

## A PSYCHOMETRIC TOOL FOR THE ASSESSMENT OF THE DYNAMICS OF THE PHYSICAL SELF

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**Abstract:** The purpose of this study was to validate a new psychometric tool for the assessment of self-esteem in the physical domain, based on the *Physical-Self Inventory* (Ninot, Delignières, and Fortes, 2000), a French adaptation of the *Physical Self-Perception Profile* (Fox and Corbin, 1989). This instrument is composed of six one-item subscales assessing the following six dimensions: general self-esteem, physical self-worth, sports competence, physical condition, attractive body, and physical strength. The rating is performed using a visual analog scale. Seventy-seven subjects responded to a preliminary version and to a battery of four questionnaires. Statistical analyses allowed us to select the six items of the final version, called PSI-6, and confirmed its hierarchical structure. Finally, significant correlations between this new inventory and constructs like masculinity and neuroticism showed its external validity. A confirmatory factor analysis was conducted in the second study to confirm the internal structure of the PSI-6. The specific aim of this shortened version of the *Physical-Self Inventory* is to allow a dynamic assessment of self-concept, with repeated and frequent measures over a relatively long period.

**Key-words:** Self-esteem, physical self, psychometric tool, dynamic approach.

**Résumé:** Le but de cette étude était de valider un nouvel instrument psychométrique destiné à évaluer de manière répétée l'estime de soi dans le domaine physique, d'après l'adaptation française du *Physical Self-Perception Profile* de Fox et Corbin (1989), l'*Inventaire du Soi Physique* (Ninot, Delignières, and Fortes, 2000). Cet instrument est composé de six items évaluant six dimensions, l'estime globale de soi, la valeur physique perçue, la compétence sportive, la condition physique, l'apparence et la force. La mesure s'effectue à partir d'une échelle visuelle analogique. Soixante dix sept sujets ont répondu à une batterie de quatre questionnaires. Les analyses statistiques effectuées ont permis de déterminer les six questions les plus pertinentes et de confirmer la structure hiérarchique de l'instrument nommé ISP-6. Ce premier travail a montré sa validité interne sur la base de corrélations significatives de ce nouvel inventaire avec des construits tels que la masculinité et le névrosisme.

Une analyse confirmatoire a permis de confirmer sa structure interne. Le but de cette version courte de l'Inventaire du Soi Physique n'est pas le remplacer mais de permettre la réalisation de mesures répétées sur des périodes relativement longues.

**Mots-clés:** Estime de soi, soi physique, test psychométrique, approche dynamique

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Over the last 30 years, scientific conceptions about self-esteem have changed markedly (Fox, 1997). Initially, self-esteem was conceived as a unidimensional and very general concept (Coopersmith, 1967; Marx and Winne, 1978; Piers, 1969). More recently, multidimensional models were proposed, which conceived self-esteem as the aggregation of a set of distinct self-assessments, relative to specific domains (Harter, 1982). These models were then enriched by the introduction of hierarchical conceptions (Fox and Corbin, 1989; Marsh and Shavelson, 1985). According to these conceptions (see, for example, Figure 1), self-concepts are organized in a hierarchical manner. The apex of the model represents general self-esteem, the feeling everyone gets about one's own value. The median level is occupied by diverse domains of competence, as proposed in Harter's model (1982), and each domain is then composed of several more specific subdomains.

Our interest in this paper focuses on the physical domain (Fox and Corbin, 1989; Fox, 1992; Marsh and Redmayne, 1994). Fox and Corbin (1989) proposed the concept of physical self-worth, for labeling this domain. Physical self-worth reflects the general feelings of happiness, satisfaction, pride, respect, and confidence in the physical self. According to the authors, physical self-worth should be decomposed into four subdomains: physical condition, sport competence, physical strength, and attractive body. Physical condition represents perceptions 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. Sport competence corresponds to the perceptions of sport and athletic ability, ability to learn sports skills, and confidence in the sports environment. Physical strength is related to

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perceived strength, muscle development, and confidence in situations requiring strength. Finally attractive body corresponds to the perceived attractiveness of the body, the ability to maintain an attractive body and the confidence in appearance.

