Gaussian noise (Slifkin & Newell, 1998). According to this hypothesis, global self-esteem, which is considered to be minimally sensitive to life events, would not present a fluctuating type of functioning and would be stable and stationary over a 6-month period. From a mathematical viewpoint, autocorrelations that usually indicate short-term functioning would be nonsignificant.

In the present study, we assessed the intra-individual dynamics of global self-esteem in healthy adults over a 6-month period. Our purpose was to examine the suppositions offered by nomothetic researches about the dynamics of self-esteem over time. Our first hypothesis was that fluctuations in this dimension can be considered random measurement errors. Our second hypothesis was that self-esteem functions as a *trait* over a 6-month period in adults (McCrae & Costa, 1994).

Method

Participants

The participants were 8 adults (4 women and 4 men; mean age = 29.4 years; $SD = 7.9$; $SEM = 2.8$). They were all employed and were from middle-class

backgrounds; none lived alone. Five were also students. None had pharmacologically treated psychiatric disorders or severe medical illness, and none had recently undergone major negative life events that would have affected psychological functioning over the 6-month period. All gave informed written consent to participate.

Measures

The Physical Self Inventory (Ninot et al., 2001), which has been validated in French, was used to assess global self-esteem. This instrument is a 6-item questionnaire with a *visual analog scale* (a single 10-cm horizontal line without formal indications) that can be scored from *not at all* (measured 0.0 cm) to *absolutely* (measured 10.0 cm). This instrument measures six dimensions: global self-esteem, physical self-worth, physical condition, sport competence, physical strength, and attractive body (Fox, 1997). The participants responded exclusively to the global self-esteem item ("Globally, you have a good opinion of yourself"). They were also requested to draw a mark on the center of a second 10-cm horizontal visual analog scale. This added item was designated to estimate the measurement error that corresponded to the difference between the true value of the center of the line (i.e., 5 cm) and the value of the response mark. Participants were not informed of these numerical scores and were not allowed to consult their previous responses.

Procedure

Each participant completed the inventory items (one item for global self-esteem and one for the measurement error) twice a day between 7:00 and 9:00 a.m. and between 7:00 and 9:00 p.m. over a 6-month period. The individual time series presented 364 observations.

Statistical Analyses

The statistical analysis focused on the individual time series. For our first hypothesis (mathematically, fluctuations of global self-esteem individual time series can be considered as a random measurement error), we performed two "run" tests and the Box-Pierce test to determine the randomness of each time series. The runs above and below the median test counted the number of runs that were completely above or below the median and ignored the values that were equal to the median. The runs up and down test counted the number of times a sequence rose or fell. If the p values of the test were less than .05, then the values occurred in a nonrandom order. The Box-Pierce test verified whether the autocorrelation was equal to 0. If the p value was less than .05, the autocorrelation was not equal to 0.

For the second hypothesis, global self-esteem functioned as a *trait* (i.e., individual time series mathematically followed an iterative equation consisting of a reference value corresponding to the mean, plus a random measurement error term), and we applied ARIMA procedures to determine the iterative functioning of the time series and to infer the underlying psychological processes (Spray & Newell, 1986; Guastello et al., 1999). ARIMA procedures are mainly based on the analysis of the autocorrelation function and the partial autocorrelation function, which are essential diagnostic instruments to identify the dependence structure of the series.

The autocorrelation is the correlation of the series with itself, lagged by a particular number of observations. The partial autocorrelation is the partial correlation of a series with itself, lagged by a particular number of observations and controlling for all correlations for lags of lower order. For example, the partial autocorrelation for a lag of 2 represents the unique correlation of the series with itself at that lag, after controlling for the correlation at lag 1. The model is supported by the potential association of three kinds of mathematical processes: moving average (MA), integrated process, and autoregressive process. The model takes the form (p, d, q), where p indicates the number of autoregressive parameters, d the number of differencing passes, and q the number of MA parameters.

