

Ninot, G., Fortes, M., & Delignières, D. (2006). Validation of a shortened instrument for assessing the dynamics of the global self-esteem and physical self in adults. *Perceptual and Motor Skills*, 103, 531-542.

Validation of a Shortened Instrument for Assessing the Dynamics of the Global Self-Esteem and Physical Self in Adults

Grégory Ninot, Marina Fortes & Didier Delignières

Abstract: The purpose of this study was to validate a brief tool for the assessment of global self-esteem (GSE) and physical self in adults. This inventory, named PSI6-b, is a refined version of the previously validated PSI6-a (Ninot, Fortes & Delignières, 2001) based on the Physical-Self Inventory (PSI, Ninot, Delignières & Fortes, 2000), a French adaptation of the Physical Self-Perception Profile (Fox & Corbin, 1989) including a GSE scale. PSI-6b is composed of 6 single-item subscales assessing the following dimensions: GSE, physical self-worth, sport competence, physical condition, attractive body, and physical strength. The rating is performed using a visual analog scale. Three hundred and thirty three participants completed the experimental inventory. The items of the PSI6-b were closely related to their counterparts of the previous versions (PSI and PSI6-a), and the results allowed to confirmed its hierarchical structure. Significant correlations between this new inventory and constructs like masculinity, neuroticism, and depression showed its external validity. A second study, based on the collection of time series over a one-month period ($N = 40$) allowed to confirm in most cases the hierarchical structure of the inventory, at the individual level. An original test of reliability was conducted, through the collection of time series over a short period in a closed environment without exogenous constraints. In most cases the series were modeled as white noise processes, evidencing their short-term reliability. Finally, a study including 10 adults confirmed the dynamics obtained previously with the PSI6-a over a period of 6 months. The specific aim of this shortened version is to allow a dynamic assessment of self-concept related to physical self, with repeated and frequent measures over a relatively long period.

Key-words: Self-esteem, physical self, psychometric tool, validation, single-item

Corresponding author: Grégory Ninot, E.A. Addictive, Performance and Health Behaviors, 700 avenue du Pic St-Loup, 34090, Montpellier, France. Tel.: 00 33 467 415 731, Fax: 00 33 467 415 751, Email: gregory.ninot@univ-montpl.fr

Over the last 30 years, scientific conceptions about self-esteem have changed markedly (Fox, 1997). Initially, self-esteem was conceived as an unidimensional and very global construct (Coopersmith, 1967, 1984; Marx & Winne, 1978; Piers, 1969), namely the individual's overall sense of worth as a person (Harter, Bresnick, Bouchey & Whitesell, 1997). More recently, multidimensional models considered self-esteem as the combination of distinct self-assessments relative to specific domains of competence (Harter, 1982; Harter et al., 1997). These models were then enriched by the introduction of hierarchical conceptions (Fox, 1997; Fox & Corbin, 1989; Marsh & Redmayne, 1994; Marsh & Shavelson, 1985). According to Fox and Corbin (1989), global self-esteem (GSE) represents the apex of the hierarchical structure, the feeling everyone gets about one's own value. The median level is occupied by physical self-worth (PSW), which represents the general feeling of happiness, satisfaction, pride, respect, and confidence in the physical self. The more specific level is composed of four subdomains: physical condition (PC), sport competence (SC), physical strength (PS), and attractive body (AB). PC represents perception of one's level of physical condition, fitness and stamina, one's ability to maintain exercise, and one's confidence in the exercise, and fitness setting. SC corresponds to perception of sport and athletic ability, ability to learn sports skills, and confidence in the sports environment. PS is related to perceived strength, muscle development, and confidence in situations requiring strength. Finally, AB corresponds to the perceived attractiveness of the body, the ability to maintain an attractive body and the confidence in appearance.

In order to assess the hierarchical model of the physical self, Fox and Corbin (1989) validated the Physical Self-Perception Profile (PSPP) that measured PSW and four subdomain scales (30 items). The use of PSPP is strongly encouraged (Fox, 1997; Sonstroem, Speliotis, & Fava, 1992). A French version of PSPP, named Physical Self Inventory (PSI) was recently validated (Ninot, Delignières & Fortes, 2000). PSI includes the five scales of the PSPP: one scale at the domain level (PSW, 5 items), and four at the subdomain level (PC, 5 items; SC, 4 items; PS, 3 items; AB, 3 items). The inventory was completed with a GSE scale (5 items), adapted from the French version of the Self-Esteem Inventory (Coopersmith, 1984). This inventory possesses a satisfying internal consistency (with Cronbach's α ranging from .77 to .90), and a good test-retest reliability ($r = .90$ to $.96$; over a one-month interval). The hierarchical organization of the scales was confirmed by way of partial correlational and confirmatory factor analyses.

Recent dynamical social psychology emphasized the research on intra-individual measure of psychological dimensions (Nowak & Vallacher, 1997). The main aim of this approach is to study the evolution over time of these dimensions, in other words to assess the individual dynamics. Such analysis requires the collection of time series with a large amount of repeated measurements. The use of classical inventories as PSPP or PSI is difficultly conceivable for this purpose. In sport or exercise rehabilitation context, participants declare having not enough time for using classical inventories (from 20 to 48 items). Moreover, they consider that they respond several times at the same question. Such reaction may lead participants to skip questions, respond randomly, and engage in other test-taking behaviors that contribute to invalidate protocols (Robin, Hendin, & Trzesniewski, 2001). An alternative strategy could be the use of briefer tools, composed of a single item per assessed dimension, assuming that the loss of accuracy due to the shortness of the inventory should be compensated by its repeated administration. A single-item measure eliminates item redundancy and therefore reduces fatigue, frustration, and boredom associated with answering highly similar item repeatedly. In order to avoid learning effect and for increasing the sensibility of the inventory, the use of a Visual Analog Scale (VAS) response protocol (Huskisson, 1974) seems more relevant than the classical Likert scales.