This model suggests that the apex level is the more general and stable and conversely the lower level is very specific and changeable. The main advantage of these hierarchical models is to support hypotheses concerning their own evolution with time. For example, one could suppose that a high satisfaction in a given physical task reinforces the corresponding subdomain, and then enhances physical self-worth, and

finally general self-esteem. Conversely, a sudden depreciation of general self-esteem will radiate the domains, and especially the physical domain, and determine a decrease of the related subdomains.

Fox and Corbin (1986) enriched their model by the introduction of the perceived importance hypothesis, which proposes that the influence of a given component in the model is related to its subjective importance. Perceived importance can be conceived as a filter which modulates the respective weights of the components of a level.

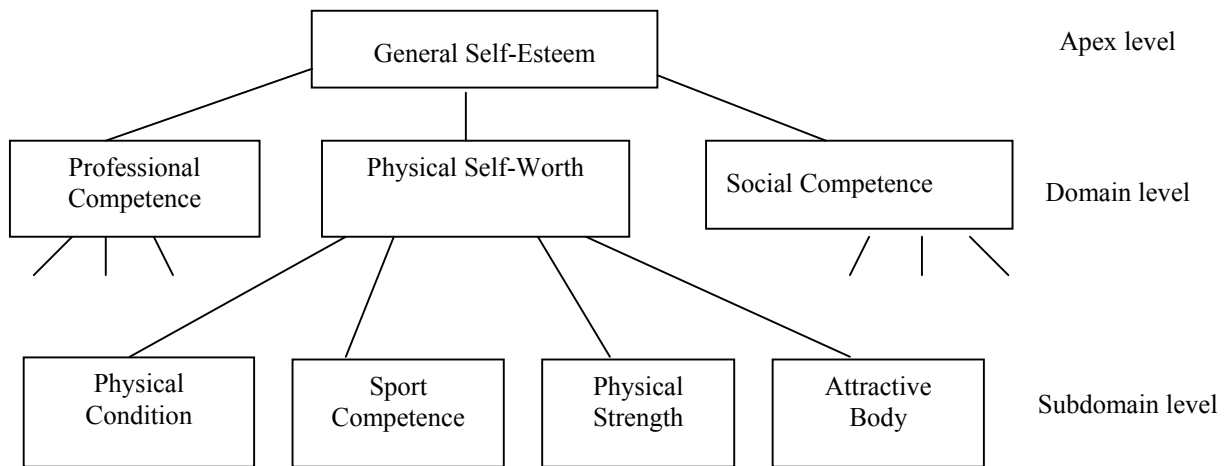


Figure 1: Hierarchical model of self-esteem. The physical domain is particularly developed (adapted from Fox & Corbin, 1989)

As such, these hierarchical models are essentially dynamical models, and allow for a new approach of self-esteem, from a dynamical systems perspective. The aim of the dynamical systems approach is to discover the rules which govern the emergence of order in complex systems. The behavior of the system is conceived, from this point of view, as an emergent property, which arises from the interplay of the many elements included in the system. Recent developments in this approach were proposed in the domain of motor coordination (Kelso, 1995), but also in the domains of social psychology (Vallacher and Novak, 1997) or cognitive psychology (Van Gelder, 1998). In these approaches, the behavior of the system is captured through the time evolution of a collective variable, or *order parameter*. In the domain of self-esteem, the psychological state represents the system under study, and the hierarchical models are good candidates as order parameters to offer a viable description of this state.

Dynamical systems often exhibit spontaneous behaviors, characterized by a high level of stability and reproducibility. This tendency reveals the presence of attractors, or zones of stability in the state space. Several kinds of attractors have been described,

according to the nature of the time evolution of the order parameter. Fixed-point attractors refer to the fact that the order parameter tends to converge towards a given value. Periodic, or limit-cycle attractors, are characterized by the reproducibility of a given trajectory of the order parameter in the state space. Note that this concept of attractor is fairly appropriate to account for psychological traits especially characterized by their relative stability.