If the time series is stationary, it indicates that successive observations did not present an increasing or decreasing tendency. This iterative functioning, corresponding to a (0, 0, 0) ARIMA model, is characterized by the following equation:

$$y_t = \mu + \varepsilon_t \quad (1)$$

where y_t is the value observed at time t , μ is the mean of the time series, and ε_t is a random error demonstrating white Gaussian noise. The series can appear quite choppy because of the uncorrelated adjacent points. This process is termed stationary since the mean of the series is constant and does not depend on time. A white noise model has sometimes been encountered in motor learning research. This model was found to represent some series of successive motor task performances with knowledge of results (Spray & Newell, 1986).

The psychological interpretation of such models lies on the stationarity of the mean, which suggests that individuals develop a stable reference around which responses randomly fluctuate. Similarly, the time series of measurement error item should evolve around a mean whose value should correspond to the center of the line ($\mu = 5$). The personality *trait* hypothesis related to global self-esteem suggests that its functioning would be characterized by a (0, 0, 0) model as the stable referenced value associated with weak and random fluctuations.

Because the time series is nonstationary, the first step in fitting an ARIMA model is to determine the order of differencing needed to stabilize the series (*stationarity*). Mathematically, the stationarity of a time series refers to the time invariance of the data-generating process, revealed by the stability over time of mean and variance. Stationarity, with respect to the mean, implies that a time series fluctuates around a constant value over time. This first step removes the general trend

of the time series (to increase and/or decrease with significant autocorrelations) and transforms it to a new time series fluctuating around a well-defined mean value. The first order differencing (p, 1, q) replaces value y_t by a value $(y_t - y_{t-1})$. The stationary time series that was obtained implied that the successive increments of the fitted series did not present an increasing or decreasing tendency. This signified that the slope of the series was removed and that the following mathematical transformations were based on a time series whose statistical properties such as mean, variance, and autocorrelation were constant over time.

Once this forecasting procedure has been accomplished, the second step is to identify autoregressive and/or MA terms through the examination of the autocorrelation and partial autocorrelation patterns of the fitted series. In such cases, it is necessary to determine which processes need to be included and how many terms are sufficient to fit the data and then to establish the value of each parameter for the respective autoregressive and MA processes. An MA model (0, 1, 1) without a significant constant is defined by terms of y_{t-1} (one differencing parameter), $-\theta \epsilon_{(t-1)}$ as a function of previous random measurement error, and ϵ_t as a random measurement error at time t . The MA model suggests that the dynamics of the time series are based on a short-history reference value that evolves slowly over time:

$$y_t = y_{(t-1)} - \theta \epsilon_{(t-1)} + \epsilon_t \quad (2)$$

An autoregressive model (1, 0, 0) supposes that each point is explained by the weighted mean of the preceding measure plus the random error. The model (1, 0, 0) is related to constant adaptation to events over time. The autoregressive model (1, 0, 0) may characterize psychological *state* functioning over time. This model without a significant constant is typical of a time series that exhibits sensitivity to local events (immediate experience). The current value is determined by the preceding weighted value (y_{t-1}) plus the current disturbance (ϵ_{t-1}). The first process is the resistance to change. The amplitude is given by ϕ , and the resistance is maximal with a ϕ value close to 1.

The second process relates to the local event (or random shock) that impacts either positively or negatively on the time series. The combined effect of these two processes leads to a substantial evolution in the local mean of the series under the influence of life events. Conversely to the MA procedure, autoregressive dynamics depend on local events. For example, patients with chronic disease cannot completely conserve the preceding value; instead, they depend on positive or negative events that have a certain uncontrollability. These patients must focus on disease symptoms and all their consequences. They are unable to present a high resistance to the influence of daily events:

$$y_t = \phi y_{(t-1)} + \epsilon_t \quad (3)$$

Consequently, our second hypothesis was that we would find a (0, 0, 0) process for the global self-esteem of participants without chronic disease. This process characterizes random oscillations around a reference value over time.