Recent studies proposed such single item measures for GSE (Robin et al., 2001; Ninot, Fortes & Delignières, 2001), physical self (Ninot et al., 2001) or other psychological dimension such as subjective well-being (Sandvik, Diener & Seidlitz, 1993). Single item measuring certain psychological dimensions can provide an acceptable balance between practical needs and psychometric concerns (Robin et al., 2001). Single-item self-report scales are not necessary relevant for assessing all kinds of psychological dimensions. For example, it is unlikely that a single-item would be valid for a multifaceted and psychodynamically complex structure. According to Robin et al. (2001), a single self-report item may be adequate when the construct is highly schematized for most individuals, as proposed by Markus (1977). Most adults are schematic for GSE and physical self because such dimensions are likely to be activated in a wide range of situations and therefore likely to be chronically accessible to adulthood (Robin et al., 2001). In intra-individual survey, multiple repeated measures can provide specific information of about stability (Amorose, 2001; Greenier, Kernis, McNamara, Waschull, Berry, Herlocker, & Abend, 1999; Nezlek & Plesko, 2001) and dynamics (Ninot et al., 2001; Nowak, Vallacher, Tesser, & Borkowski, 2000) over time. Each subject is his or her main control. In that case, the stability and the causal flow hypotheses in the hierarchical structure can be explore with the use of time series analyses. Fox (1997) supposed that the apex level is the more general and stable and conversely the lower level is very specific and changeable. The direction of causal flow in the physical self-concept hierarchy is clearly inconclusive (Marsh & Yeung, 1998). The bottom-up functioning, based on cognitive predominance, supposed that the causal flow is from factors at the base of the self-structure to higher order factors (Byrne & Gavin, 1996; Harter, 1982; Shavelson et al., 1976). A high satisfaction in a given physical task reinforces the corresponding subdomain, and then enhances PSW, and finally GSE. Inversely, the top top-down functioning, referring to affective predominance, supposed that the direction of causal flow is from higher order factors at the apex of the model to lower order factors at the base (Brown, 1998). A third model, named reciprocal (Marsh & Yeung, 1998), suggested a causal flow in both directions (Fox & Corbin, 1989; Marsh & Yeung, 1998).

Ninot et al. (2001) validated a questionnaire especially devoted to the study of the dynamics of GSE and physical self. This questionnaire, named PSI6-a, was a shortened version of the PSI, and based on a single item self-assessment related to each dimension of the hierarchical structure. The authors provided reasonable support for the internal structure of the PSI6-a, as well as for its construct validity. This 6-items version (Table 1) was validated with a 10-cm horizontal VAS (from 0 for “not at all” to 10 for “absolutely”).

Table 1: Physical Self Inventory 6 items version a (PSI6-a)

Category	Item
GSE	Globally, you have a good opinion of yourself
PSW	You are proud of who you are and what you can do physically
PC	You should be good in an endurance test
SC	You manage well in all the sports
PS	When you come to situations requiring strength, you are among the first to step forward
AB	You think that you have a body pleasant to look at

Note. GSE: global self-esteem scale, PSW: physical self-worth, PC: physical condition, SC: sport competence, PS: physical strength, AB: attractive body, and EM: error measure.

Nevertheless, PSI6-a presented some weaknesses for practical application. PSI6-a was composed of item sentences using the third person. For daily longitudinal survey, first person questions should be more personalized and will endorse better activation of self-schemata (Robin et al., 2001). Secondly, the items of the PSI6-a were selected on the basis of a factorial analysis of the PSI, performed with data obtained from healthy young adults (Ninot et al., 2001). Each item was the best representative of its subjacent factor. Nevertheless, the use of PSI6-a with particular population (elderly individuals or person with disabilities) revealed the inadequacy of some items, which were judged too specific, and not adapted to the life habits of such populations. Moreover, PSI6-a needs an additional item in order to determine the standard error measure due to VAS using, but also to invalidate aberrant responses due to vision troubles or inattention.

The aim of the present paper was to propose and validate an alternative version of PSI6-a, satisfying these objections. The items of the new inventory, named PSI6-b, were then formulated using the first person, and in more general terms, in order to be acceptable by a wider range of subjects. An additional item requests participants to draw a mark in the center of the horizontal 10-cm VAS. The difference between the true center value (5 cm) and the obtained value indicates the range of error measure.

The validation of this kind of questionnaires cannot exactly follow the procedures traditionally advocated for the validation of psychological inventories. A set of specific requirements could be defined in order to declare the validity of the questionnaire.

- Generally, single-item questionnaires are designed to assess dimensions previously measured with more conventional, multi-items inventories. A brief questionnaire should be equivalent to previously validated tools. A first requirement should be to obtain close relationships between the items of the new questionnaire and the corresponding dimensions of previously validated inventories. In the present case, the 6 dimensions of PSI6-b should present significant correlations with their counterpart items of PSI6-a or dimensions of PSI.

- The equivalence between the new questionnaire and the earlier tools should also be checked in terms of level of response, for each item. No significant differences in average response should be evidenced between corresponding items or dimensions.

- An important step in the validation of psychological inventories concerns construct validity, generally checked by the presence of theoretically hypothesized correlations between the new inventory and earlier tools measuring related dimensions.

- Often questionnaires contain multiple dimensions, which are theoretically more or less correlated. This was the case, for example for the PSPP and the PSI, whose dimensions were organized according to the hierarchical structure previously presented. A shortened questionnaire should obviously reproduce an internal organization identical to that described with earlier tools. Interestingly, these inventories allow two distinct validations of their internal structure: the first one at the group level, checking with a unique measure the correlation between dimensions, and the second one at the individual level, assessing the relationships among the set of time series obtained with the questionnaire. The second procedure opens a completely new window in psychometrics.

Finally, such questionnaires are generally created to assess the dynamics of dimension conceived as changeable over time (Greenier et al., 1999). The classical tests of reliability, generally requested for questionnaires aiming at measuring stable dimensions as personality traits, cannot be applied. An adapted version of reliability testing, considering that these questionnaires aim at the collection of time series, could be to collect series on a sufficiently short time scale for assuming the stationarity of the subjacent dimensions. The obtaining of

uncorrelated white noise in such series should testify the (short-term) reliability of the questionnaire. Inversely, the time series have to exhibit significant progressive decrease of autocorrelation lags over a period of several months due to adaptation process to external events. The time series have to show a slow evolution of the local value under the influence of life events (Greenier et al., 1999; Ninot et al., 2001; Nezlek & Plesko, 2001).

Study 1: Validation of the PSI6-b

The items of new inventory were derived from the PSI. As previously stated, these items were chosen among the most representative of each original factor. We selected the most general, non-specific formulations, and the sentences were eventually rewritten at the first person. The items of the experimental version are presented in Table 2. An item of error measure (EM) was added.

Table 2: Physical Self Inventory 6 items version b (PSI6-b)

Category	Item
GSE	Globally, I am satisfied of myself
PSW	Physically, I am content of myself
PC	I am satisfied with my physical condition
SC	I am satisfied with my sport competence
PS	I am satisfied with my physical strength
AB	I am satisfied with my body appearance
EM	Draw a mark in the center of the horizontal trait

Note. GSE: global self-esteem scale, PSW: physical self-worth, PC: physical condition, SC: sport competence, PS: physical strength, AB: attractive body, and EM: error measure.

This study was designed to check the internal structure of the PSI6-b and to determine the construct validity by studying the relationships of this inventory with other questionnaires measuring GSE, physical self, neuroticism, masculinity, and depression. The PSI6-b should correlate with other GSE and depression inventories. Additionally, as reported in the literature, significant relationships were expected between the higher levels of our inventory and depression or traits such as neuroticism and masculinity.