The behavior of complex systems is generally analyzed through processes of coupling, defined as the reciprocal influences of the components of the system. For example, Kelso (1995) explained the overall behavior of two hands in a bimanual task by the coupling between the oscillatory motions of the two effectors. Recent examples can be found in the domain of interpersonal relationships, based on the same assumptions (Feichtinger, Jørgensen, and Novak, 1999; Felmlee and Greenberg, 1999; Guastello and Guastello, 1998; Hodges, McGarry, and Franks, 1998). The hierarchical model of Fox and Corbin (1989) could also be conceived as a complex set of coupled components, with a specific combination of direct and indirect couplings. Moreover, the importance hypothesis can be analyzed as a possible modulation of

the strength of the coupling between two given components.

Another central concept in the dynamical systems approach is the *control parameters*, a term applied to nonspecific parameters whose evolution in time provokes a qualitative alteration of the behavior of the system. The hierarchical model of Fox and Corbin (1989) suggests that life events, and their assessment by individuals, constitute good candidates for this role of control parameter.

Some basic hypotheses can be proposed concerning the behavior of such systems. First of all, each component in the model can be considered as a fixed-point attractor, oscillating around a mean value. As suggested by Fox (1997), the apex level is expected to exhibit higher stability, and the subdomain level greater variability. Moreover, periodic behaviors could also be expected from appropriate time series. Such behaviors could reflect seasonal trends, at the time scales of the day, the week, or the year. Another hypothesis concerns the behavior of a component after a small perturbation following a given life event: this component is expected to return to its initial value, after a so-called *relaxation time* which constitutes another measure of the stability of the attractor (Kelso, Ding, and Schöner, 1993). Greater perturbations are expected to produce the stabilization of the system on a new value, a phenomenon called *bifurcation* in the dynamical framework. Such bifurcation should be preceded by *critical fluctuations*; revealed by an increase in the variability of the order parameter. These hypotheses are testable by ways of classical time series analysis, such as the ARIMA procedure introduced by Box and Jenkins (1976).

Another set of hypotheses is related to the relationships between the components in the model. According to the hierarchical theory, a perturbation at a given level of the model is expected to affect the other levels or components. The proximity of components in the model and the relative importance of these components are expected to induce specific effects, such as attenuation, latency, or hysteresis. Here also, time series statistics, and especially cross-correlational analysis, constitute valuable tools for evidencing such phenomena.

The scientific test of such hypotheses requires the collection of time series data for all the components of the model. Some recent experiments were conducted according to this rationale in the domains of motivational flow (Guastello, Johnson, and Rieke, 1999) and quality of life (Barge-Schaapveld, Nicolson, Berkhof, and deVries, 1999). For these experiments, data were collected from an activity log, which was completed at fixed intervals during a complete week. Clearly, the available physical self inventories (Fox and Corbin, 1989; Ninot, Delignières, and Fortes, 2000) were not designed to allow such repeated measurements. If we can try a metaphor, classical

inventories provide good and accurate pictures of psychological states. But a dynamical systems approach requires movies.

The aim of this paper was to construct and validate a specific psychometric tool, for the assessment of the physical self. As our goal was to study the dynamics of the entire hierarchical structure of the physical self, this inventory should include scales corresponding to the three levels previously depicted (general or apex level, domain level, subdomains level). This inventory should allow repeated and frequent measurements, so (a) its completion should be as short as possible, and (b) the response protocol should avoid answer learning phenomena.

The starting point of our work was the *Physical-Self Inventory* (PSI; Ninot *et al.*, 2000). The PSI is composed of six scales: the *General Self-Esteem* scale (GSE, 5 items) was adapted from the French version of the Coopersmith's *Self-Esteem Inventory* (Coopersmith, 1984). The remaining five scales were adapted from the Fox and Corbin's (1989) *Physical Self-Perception Profile*: one scale at the domain level, the *Physical Self-Worth* (5 items), and four at the subdomain level, *Sport Competence* (SC, 4 items), *Physical Condition* (PC, 5 items), *Attractive Body* (AB, 3 items), and *Physical Strength* (PS, 3 items). This inventory possesses a satisfying internal consistency (Cronbach  $\alpha = .77$  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.