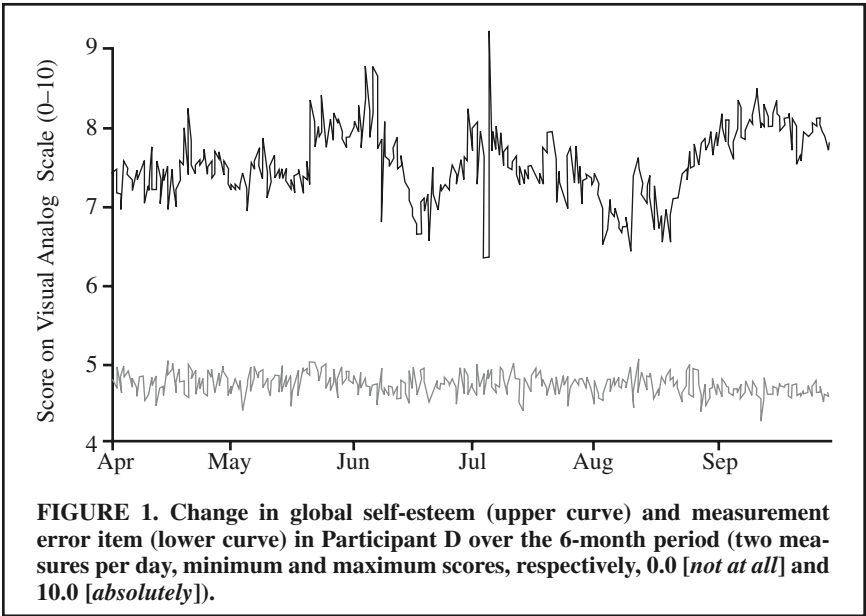
Results

Type of Time Functioning

Figures 1 and 2, respectively, show the global self-esteem and measurement error item time series for participants D and F. Table 1 shows descriptive data. The three tests (runs above and below the median, runs up and down, and Box-Pierce) showed p values less than .001 for each global self-esteem time series. Thus, the individual time series of global self-esteem may not be a random order. In contrast, the tests showed no statistically significant p value for the time series of the measurement error item for each participant. The observations reflected white noise with weak variability.

Pattern of Time Functioning

All time series of global self-esteem (from 8 participants) presented a long-trend autocorrelation function. Figure 3 displays the autocorrelogram (i.e., autocorrelation graph) of global self-esteem for Participant D with significant autocorrelation coefficients from lag 1 to lag 28. Each of them exhibits a significant and progressive decline in autocorrelation coefficients from lag 1 to the maximal significant lag ($p < .05$): A, 114; B, 30; C, 57; D, 28; E, 10; F, 93; G, 86; H, 99). This lag assumes that the original series were nonstationary and had a constant average trend. Moreover, the better and significant autocorrelation coefficient