Method

333 adults (185 males and 148 females with mean age respectively 25.5 ± 6.0 and 25.9 ± 6.8) volunteered for this study. Each participant completed the PSI6-b and a battery of six paper-and-pencil inventories:

- The PSI original version (Ninot et al., 2000), previously described.
- The PSI6-a (Ninot et al., 2001), previously described.
- The Self-Esteem Inventory (SEI: Coopersmith, 1967; validation in French by the Centre de Psychologie Appliquée, 1984).
- The Eysenck Personality Inventory (EPI: Eysenck and Eysenck, 1968; validation in French by Ganansia, 1971). This inventory is composed of two 24-item scales which measure the extroversion-introversion and the neuroticism-stability dimensions of personality.
- The Bem Sex-Role Inventory (BSRI: Bem, 1974; validation in French by Delignières and Matkowski, 1997). The French version includes two 10-item scales, measuring respectively masculinity and femininity.

- The Beck Depression Inventory (BDI: Beck & Steer, 1993, validation in French by Gauthier, Morin, Theriault & Lawson, 1982). This 21-item inventory assesses overall depression score with demonstrated relationships with GSE (Beck, Steer, & Garbin, 1988).

To confirm the hierarchical structure of the physical self, Fox (1990) outlined the following four conditions that indicated support for the hierarchical organization: (a) PSW exhibits the strongest relationship with GSE, (b) the four sub-domain dimensions exhibit stronger relationships with PSW than with GSE, (c) relationships between sub-domains and GSE are extinguished when the effect of PSW is removed by partial correlation, and (d) relationships between sub-domain dimensions are weaker than their relationships with PSW and are extinguished or reduced when the effect of PSW is controlled (Page, Fox, Ashford, & Biddle, 1993). Zero-order and partial correlation coefficients were calculated to determine the degree of support for the hierarchical structure among perceived dimensions.

The normality of the distribution was tested using the Shapiro-Wilks test. As results evidenced satisfactory normal distribution, Pearson's correlation coefficients were used for assessing inter-scales relationships. The internal structure of the PSI6-b was tested by means of a confirmatory analysis.

Results

The descriptive data for PSI6-a, PSI6-b and PSI are presented in Table 3. The MANOVA did not revealed significant differences between perceived dimensions scores from PSI-6a and PSI6-b (*Wilks' Lambda* = 0.98, *R / Rao* (6,659) = 1.67, $p = .125$). A correlational analysis evidenced a good agreement between the items of PSI-6b and their PSI-6a counterpart (GSE: $r = .95, p < .001$; PSW: $r = .89, p < .001$; PC: $r = .76, p < .001$; SC: $r = .65, p < .001$; AB: $r = .72, p < .001$; PS: $r = .72, p < .001$). Reasonable agreements were also found with the respective subscales of PSI (GSE: $r = .65, p < .001$; PSW: $r = .65, p < .001$; PC: $r = .42, p < .001$; SC: $r = .41, p < .001$; AB: $r = .64, p < .001$; PS: $r = .54, p < .001$). The best correlation between PSI6-b and PSI or PSI6-a were systematically obtained with the same dimension.

Table 3: Descriptive statistics of Physical Self Inventory (PSI), and both shortened 6 items version PSI6-a and PSI6-b

	GSE		PSW		PC		SC		AB		PS	
	m	SD	m	SD	m	SD	m	SD	m	SD		
PSI*	4.45	0.85	4.12	0.90	4.05	1.32	3.76	1.03	4.44	0.92	3.22	1.12
PSI**	6.89	1.69	6.24	1.78	6.07	2.65	5.50	2.07	6.86	1.84	4.42	2.23
PSI6-a***	6.49	1.67	6.26	1.85	6.03	2.37	6.04	2.05	6.25	2.06	5.54	2.15
PSI6-b***	6.45	1.65	6.20	1.84	5.73	2.13	5.82	2.00	6.25	1.99	5.74	2.00

Note. * Likert 6 point (from 1 for “not at all” to 7 for “absolutely”), ** rescaled within the interval [0; 10], *** 10cm horizontal EVA from 0 “not at all” to 10 “absolutely”, GSE: global self-esteem scale, PSW: physical self-worth, PC: physical condition, SC: sport competence, PS: physical strength, AB: attractive body, and EM: error measure.

Figure 1 presents the hierarchical structure obtained with PSI, PSI6-a and PSI6-b. As expected, PSW of PSI6-b exhibits the strongest relationship with GSE. The four sub-domain dimensions of PSI6-b exhibit stronger relationships with PSW than with GSE. Relationships with GSE of PSI6-b subdomain were reduced or extinguished when the effect of PSW was removed by partial correlation. Relationships among sub-domain dimensions of PSI6-b are weaker (from .45 to .59) than their relationships with PSW (from .54 to .74) and are extinguished or reduced when the effect of PSW is removed (from -.03 to .37).