Our goal in this paper was to validate a very short version of this inventory, with only one item per scale. Additionally, to avoid any learning effect, the participants were requested to give their answers with a visual analog scale (Huskisson, 1974; see Figure 2). This instrument is a small plastic ruler equipped with a moving cursor. A 10-cm straight line is drawn on the side which is presented to the participant. This line is punctuated at its extremities by two labels: "I completely agree" and "I absolutely disagree". On the other side of the ruler a millimetric graduation allows the conversion of the answer according to a numeric scale (measure of the nearest millimeter).

The validation procedure involved the following steps:

- (a) First, the inventory was constructed by selecting the most appropriate items for each of the six scales. A first group of participants completed the paper-and-pencil version of the PSI, and a preliminary 12-item version of the new inventory, including the two more representative items of each scale. The answers for this second inventory were collected with the visual analog scale. We selected, for each scale, the item which presented the highest correlation with the corresponding scale of the PSI.

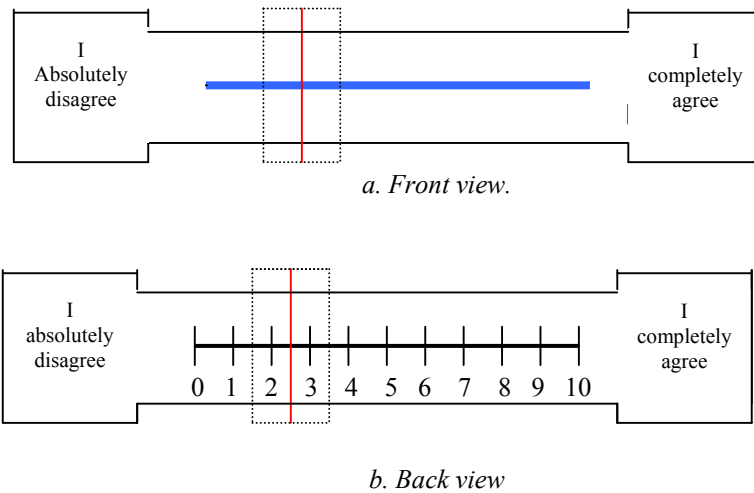


Figure 2: The visual analog scale.

- (b) The internal structure of the final 6-item inventory (PSI-6) was then checked by means of correlation and partial correlation analyses. High intercorrelations were expected between the six scales. Nevertheless, because of the hierarchical structure of the 6-item inventory, partial correlation procedures controlling for the domain level (*physical self-worth*) were expected to extinguish most of the correlations between the apex level and the subdomain level, and between subdomains.

- (c) Then, the construct validity was assessed by studying the relationships of the inventory with other questionnaires measuring self-esteem, neuroticism, and masculinity. Our inventory should correlate with other self-esteem inventories. Additionally, as reported in the literature, significant relationships were expected between the higher levels of our inventory and traits such as neuroticism, and masculinity. Moreover, a specific relationship was expected between sport competence and extroversion, as this latter trait was depicted as a general characteristic of sport involvement (Kirkcaldy and Furnham, 1991).

- (d) Finally, the final version of the 6-item inventory was completed by a larger group of participants and its internal structure was tested by means of a confirmatory analysis.

**Study 1: Construction and Validation of the PSI-6**

This study was designed to complete the first three steps of the validation procedure.

**Method**

Seventy-seven participants (39 males and 38 females; mean age = 24, *SD*= 6.07) volunteered for this study. Each participant completed the preliminary 12-item version of the inventory (Table 1). These 12 items were chosen on the basis of their (high) loadings on their corresponding factors (two items for each factor), in the analysis performed by Ninot *et al.* (2000). The answers were collected individually, in the presence of an experimenter, by use of the visual analog scale. The items were presented orally in the order indicated in Table 1.

N°	Code	Item
1	GSE1	Globally, you have a good opinion of yourself
2	PSW1	You are proud of who you are and what you can do physically
3	PC1	You think you are able to run for a long time without fatigue
4	SC1	You manage well in all the sports
5	AB1	You do not have any problem to put to you in bathing suit in front of the others.
6	PS1	When you come to situations requiring strength, you are among the first to step forward.
7	GSE2	Generally, you would like to remain as you are.
8	PSW2	You are confident in your physical worth
9	PC2	You should be good in an endurance test.
10	SC2	You think you are good in all sports.
11	AB2	You think that you have a body pleasant to look at.
12	PS2	You think that you would be good in a strength test.