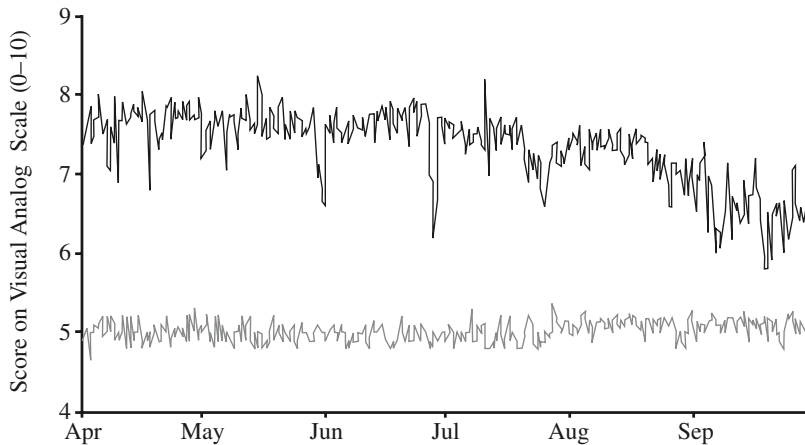


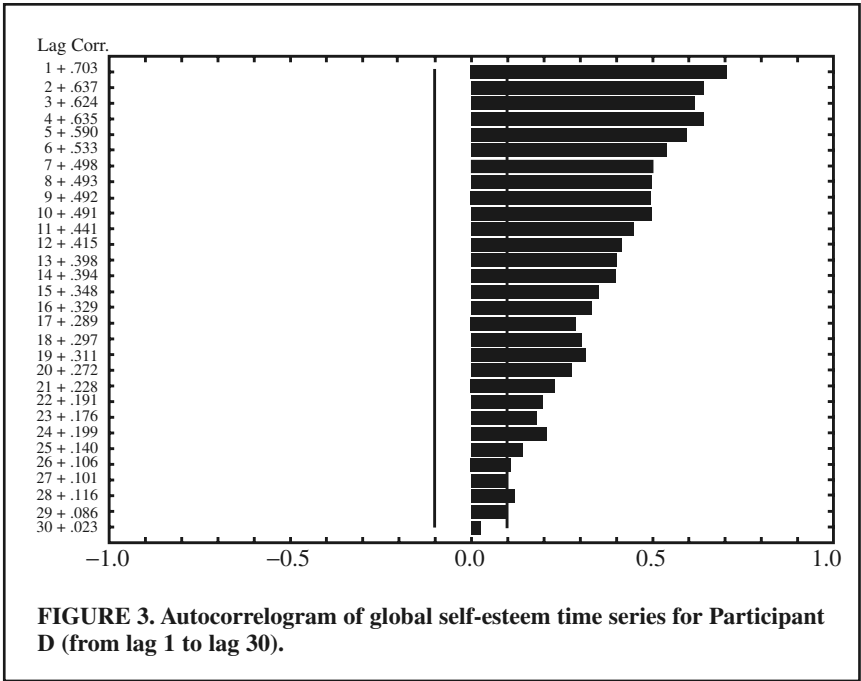
FIGURE 2. Change in global self-esteem (upper curve) and measurement error item (lower curve) in Participant F over the 6-month period (two measures a day, minimum and maximum scores, respectively, 0 and 10.0).

TABLE 1. Descriptive Statistics of Global Self-Esteem and Measurement Error Time Series

Participant	Global self-esteem				Measurement error item			
	<i>M</i>	<i>D</i>	Min	Max	<i>M</i>	<i>D</i>	Min	Max
A. (M, 24)	8.86	0.47	7.67	9.53	0.11	0.12	4.62	5.40
B. (M, 27)	8.25	0.79	5.14	9.70	0.11	0.12	4.57	5.40
C. (M, 48)	7.30	0.60	5.60	8.60	0.05	0.14	4.50	5.40
D. (M, 32)	7.53	0.38	6.50	9.00	0.11	0.15	4.86	5.35
E. (W, 26)	5.10	1.07	2.08	7.92	0.10	0.13	4.71	5.38
F. (W, 26)	7.50	0.46	6.22	8.34	0.12	0.12	4.80	5.40
G. (W, 27)	6.87	0.51	4.66	7.62	0.06	0.14	4.71	5.38
H. (W, 25)	5.99	0.47	4.97	7.41	0.12	0.12	4.71	5.40

Note. *SD* = standard deviation, (M = man, W = woman, years old). Minimum and maximum scores on a 10-cm horizontal visual analog scale ranging from 0.0 (*not at all*) to 10.0 (*absolutely*). For the measurement error item (ME), each participant had to draw a mark in the middle of the scale (corresponding to 5 cm). The difference indicates measurement error.

was always found at lag 1 (A, .87; B, .68; C, .85; D, .70; E, .54; F, .67; G, .83; H, .83). Conversely, the autocorrelation and partial autocorrelation functions of each measurement error time series did not exhibit any lag significant coeffi-



cients. Figure 4 displays the autocorrelogram of the measurement error item for Participant D. Thus, the best ARIMA model for measurement error time series is systematically a (0, 0, 0) model, which is characterized by Equation 1.

To determine the best fitted ARIMA model for the global self-esteem time series, we performed differencing procedures for all series to make them stationary. The time series presenting a long-trend autocorrelation function (see Figure 3) underwent a first-order differencing. The lag 1 autocorrelation of the differenced series satisfied requirements, thus indicating that no further differencing was necessary. As a result, all the models were (p , 1, q) models, suggesting that the original series were not stationary and had constant average trends. No significant constants were found and the standard deviations were reduced, indicating that the trends had been completely eliminated.