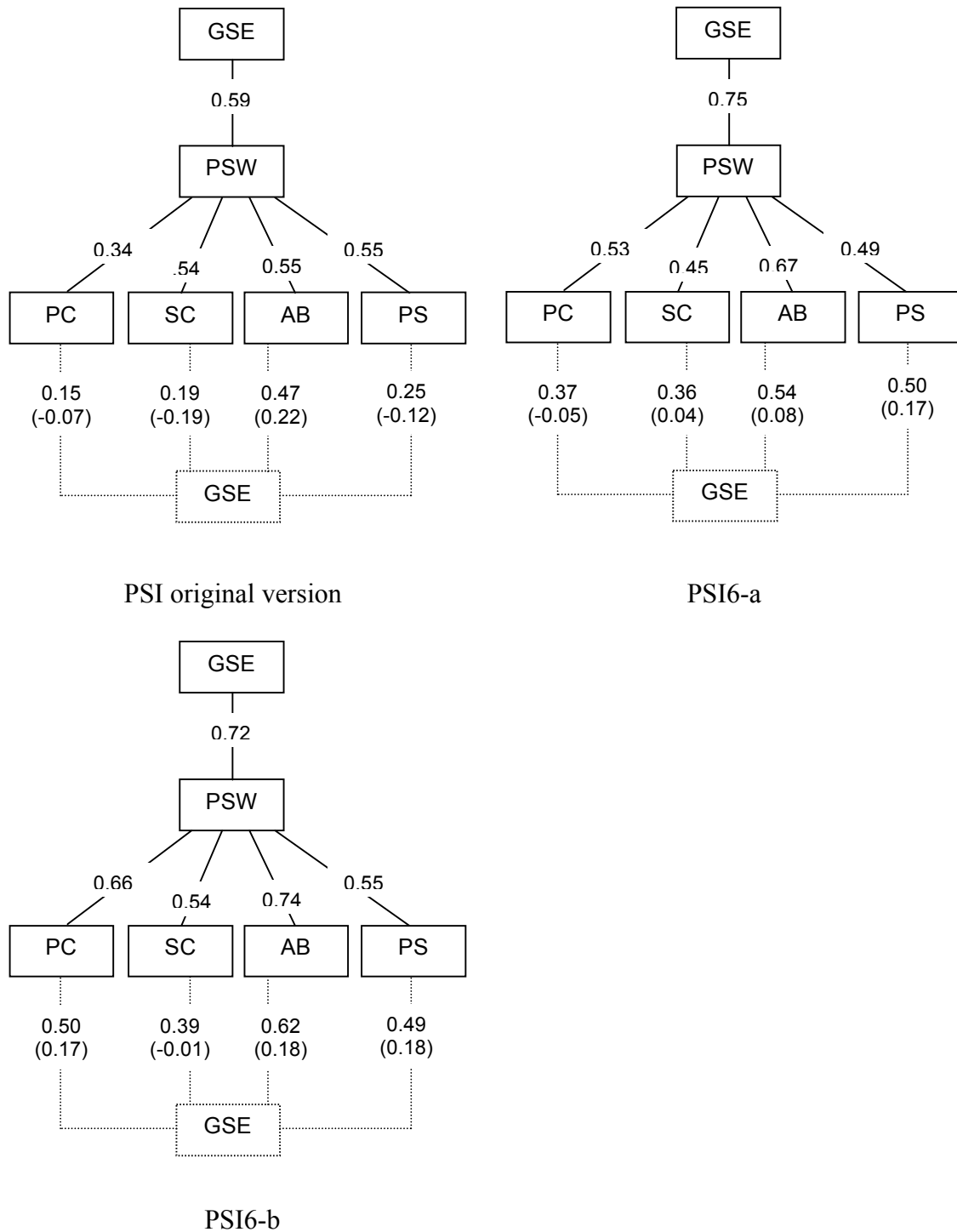


Figure 1: Correlation and partial correlation among the 6 dimensions of Fox and Corbin (1989)'s hierarchical model. The coefficients of correlation between adjacent dimensions in the model are reported in the upper part of each Physical Self Inventory (PSI) panel. In the lower part (with dotted lines) are indicated the coefficients of correlation between subdomains and global self-esteem (GSE), and in brackets the corresponding coefficients of partial correlation controlling for physical self-worth (PSW)

The relationships between the items of PSI6-b and the other inventories are reported in Table 4. As expected, significant coefficients were obtained between the neuroticism scale of

the EPI, and items of PSI6-b. The highest correlation was for GSE. On the other hand, there was no relation between the items of the PSI6-b and Eysenck's Extroversion scale.

The observed relationships between the items of the PSI6-b and the masculinity and femininity subscales of the BSRI were in general consistent with our hypotheses: masculinity was correlated with all the PSI6-b items, and no correlation was observed with femininity.

Finally, we obtained significant positive correlation between the domain and subdomains items of the PSI6-b and the General dimension of SEI. The coefficient correlation is lower for GSE than for AB item. As expected, the results showed negative correlation between BDI score and the six items of the PSI6-b. The higher negative correlation is obtained by the GSE and the overall depression score.

Table 4: Correlation between the items of the PSI6-b and the others inventories

		GSE	PSW	PC	SC	AB	PS
SEI	G	.19***	.13***	.20***	.19***	.26***	.15**
BDI	Total score	-.43***	-.36***	-.33***	-.31***	-.24***	-.28***
EPI	Neuroticism	-.23***	-.17**	-.20***	-.19***	-.19**	-.12*
	Extroversion	-.02 ^{NS}	-.03 ^{NS}	.00 ^{NS}	.09 ^{NS}	-.04 ^{NS}	.05 ^{NS}
BSRI	Masculinity	-.21***	-.17**	-.22***	-.19**	-.13*	-.29***
	Femininity	-.07 ^{NS}	-.02 ^{NS}	-.01 ^{NS}	.02 ^{NS}	-.05 ^{NS}	-.04 ^{NS}

Note. ***: $p < .001$, **: $p < .01$; *: $p < .05$; ^{NS}: non significant, GSE: global self-esteem scale, PSW: physical self-worth, PC: physical condition, SC: sport competence, PS: physical strength, AB: attractive body, EM: error measure, SEI: Self-Esteem Inventory, BDI: Beck Depression Inventory, EPI: Eysenck Personality Inventory, BSRI: Bem Sex Role Inventory

Discussion

These results showed no significant difference between the scores of PSI6-a and PSI6-b for each dimension. The differences for GSE and PSW are minimal, respectively +0.04 and +0.06 in favor of the PSI6-a. The differences are higher for the physical abilities subdomains: PC (+0.30), SC (+0.22), and PS (+0.20). The correlational analysis evidenced a good agreement between the new inventory and the earlier shortened version, as well as with the 25-item version.

The internal validity of the PSI6-b version is satisfactory as it reproduces the hierarchical structure of the model of Fox and Corbin (1989) as well as previous validated version of PSI, classic (Ninot et al., 2000) or shortened (Ninot et al., 2001). The finding showed also the same internal structure with the three instruments. The correlation coefficients are higher when variables are directly linked in the model, and lower or nonsignificant when the link is indirect (for example, between the apex and the subdomains level). Moreover, the partial correlation procedure, controlling for the median level of the model, extinguished most of the correlation. These results were in agreement with the postulated hierarchical structure of the original versions of PSPP (Fox, 1997; Fox & Corbin, 1989; Page et al., 1993) and the PSI (Ninot et al., 2000).

Concerning the external validity of PSI6-b, the present results confirm our hypotheses. The relationships obtained between PSI6-b and other inventories were identical to those described during the validation of the original version of PSI (Ninot et al., 2000) or PSI6-a (Ninot et al., 2001). The relation between neuroticism and the highest levels of the PSI6-b (GSE and PSW)

was clearly expected. In most experiments, GSE appeared closely (and negatively) related to measurements of anxiety or neuroticism (Delignières, Marcellini, Legros & Brisswalter, 1994; Francis, 1996; Many & Many, 1975; Robin et al., 2001). As neuroticism is conceived as a global personality construct, its closer relationship with the apex level of the model than with the lower level appears as a logical result.

The positive correlation between GSE score of PSI6-b and SEI general self-esteem score (Coopersmith, 1967), and the negative correlation between GSE score of PSI6-b and the BDI depression score confirm our hypotheses. According to Beck (1972), low GSE is considered as central to depression and the two concepts are not entirely independent.

The positive relationship between masculinity and GSE was also expected. The masculinity is highly linked with self-confidence, self-efficacy, and GSE (Allgood-Merten & Stockard, 1991; Delignières et al., 1994; Whitley, 1983).

However, attractive body developed the largest relationships of any of the subdomain scales with both GSE and PSW. This results is supported by the higher correlation between the SEI general score and AB, as compared to the correlation between the SEI general score and GSE scale. As indicated in previous study (Ninot et al., 2000; Sonstroem et al., 1992), these data would seem to indicate a health-conscious, middle-age sample actively pursuing health goals.

Study 2: Analysis of the intra-individual hierarchical structure over time

The aim of this second study was to conduct a hierarchical analysis based on correlation and partial correlation in order to assess the intra-individual validity of the model. We used in this study 56 repeated measures over a one-month period.