Table 1: The preliminary 12-item version of the inventory. GSE: general self-esteem scale, PSW: physical self-worth, PC: physical condition, SC: sport competence, AB: attractive body, and PS: physical strength.

A factor analysis allowed us to select the most representative item for each underlying factor, on the basis of their respective loading. This procedure was realized for each 6-scales.

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.

Then the participants completed four paper-and-pencil inventories:

- The *Physical Self Inventory* (PSI; Ninot *et al.*, 2000), previously described.

- 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 the 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 *Self-Perception Profile* (SPP; Harter, 1985; validation in French by Pierrehumbert, Plancherel, and Jankech-Caretta, 1987). This inventory assesses perceived competence in five domains (social, physical, appearance, behavior, and general self-worth).

## Results

The correlation coefficients between the 12 items of the preliminary version and the corresponding scales of the PSI are shown in Table 2. As expected, all of these coefficients were significant. On the basis of these results, we selected for the final version of the inventory (called *PSI-6*) items 1 for *general self-esteem*, *physical self-worth*, *sport competence* and *physical strength*, and items 2 for *physical condition* and *attractive body*.

As can be seen in Table 3, the four subdomain items were significantly intercorrelated, and each subdomain item presented a significant correlation with physical self-worth. The subdomain items were not correlated with general self-esteem, except for attractive body. Finally, physical self-worth was, as expected, significantly related to general self-esteem.

The correlation between general self-esteem and attractive body was clearly extinguished following a partial correlation procedure controlling for physical self-worth (Table 3). Moreover, when controlling for PSW, the inter-subdomains correlations were no more significant, excepted for the correlation between physical condition and attractive body. These results

were in agreement with the postulated hierarchical structure of the inventory.

PSI	Items 1	Items 2
GSE	.682***	.248*
PSW	.574***	.525***
PC	.853***	.880***
SC	.772***	.682***
AB	.428***	.526***
PS	.691***	.662***

(\*\*\* :  $p < .001$ ; \*\* :  $p < 0.01$ ; \* :  $p < .05$ )

Table 2: Correlations between the 12 items of the preliminary version and the corresponding scales of the PSI. GSE: general self-esteem scale, PSW: physical self-worth, PC: physical condition, SC: sport competence, AB: attractive body, and PS: physical strength.

The relationships between the items of the PSI-6 and the other inventories are shown in Table 4. As expected, significant coefficients were obtained between the neuroticism scale of the EPI, and most items of PSI-6. The highest correlation was for GSE, and two subdomain items were not significantly correlated with neuroticism. On the other hand, there was no relation between the items of the PSI-6 and Eysenck's Extroversion scale, except the SC item.

The observed relationships between the items of the PSI-6 and the masculinity and femininity subscales of the BSRI were in general consistent with our hypotheses: masculinity was correlated with all the PSI-6 items, excepted PS, and no correlation was observed with femininity, except for SC.

Finally, we obtained significant correlations between the domain and subdomains items of the PSI-6 and the Physical subscale of the SPP. The correlations with the other subscales of the SPP were not significant, except between Behavior and GSE.

## Discussion

The correlational analysis allowed us to select the six items of the final version of the PSI-6: GSE1, PSW1, PC1, PS1, SC2 and AB2 (see table 1 or details in the text).

The internal validity of this version is satisfactory as it reproduces the hierarchical structure of the model of Fox and Corbin (1989). The coefficients of correlation 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 correlations.

	GSE	PSW	PC	SC	AB	PS
GSE	1.000					
PSW	.395***	1.000				
PC	.162 <sup>NS</sup>	.489***	1.000			
SC	.103 <sup>NS</sup>	.475***	.425***	1.000		
AB	.364***	.624***	.504***	.381***	1.000	
PS	.031 <sup>NS</sup>	.288**	.318**	.319***	.300**	1.000
GSE	1.000					
PC	-.038 <sup>NS</sup>	-				
SC	-.104 <sup>NS</sup>	-	.250*			
AB	-.164 <sup>NS</sup>	-	.292**	.123 <sup>NS</sup>		
PS	-.094 <sup>NS</sup>	-	.212 <sup>NS</sup>	.216 <sup>NS</sup>	.161 <sup>NS</sup>	

(\*\*\* :  $p < .001$  ; \*\* :  $p < .01$  ; \* :  $p < .05$  ; <sup>NS</sup> : non significant)

Table 3: Matrices of correlation (upper panel) and partial correlation controlling PSW (lower panel) among the items of the PSI-6.