The autocorrelation function of the differenced series displayed a sharp cutoff, whereas the partial autocorrelation function decayed slightly (i.e., had significant spikes at higher lags), thus suggesting a MA signature. The MA model (0, 1, 1) without a significant constant was systematically obtained for all of the differenced time series ($p < .001$). All the time series presented the same MA dynamics with a specific theta coefficient from 0.47 to 0.81 (see Table 2), thus characterizing the time functioning as not stationary and with short-term autocorrelation.

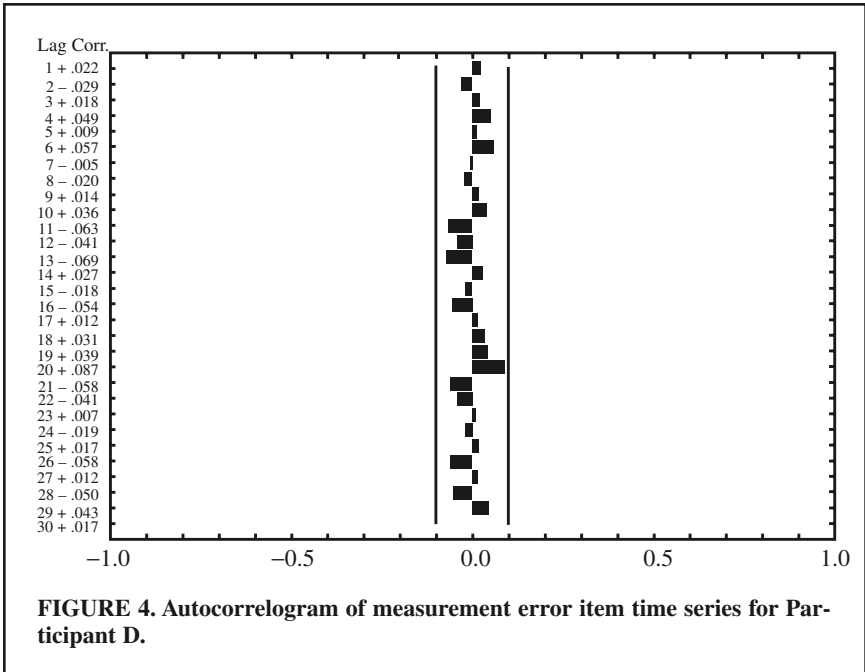


TABLE 2. Values for Moving Average Model (0, 1, 1) Without Significant Constant on Global Self-Esteem in Eight Adults Over a 6-Month Period ($p < .001$)

Participant	θ coefficient	ϵ_t
A	0.79	0.04
B	0.71	0.12
C	0.54	0.09
D	0.66	0.06
E	0.65	0.05
F	0.81	0.09
G	0.47	0.08
H	0.81	0.05

Note. Equation of (0, 1, 1) model without significant constant: $y_t = y_{(t-1)} - \theta \epsilon_{(t-1)} + \epsilon_t$.

The time series cannot be considered as white noise fluctuations around a stable value. In other words, the expected value at time t is modeled as the preceding observed value (y_{t-1}) minus a fraction of its own disturbance ($\theta\epsilon_{t-1}$). The

expected value at time t tends to absorb the preceding disturbance to restore the previously expected value. The amplitude of the correction is given by θ , and the restoration should be complete with a θ value close to 1. This correction underlies the preservation process, which limits the influence of the perturbations and ensures the stability of the series. This model (also called the *simple exponential smoothing model*) is typical of time series that exhibit noisy fluctuations around a slowly varying mean.

Discussion

Our first hypothesis was that global self-esteem dynamics were only related to measurement error (see Equation 1), suggesting that individuals actively resist change and return to a reference value. The results clearly showed that the eight global self-esteem time series fluctuated over the 6-month period, more than the time series resulting from the measurement error item. The global self-esteem time series were not stationary or random. The significant autocorrelation, including a progressive decrease, indicated that the process of global self-esteem functioned with a short-term history for each participant. Using a sensitive instrument repeatedly over a long period showed that global self-esteem can be considered a complex dynamical system subject to internal and environmental constraints (Nowak et al., 2000). It cannot be considered as white noise fluctuations around a stable value.