Method

40 adults (24 males and 16 females; mean age = 30.9, $SD = 13.0$) completed the PSI6-b over a period of 28 consecutive days (56 observations). Each participant completed a brief questionnaire on a single page of a personal notepad twice a day between 7:00 and 9:00 (AM and PM). Each inventory included six items, one for each dimension, presented in random order, and one item for the error measure. The participants completed the PSI6-b as they are going about their everyday activities, and they based their responses on how they feel at the moment they were completing each form. The participants assessed their immediate feelings of self-perception.

Inter-item correlations, as well as inter-item partial correlations controlling for PSW based on intra-individual data were computed to confirm the results obtained in the first study. In order to confirm the significance of the differences between correlation coefficients at the individual level, each coefficient was submitted to z -Fisher transformation. A t -test was then computed for each relevant pair of coefficients according to the specific procedure proposed by Fisher (1970).

Results

For 23 participants (58%), the correlations appeared similar to those obtained in the first study, with high correlations between adjacent items in the model, low correlations between GSE and the subdomain items, and a significant decrease of the coefficients following the partial correlation procedure. The relationships among sub-domain dimensions were weaker than their relationships with PSW and were extinguished or reduced when the effect of PSW was removed. The matrices of intra-individual correlation and partial correlation controlling

for PSW are reported in Table 5 for two subjects. For 18 participants (subject 24 to 40), the results are also globally identical for correlation condition (Page et al., 1993). However, the relationships with GSE of PSI6-b subdomains were not significantly reduced when the effect of PSW is removed by partial correlation for one subdomain (12%, subjects 36 to 40), two subdomains (10%, subjects 32 to 35), three subdomains (10%, subjects 28 to 31), and four subdomains (10%, subjects 24 to 27). The Table 5 illustrated the several matrices of intra-individual correlation and partial correlation controlling for PSW for two subjects in each case. The relationships among sub-domain dimensions are weaker than their relationships with PSW and are globally reduced when the effect of PSW is removed.

Table 5: Zero-order and significant decrease partial correlations between physical self subdomains and global self-esteem controlling for physical self-worth ($p < .05$)

		GSE-PC		GSE-PC		GSE-SC		GSE-SC		GSE-AB		GSE-AB		GSE-PS		GSE-PS	
Subject		Zero	Partial	Zero	Partial	Zero	Partial	Zero	Partial	Zero	Partial	Zero	Partial	Zero	Partial	Zero	Partial
4	5 (F)	.70**	.09 ^{NS}	.77**	.24 ^{NS}	.48**	.23 ^{NS}	.46**	.23 ^{NS}	.46**	.23 ^{NS}	.46**	.23 ^{NS}	.46**	.23 ^{NS}	.46**	.23 ^{NS}
	13 (M)	.74**	.02 ^{NS}	.78**	.22 ^{NS}	.76**	.08 ^{NS}	.78**	.08 ^{NS}	.78**	.08 ^{NS}	.78**	.08 ^{NS}	.78**	.08 ^{NS}	.78**	.08 ^{NS}
3	36 (F)	.47**	.28*	.40**	.18 ^{NS}	.41**	.16 ^{NS}	.62**	.51**	.62**	.51**	.62**	.51**	.62**	.51**	.62**	.51**
	40 (M)	.54**	.25*	.57**	.27*	.52**	.16 ^{NS}	.49**	.38**	.49**	.38**	.49**	.38**	.49**	.38**	.49**	.38**
2	32 (F)	.46**	.27*	.47**	.32*	.55**	.45**	.27*	-.07 ^{NS}	.27*	-.07 ^{NS}	.27*	-.07 ^{NS}	.27*	-.07 ^{NS}	.27*	-.07 ^{NS}
	34 (M)	.33**	.29*	.26*	-.02 ^{NS}	.58**	.45**	.47**	.25 ^{NS}	.47**	.25 ^{NS}	.47**	.25 ^{NS}	.47**	.25 ^{NS}	.47**	.25 ^{NS}
1	29 (F)	.34**	.13 ^{NS}	.37**	.27*	-.01 ^{NS}	-.11 ^{NS}	.09 ^{NS}	-.09 ^{NS}	.09 ^{NS}	-.09 ^{NS}	.09 ^{NS}	-.09 ^{NS}	.09 ^{NS}	-.09 ^{NS}	.09 ^{NS}	-.09 ^{NS}
	30 (M)	.32**	.20 ^{NS}	.26*	.11 ^{NS}	.41**	.34**	.47**	.15 ^{NS}	.47**	.15 ^{NS}	.47**	.15 ^{NS}	.47**	.15 ^{NS}	.47**	.15 ^{NS}
0	26 (F)	.18 ^{NS}	.10 ^{NS}	.34**	.32*	.63**	.61**	.37**	.33**	.37**	.33**	.37**	.33**	.37**	.33**	.37**	.33**
	27 (M)	.41**	.35**	.28*	.21 ^{NS}	.19 ^{NS}	.16 ^{NS}	.43**	.37**	.43**	.37**	.43**	.37**	.43**	.37**	.43**	.37**

Note. M: man, W: woman, * $p < .05$, ** $p < .01$, ^{NS}: non significant, GSE: global self-esteem scale, PSW: physical self-worth, PC: physical condition, SC: sport competence, PS: physical strength, AB: attractive body

Discussion

This second study confirms the validity of the internal structure of the PSI6-b with intra-individual data for the majority of participants. The pattern of correlations and partial correlations are consistent with those obtained in the first study, and support the main hypotheses underlying the hierarchical model of Fox and Corbin (1989) over time. One could note, however, that in this study a proportion of participants present no significant extinguishing of correlation by the partial correlation procedure for one, two, three, or four subdomains. These findings could indicated low hierarchical structure in certain adults. Further studies are needed to showed if the low hierarchical structure is due to sedentary way of life that degrades the relationships between subdomains and PSW, to low importance attributed to certain subdomains particularly with aging or to intra-individual change over time.

Study 3: Analysis of short-term fluctuations in a closed environment

The aim of the third study was to confirm that GSE and physical self dynamics were only related to white noise fluctuations around a defined value over a period of four hours and fifteen minutes in a closed room without exogenous stimulation.

Method

Eleven adults (5 males and 6 females; mean age = 26.8, $SD = 6.0$) completed on a personal computer the PSI6-b every five minutes over four hours and fifteen minutes. The participants

stay in a single room without exogenous solicitation. Each inventory included six items, one for each dimension, presented in random order, and one for the error measure. The individual time series presented 51 observations per dimension.

The ARIMA procedures were applied to determine the underlying iterative functioning of the time series and to infer the subjacent psychological processes (Box & Jenkins, 1976; Spray & Newell, 1986). The first step in fitting an ARIMA model is the determination of the order of differencing needed to stationarize the time series. The determination of the order of differencing depends on autocorrelation function plots that are positive out to a high number of lags. Stationarity obtained from differentiation implies that successive increments of the fitted series do not present increasing or decreasing tendency. Moreover, mean, variance and autocorrelation were constant over time. A stationarized time series is named (0,0,0). This process characterizing weak and random oscillations around a reference value were expected for each perceived dimension over four hours and fifteen minutes in a closed room. The iterative equation of (0,0,0) model is:

$$y_t = \mu + \varepsilon_t$$

where y_t is the value observed at time t , μ represents the mean of the time series and ε_t a random measure error demonstrating a white noise.