		GSE	PSW	PC	SC	AB	PS
EPI	Neuroticism	-.448***	-.268*	-.266**	-.073 <sup>NS</sup>	-.285***	-.141 <sup>NS</sup>
	Extroversion	.154 <sup>NS</sup>	.112 <sup>NS</sup>	.131 <sup>NS</sup>	.374***	.086 <sup>NS</sup>	.040 <sup>NS</sup>
BSRI	Masculinity	.305***	.263*	.319***	.237*	.322***	.115 <sup>NS</sup>
	Femininity	-.075 <sup>NS</sup>	-.032 <sup>NS</sup>	.042 <sup>NS</sup>	-.245*	-.101 <sup>NS</sup>	.035 <sup>NS</sup>
SPP	Social	-.088 <sup>NS</sup>	.037 <sup>NS</sup>	.018 <sup>NS</sup>	-.157 <sup>NS</sup>	.117 <sup>NS</sup>	-.029 <sup>NS</sup>
	Physical	.058 <sup>NS</sup>	.492***	.498***	.537***	.419***	.402***
	Appearance	.163 <sup>NS</sup>	.023 <sup>NS</sup>	.111 <sup>NS</sup>	.074 <sup>NS</sup>	.148 <sup>NS</sup>	.134 <sup>NS</sup>
	Behavior	.237*	.141 <sup>NS</sup>	.148 <sup>NS</sup>	.096 <sup>NS</sup>	.062 <sup>NS</sup>	.034 <sup>NS</sup>
	GSW	.115 <sup>NS</sup>	.085 <sup>NS</sup>	.061 <sup>NS</sup>	-.05 <sup>NS</sup>	.027 <sup>NS</sup>	.166 <sup>NS</sup>

(\*\*\* :  $p < .001$  ; \*\* :  $p < .01$  ; \* :  $p < .05$  ; <sup>NS</sup> : non significant)

Table 4: Correlations between the items of the PSI-6 and the others inventories.

Concerning the external validity of the PSI-6, the present results confirm most of our hypotheses. Despite the use of only one item for each subscale, the relationships obtained between the PSI-6 and the other inventories were identical to those described during the validation of the original version of the PSI (Ninot *et al.*, 2000). The relation between neuroticism and the highest levels of the PSI-6 (GSE and PSW) was clearly expected: in most experiments general self-esteem appeared closely (and negatively) related to measurements of anxiety or neuroticism (Delignières, Marcellini, Legros and Brisswalter, 1994; Francis, 1996, 1997; Many and Many, 1975). 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.

As we hypothesized, there was a significant relationship between the SC item and extroversion. The

relation between sport involvement and extroversion was frequently described, and especially concerning competitive and high-risk sports (Kirkcaldy and Furnham, 1991; see also Zuckerman, 1983). One could suppose that SC is generally higher for sport practitioners than for sedentary people. Then a significant relation between SC and extroversion was not surprising. Such a hypothesis was difficult to sustain at the apex level: the results reported in the literature concerning the relationships between general self-esteem and extroversion are rather inconsistent (Abrams, 1988; Francis, 1996; 1997; Spanos and Moretti, 1988), and a theoretical link between the two constructs appears less easy to establish.

The positive relationship between masculinity and general self-esteem was also expected: the most recent theorizations about masculinity highlighted its close links with self-confidence, self-efficacy, and self-

esteem (Allgood-Merten and Stockard, 1991; Delignières *et al.*, 1994; Whitley, 1983; 1984).

The pattern of correlations obtained with the SPP confirms the specificity of the physical domain, in the self-concept structure: the PSW item and the subdomain items present significant and exclusive relationships with the physical subscale of the SPP. The absence of relation between the GSE item and the general self-worth subscale of the SPP is more surprising.