For our second hypothesis, the ARIMA procedures did not support the (0, 0, 0) model. The results were a systematically MA model associated with first order differencing and a nonsignificant constant (0, 1, 1) characterized by Equation 3, also called the simple exponential smoothing model (SESM). The system did not oscillate around one reference value, and it did not tend to come back to this reference after a perturbation. The system exhibited noisy fluctuations around a slowly varying mean. Conversely, the (0, 0, 0) model, characterized by random fluctuation around a reference value corresponding, was systematically obtained ($\mu = 5$). Thus, our second hypothesis had to be rejected. Global self-esteem cannot be an attractor that functions as *trait* (McCrae & Costa, 1994) or *dynamic equilibrium* (Headey & Wearing, 1989; Nowak et al., 2000) over time. Nevertheless, global self-esteem, measured over time, did not function as a real *state* either (Markus & Wurf, 1987).

The MA pattern of global self-esteem emerges from an organic system confronted by several constraints. The time series has a specific sense over a short time period. The first part of the MA equation ($y_t = y_{(t-1)}$) proposes individual iterative functioning based on history over a short period that generates self-esteem maintenance and resistance to incoming information (Tesser, 1988). The importance of maintaining relatively stable and positive self-evaluation despite a high number of negative events that may affect stability of self has been clearly demonstrated in the literature (Markus & Wurf, 1987; Sedikides & Skowronski, 1997; Tesser, 1988).

The second part of the MA equation is related, respectively, to two adaptive functions ($-\theta\epsilon_{(t-1)}$), corresponding to a fraction of the measurement error emerging from the previous auto-evaluation (a sort of correction of previous adaptation), and $(+\epsilon_t)$, to an adaptation to the impact of daily events (perceptible and/or imperceptible variation). This finding supports previous observations that individuals tend to experience slight variations rather than dramatic shifts in their self-evaluations (Kernis, 1993; Kernis et al., 1989; Kernis et al., 1991). Our findings showed that this process functioned essentially with a short-history process. The reference value was equal to the previous value ($y_{(t-1)}$), functioning as a resistance to the influence of daily events, plus two functions ($-\theta\epsilon_{(t-1)}$ and ϵ_t), operating as adaptive processes. This model suggests that the dynamics of self-esteem could be underlaid by the combination of two opposite processes—a *preservation* process, which tends to restore the previous value after a disturbance; and an *adaptation* process, which tends to inflect the series in the direction of the perturbation. The combined effects of these two processes led to a slow evolution of the local value of the series under the influence of life events.

The results may thus indicate that a *dynamic adjustment* governs changes in global self-esteem. According to Marks-Tarlow (1999), self-esteem can be viewed as a continuous flow that is beyond contextual, social, and cultural factors. This global self-perception emerges from a system possessing enough stability to maintain consistent functioning but sufficient randomness to ensure adaptability and creativity. The analysis of its historical evolution is essential to understanding it (Marks-Tarlow).

Biological systems are often characterized by spontaneous behaviors having a high level of stability and ability to reproduce (Kelso, 1995). Our study indicates that the same may be said of the psychological systems producing self-esteem. The similar pattern of the participants (the model with one MA parameter, one differencing parameter, and a nonsignificant constant) suggests that the intra-individual dynamics of global self-esteem were stable over time. This tendency reveals the presence of attractors linked to the dynamics of self, a concept that is particularly suited to account for the stable dynamics of perceived dimensions over time. Research is needed to explore this hypothesis over a longer period and in function of specific impacts (Marks-Tarlow, 1999; Nowak et al., 2000).

This exploratory study showed a common dynamic of global self-esteem over a period of 6 months in 8 adults. The application of the ARIMA procedures provided interesting statistical results and a quite reasonable model of the psychological processes underlying the dynamics of self-esteem. The system exhibited noisy fluctuations around a slowly varying mean. Our results support a different perspective on the nature of stability (trait) and change (state) in global self-esteem. Nevertheless, this approach tends to focus on short-term correlations in the time series and is unable to reveal longer-term dependencies, which could be indicative of the presence of fractal processes in the time series. Inves-

tigating global self-esteem as an emergence of a complex dynamical system leads to a variety of insights regarding self-structure and self-process.

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