Results

The majority of time series (90%) did not present long-trend autocorrelation function and did not need to be differentiated following a first order procedure. This assumes that the original time series are stationary, not only for the error measure item but also for the GSE and the physical self items. The time series reflected white noise with small variability (SD from 0.08 to 0.36). ARIMA models (0,0,0) were reported for 69 of the 77 time series: 11/11 for measure error item, 8/11 for GSE, 9/11 for PSW, 10/11 for physical condition, 10/11 for sport competence, 11/11 for attractive body and 10/11 for physical strength. The other models were moving average with one differentiation and without significant constant (3), and autoregressive with one differentiation and without significant constant (5). Figure 2 shows the dynamics (0,0,0) of GSE, PSW and error measure for one participant.

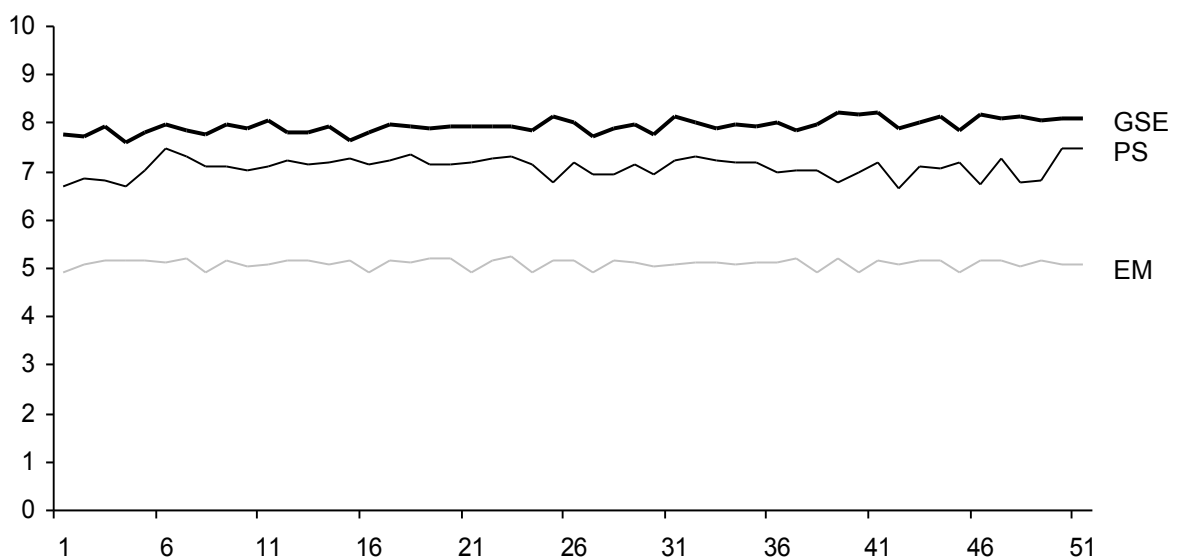


Figure 2: Change in global self-esteem (GSE), physical strength (PS) and error measure (EM) for participant C over a period of 4 hours and 15 minutes

Discussion

The results showed that 90% of auto-evaluative dimensions did not significantly fluctuate over few hours, no more than error measure item. The results suggested that individuals actively resist to change and stay referenced to a local value in a closed environment without exogenous constraints during a short period. Thus, the self perception seems to function linearly according to these particular condition. However, 10% of time series functioning as model with differentiation suggested that certain auto-evaluative dimension present respectively noisy fluctuations around a slowly varying mean and oscillation due to perceived event at t time.

Study 4: Analysis of dynamics of physical self over a period of six months

The aim of the fourth study was to confirm that GSE and physical self dynamics obtained with the PSI6-b over a period of six months were similar with dynamics obtained with the PSI6-a, in other words, the series should be modeled according to a (0,1,1) ARIMA model, without significant constant (Ninot et al., 2001). Such dynamics is based on a short-history reference value that evolves slowly over time.

Method

Eight adults (4 males and 4 females; mean age = 26.8, $SD = 6.0$) completed on a personal computer the PSI6-b twice a day between 7:00 and 9:00 (AM and PM) over a six-month period. The individual time series presented 364 observations per dimension.

The ARIMA procedures were applied to determine the underlying iterative functioning of the time series.

Results

Except error measure item time series that exhibit noisy fluctuation around 5, time series presenting long-trend autocorrelation function have been differentiated following a first order procedure. The first lag of autocorrelation led to a negative value, thus the series did not need further differencing. This assumes that the original series are nonstationary and have a constant average trend. After fitting an ARIMA model with one differentiation, the standard deviation was reduced, indicating that the trend had been completely eliminated. The autocorrelation function displayed a sharp cutoff while the partial autocorrelation function decayed slightly (i.e., had significant spikes at higher lags), thus suggesting an MA signature. MA models (0,1,1) without significant constant were reported in all time series ($p < .001$). Such models obey the following equation:

$y_t = y_{(t-1)} - \theta \epsilon_{(t-1)} + \epsilon_t$ where y_t represent the observation and ϵ_t the error term, at time t . This model characterizes random oscillations around a slowly varying mean value. The Table 6 showed the θ coefficient of MA model. The more the θ coefficient is near to 1, the more the perceived system is conservative. The GSE and physical self measured with the PSI6-b presented the same MA dynamics over a period of six months. Figure 3 shows the dynamics (0,1,1) of GSE, PSW and error measure for one participant.

Table 6: Coefficient value θ of MA model (0,1,1) without significant constant on global self-esteem, physical self-worth and sub-domains in eight adults over a period of six months ($p < .001$)

	GSE	PSW	PC	SC	AB	PS
A(W)	0.66	0.68	0.76	0.52	0.56	0.74
B(W)	0.64	0.62	0.74	0.65	0.51	0.73
C(W)	0.48	0.38	0.34	0.3	0.3	0.19
D(W)	0.85	0.92	0.78	0.9	0.87	0.85
E(M)	0.47	0.55	0.63	0.57	0.43	0.54
F(M)	0.72	0.6	0.52	0.57	0.55	0.56
G(M)	0.39	0.57	0.65	0.55	0.62	0.68
H(M)	0.39	0.38	0.4	0.49	0.39	0.52

Note. M: man, W: woman, GSE: global self-esteem scale, PSW: physical self-worth, PC: physical condition, SC: sport competence, PS: physical strength, AB: attractive body