### Study 2: Confirmatory analysis

The aim of this second study was to conduct a multidimensional confirmatory factor analysis to assess the overall validity of the measurement model. We used in this study a larger sample, to satisfy the methodological requirements of this kind of analysis.

### Method

One hundred and forty-nine participants (85 males and 64 females; mean age = 24.3,  $SD = 5.6$ ) completed the PSI-6. This assessment was performed individually, in the presence of an experimenter. Answers were given using the visual analog scale previously presented. Inter-item correlations, as well as inter-item partial correlations controlling for PSW were computed, to confirm the results obtained in the first study. Then the program LISREL 8 (Joreskog and Sorbom, 1993) was used to test whether the covariance structure generated from the PSI-6 measurement model adequately fit the data. This program used the Unweighted Least Squares (ULS) discrepancy function to estimate parameters specified in the model, to determine errors of measurement in the observed variables and to test the goodness of fit of the whole model. The measurement model tested was the hierarchical organization proposed by Fox and Corbin (1989), presented in Figure 1.

	GSE	PSW	PC	SC	AB	PS
GSE	1.000					
PSW	.433***	1.000				
PC	.053 <sup>NS</sup>	.265***	1.000			
SC	.178*	.367***	.367***	1.000		
AB	.390***	.527***	.377***	.398***	1.000	
PS	.021 <sup>NS</sup>	.101 <sup>NS</sup>	.154 <sup>NS</sup>	.313***	.298***	1.000
GSE	1.000					
PC	-.071 <sup>NS</sup>	-	1.000			
SC	.022 <sup>NS</sup>	-	-.237*	1.000		
AB	.211*	-	.226*	.127 <sup>NS</sup>	1.000	
PS	-.025 <sup>NS</sup>	-	-.003 <sup>NS</sup>	.237*	.213*	1.000

(\*\*\* :  $p < .001$  ; \*\* :  $p < .01$  ; \* :  $p < .05$  ; <sup>NS</sup> : non significant)

Table 5: Matrices of correlation (upper panel) and partial correlation controlling for PSW (lower panel) among the items of the PSI-6.

### Results

The matrices of correlations and partial correlations controlling for PSW are reported in Table 5. These correlations appear quite similar to those obtained in the first study, with (a) high correlations between adjacent items in the model (b) low correlations between GSE and the subdomain items, and (c) a global decrease of the coefficients following the partial correlation procedure.

The results of the confirmatory factor analysis are satisfactory. The Chi-square is not significant ( $Chi^2 = 4.029$ ,  $dll = 4$ ,  $p = 0.402$ ), and the ratio  $Chi^2/dll$  (1.007) is less than 2. The goodness of fit indexes are above .9 ( $GFI = .982$ ,  $AGFI = .904$ ), suggesting a global adequacy of the model (Cuttance, 1987). The Root

Mean Square Error of Approximation ( $RMSEA$ ) is equal to .007, below the .05 value suggested by Browne and Cudeck (1993) as an acceptable criterion for a close fit. All path coefficients are significant at  $p < .01$ . These results, therefore, support the factorial structure of the PSI-6.

Note that results concerning the alternative model, in which the Attractive Body subscale constituted a specific domain, appear acceptable as well. The chi-square is not significant ( $Chi^2 = 2.11$ ,  $dll = 4$ ,  $p = .716$ ) and the ratio  $Chi^2/dll = (.527)$  is less than 2. The goodness of fit indexes are close to the results obtained for the first model ( $GFI = .984$ ,  $AGFI = .916$ ) and  $RMSEA$  is equal to zero.

Discussion

This second study confirms the validity of the internal structure of the PSI-6. 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). One could note, however, that in this study the AB item presents a strong correlation with the GSE item, which was not totally extinguished by the partial correlation procedure. This was not the case in the first study, but a similar result was obtained by Ninot *et al.* (2000) during the validation of the 25-item version of the PSI. On the basis of their data, the authors proposed an alternative model, in which the Attractive Body subscale constituted a specific domain, and not a subdomain of the Physical domain. Note that such a hypothesis was consistent with the model

proposed by Harter (1982), who distinguished a Physical domain and an Appearance domain. Nevertheless a confirmatory factor analysis did not allow Ninot *et al.* (2000) to choose between the two models, which were equally fitted by the data.