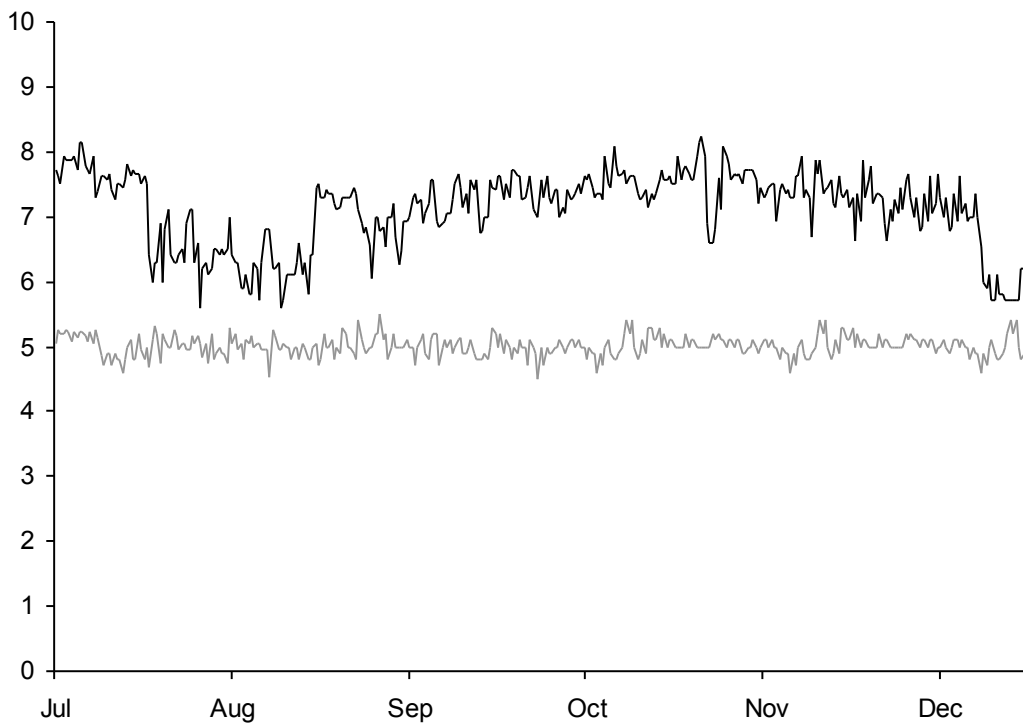


Figure 3: Change in global self-esteem (upper curve) and error measure (lower curve) in participant F(W) over the second semester of 2001 (two measures per day, minimum and maximum scores respectively 0 and 10).

Discussion

The results showed that 100% of moving average without significant constant for all time series of PSI6-b, except for the error measure item. The findings support previous results obtained with the PSI6-a (Ninot et al., 2001). The (0,1,1) ARIMA model, also called simple exponential smoothing model, characterized the time process as non-linear, non-stationary, and with short-history autocorrelation. It indicates that the dynamics of GSE and physical self of one adult confronted by several constraints tends to change in respect with the same

pattern. In details, the first part of the MA (0,1,1) equation ($y_t = y_{(t-1)} \dots$) proposes an adaptive function, as an individual iterative functioning based on historicity over a short period. The second part of the MA (0,1,1) equation is related a preservative function $-\theta\epsilon_{(t-1)}$, corresponding to a fraction of the random shock emerging from the previous auto-evaluation (a sort of correction of previous adaptation), that generates self-esteem maintenance and resistance to incoming information (Markus & Wurf, 1987; Sedikides & Skowronski, 1997; Tesser, 1988). The third part of the MA (0,1,1) equation, $+\epsilon_t$, is a reaction to the random shock of daily events (imperceptible variation or error measure). Thus, the system exhibited noisy fluctuations around a slowly varying mean. The combined effects led to a slow evolution of the local value of the series under the influence of life events. The results thus indicate that a *dynamic adjustment* governs changes in GSE and physical self. This moving average model obtained with the PSI6-b suggests that the dynamics of the time series is based on a local reference value that evolves slowly with time.

Conclusion

The literature recently argues the need of single-item instruments measuring certain psychological dimension (Ninot et al., 2001; Robin et al., 2001; Sandvik et al., 1994). The validation procedure in these instruments was not conventional. Internal consistency test was not conducted because of the specific nature of the inventory. Nevertheless, the results provided acceptable psychometric properties for the internal structure of the PSI6-b, as well as for its construct validity, for its stability over a short period in a closed environment without exogenous constraints (sort of test-retest reliability over time), and for the dynamics over a period of six months.

If the PSI6-b had very high convergent validity with the French version of the PSPP and with the PSI6-a in adults, this study does not indicated that this shortened inventory based on a single item per dimension must replace the long version in all researches context (Robin et al., 2001). The present results provided a practical complement to the PSPP in order to assess daily intra-individual dynamics of the GSE and physical self in adults. Individual differences in such instability and dynamics could be psychologically meaningful (Amorose, 2001; Greenier et al., 1999). Moreover, the PSI6-b could be extremely interesting to explore the causal flow in the hierarchical structure of the physical self which stays largely unknown (Marsh & Yeung, 1998).

References

- Allgood-Merten, B., & Stockard, J. (1991). Sex role identity and self-esteem: A comparison of children and adolescents. *Sex roles*, 25, 129-139.
- Amorose, A. J. (2001). Intra-individual variability of self-evaluations in the physical domain: prevalence, consequences, and antecedents. *Journal of Sport and Exercise Psychology*, 23, 222-244.
- Barge-Schaapveld, D. Q., Nicolson, N. A., Berkhof, J., & de Vries, M. W. (1999). Quality of life in depression: Daily life determinants and variability. *Psychiatry Research*, 88, 173-189.
- Beck, A. T. (1972). *Depression: causes and treatment*. Philadelphia: University of Pennsylvania Press.
- Beck, A. T., & Steer, R. A. (1993). *Beck Depression Inventory: Manual*. San Antonio: Harcourt Brace & Company.

- Beck, A. T., Steer, R. A., & Garbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review*, 8, 77-100.
- Bem, S. (1974) The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology*, 42, 155-162.
- Box, G. E. P., & Jenkins, G. M. (1976) *Time series analysis: Forecasting and control*. Oakland: Holden-Day.
- Brown, J. D. (1998). *The Self*. Boston: McGraw-Hill.
- Byrne, B. M., & Gavin, D. A. W. (1996). The Shavelson model revisited: Testing for the structure of academic self-concept across pre-, early, and late adolescents. *Journal of Educational Psychology*, 88, 215-228.
- Coopersmith, S. (1984). *Inventaire d'estime de soi [Self-esteem inventory]*. Paris: Editions du Centre de Psychologie Appliquée.
- Coopersmith, S. (1967). *The antecedents of self-esteem*. San Francisco: W.H. Freeman.
- Delignières, D., & Matkowski, S. (1997). *Une version courte de l'inventaire des rôles sexuels de Bem [A short version of the Bem Sex-Role Inventory]*. Communication to the VII^e Congrès International des Chercheurs en activités Physiques et Sportives, Marseille, 3-5 Novembre 1997.
- Delignières, D., Marcellini, A., Legros, P., & Brisswalter, J. (1994) Self perception of fitness and personality traits. *Perceptual and Motor Skills*, 78, 843-851.
- Duval, S., & Wicklund, R. A. (1972). *A theory of objective self-awareness*. New York: Academic Press.
- Eysenck, H. J., & Eysenck, S. B. G. (1968). *Manual for the Eysenck Personality Inventory*. San Diego: Educational and Industrial Testing Service.
- Fisher, R. A. (1970). *Statistical methods for research workers*. Englewood Cliffs, NJ: Prentice-Hall.
- Fox, K. H. (1997). *The Physical Self*. Champaign: Human Kinetics.
- Fox, K. H., & Corbin, C. B. (1989). The Physical Self Perception Profile: Development and preliminary validation. *Journal of Sport and Exercise Psychology*, 11, 408-430.
- Fox, K. R. (1990). *The Physical Self Perception Profile manual*. DeKalb, IL: Office for Health Promotion, Northern Illinois University.
- Francis, L. J (1996). The relationship between Rosenberg's construct of self-esteem and Eysenck's two-dimensional model of personality. *Personality and Individual Differences*, 21, 483-488.
- Ganansia, K. (1971). *Inventaire de personnalité d'Eysenck [Eysenck Personality Inventory]*. Paris: Editions du Centre de Psychologie Appliquée.
- Gauthier, J., Morin, C., Theriault, F., & Lawson, J. S. (1982). Adaptation française d'une mesure d'auto-évaluation de l'intensité de dépression [French adaptation of a self-assessment of depression intensity]. *Revue Québécoise de Psychologie*, 3, 13-27.
- Greenier, K. D., Kernis, M. H., McNamara, C. W., Waschull, S. B., Berry, A. J., Herlocker, C. E., & Abend, T. A. (1999). Individual differences in reactivity to daily events: examining the roles of stability and level of self-esteem. *Journal of Personality*, 67, 185-208.

- Guastello, S. J., Johnson, E. A., & Rieke, M. L. (1999). Nonlinear dynamics of motivational flow. *Nonlinear Dynamics, Psychology and Life Sciences*, 3, 259-273.
- Harter, S. (1982). The perceived competence scale for children. *Child Development*, 53, 87-97.
- Harter, S., Bresnick, S., Bouche, H.A., & Whitesell, N.R. (1997). The development of multiple role related selves during adolescence. *Development and Psychopathology*, 9, 835-853.
- Higgins, E. T. (1996). Ideals, thoughts, and regulatory focus: Affect and motivation from distinct pain and pleasure. In P. M. Gollwitzer & J. A. Bargh (Eds.), *The psychology of action: linking cognition and motivation to behavior* (pp. 91-114). New York: Guilford Press.
- Huskisson, E. C. (1974). Measurement of pain. *Lancet*, 2, 1127-1131.
- Jason, L. A., Tryon, W. W., Taylor, R. R., King, C., Frankenberry, E. L., & Jordan K. M. (1999). Monitoring and assessing symptoms of chronic fatigue syndrome: use of time series regression. *Psychological Reports*, 85, 121-130.
- Many, M.A., & Many, W.A. (1975). The relationship between self-esteem and anxiety in grades four through eight. *Educational and Psychological Measurement*, 35, 1017-1021.
- Markus, J. B. (1977). Self-schemata and processing information about the self. *Journal of Personality and Social Psychology*, 35, 63-78.
- Markus, J. B., & Wurf, E. (1987). The dynamic of self-concept: A social psychological perspective. *Annual Review of Psychology*, 38, 299-337.
- Marsh, H.W., & Redmayne, R.S. (1994). A multidimensional physical self-concept and its relation to multiple components of physical fitness. *Journal of Sport and Exercise Psychology*, 16, 43-55.
- Marsh, H.W., & Shavelson, R. (1985). Self-concept: Its multifaceted hierarchical structure. *Educational Psychologist*, 20, 107-123.
- Marx, R.W., & Winne, P.H. (1978). Construct interpretations of three self-concept inventories. *American Educational Research Journal*, 15, 99-108.
- Marsh, H. W., & Yeung, A. S. (1998). Top-down, bottom-up, and horizontal models: the direction of causality in multidimensional, hierarchical self-concept models. *Journal of Personality and Social Psychology*, 75, 509-527.
- Nezlek, J. B., & Plesko, R. M. (2001). Day-to-day relationships among self-concept clarity, self-esteem, daily events, and moods. *Personality and Social Psychology Bulletin*, 27, 201-211.
- Ninot, G., Delignières, D., & Fortes, M. (2000). L'évaluation de l'estime de soi dans le domaine corporel [Self-esteem assessment in the physical domain]. *STAPS*, 51, 35-48.
- Ninot, G., Fortes, M., & Delignières, D. (2001). A psychometric tool for the assessment of the dynamics of the physical self. *European Journal of Applied Psychology*, 51, 205-216.
- Nowak, A., Vallacher, R. R., Tesser, A., & Borkowski, W. (2000). Society of self: the emergence of collective properties in self-structure. *Psychological Review*, 107, 39-61.
- Page, A., Ashford, B., Fox, K. R., & Biddle, S. (1993). Evidence of cross-cultural validity for the Physical Self-Perception Profile. *Personal and Individual Differences*, 14, 585-590.
- Piers, E. (1969). *Manual for the Piers-Harris Children's Self-Concept Scale*. Nashville, TN: Counselor Recordings and Tests.

- Robins, R. W., Hendin, H. M., & Trzesniewski, K. H. (2001). Measuring global self-esteem: construct validation of a single-item measure and the Rosenberg self-esteem scale. *Personality and Social Psychology Bulletin*, 27, 151-161.
- Sandvik, E., Diener, E., & Seidlitz, L. (1993). Subjective well-being: the convergence and stability of self-report and non-self-report measure. *Journal of Personality*, 61, 317-342.
- Sedikides, C., & Skowronski, J. J. (1997). The symbolic self in evolutionary context. *Personality and Social Psychology Review*, 1, 80-102.
- Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Validation of construct interpretations. *Review of Educational Research*, 46, 407-441.
- Sonstroem, R. J., Speliotis, E. D., & Fava, J. L. (1992). Perceived Physical Competence in Adults: An examination of the Physical Perception Profile. *Journal of Sport and Exercise Psychology*, 14, 207-221.
- Spray, J. A., & Newell, K. M. (1986). Times series analysis of motor learning: KR versus no-KR. *Human Movement Science*, 5, 59-74.
- Swann, W. B. (1990). To be adored or to be known? The interplay of self-enhancement and self-verification. In E. T. Higgins & R. M. Sorentino (Eds.), *Handbook on motivation and cognition: Foundations of social behavior* (Vol. 21, pp. 408-448). New York: Guilford Press.
- Whitley, B. E. (1983). Sex-role orientation and self-esteem: A critical meta-analytic review. *Journal of Personality and Social Psychology*, 44, 765-778.