The confirmatory factor analysis, in the present study, provided a satisfactory support to Fox and Corbin's model, and the Lisrel program based on covariance matrix (table 6) did not suggest any transformation indices, and especially a direct path between General Self-Esteem and Attractive Body. Nevertheless, we cannot reject the alternative model, which appeared also correctly fitted by the data. The status of the Appearance subscale, as domain or subdomain, remains unclear. Further investigations are needed to definitely clarify this issue.

	PSW	PC	SC	AB	PS	GSE
PSW	5.085					
PC	024	11.497				
SC	521	3.784	9.267			
AB	870	3.089	2.926	5.830		
PSF	0.729	1.672	3.050	2.229	10.218	
GSE	2.041	0.375	1.131	1.967	0.139	4.363

Table 6: Covariance matrix of observed variables

Conclusion

The validation procedure we used in this paper was not conventional. Traditional tests, such as internal consistency, or test-retest reliability, were not conducted because of the specific nature of the inventory (one-item subscales) and its supposed inherent variability. Nevertheless, we provided reasonable support for the internal structure of the PSI-6, as well as for its construct validity.

But a more critical test for the PSI-6 will be the evaluation of its capability to provide consistent and useful time series data in longitudinal designs. Just as an example, Figure 3 shows three time series obtained with the PSI-6, with a patient with a physical disability involved in a rehabilitation program in a hospital.

The analysis of these time series offers fruitful insights about the dynamics of the self-concepts. An ARIMA procedure (Box and Jenkins, 1976) shows that a differenced first-order moving average model, without a constant, is the best fit for all these series. This kind of model can be written as:

$$y_t = y_{t-1} - \theta \varepsilon_{t-1} + \varepsilon_t$$

where  $y_t$  is the response at day  $t$ ,  $\varepsilon_t$  is the random disturbance at day  $t$ , and  $\theta$  ( $<1$ ) is the moving average coefficient ( $\theta = .483$  for GSE;  $\theta = .432$  for PSW;  $\theta = .486$  for PC). This model (also called *simple*

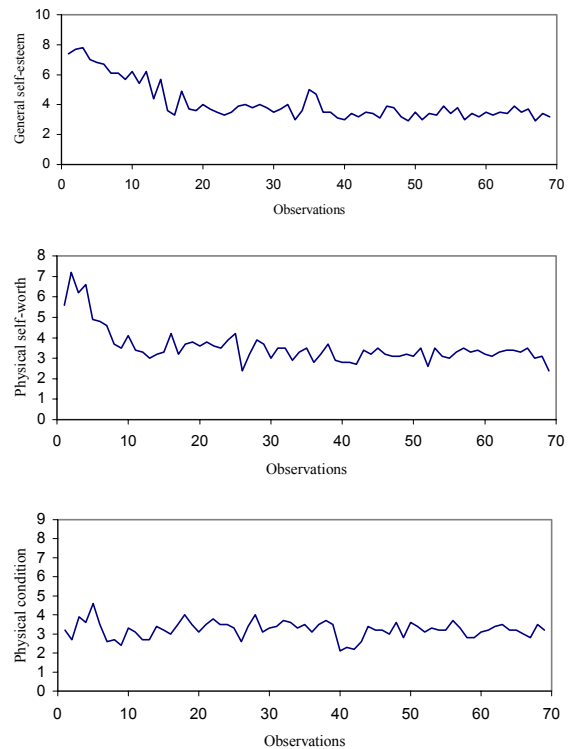


Figure 3: Individual times series of the General Self-Esteem, Physical Self-Worth, and Physical Condition items of the PSI-6.

*exponential smoothing model*) is typical of times series that exhibit noisy fluctuations around a slowly varying mean.

The main implication of these results is that these time series are not stationary. In other words, they cannot be considered as white noise fluctuations around a stable value, as for example a personality trait. Further analyses are needed to discover the true nature of the time evolution of such series, and also the dynamics of the relationships between the diverse elements of the model. This short example suggests, nevertheless, that the PSI-6 allows for repeated measurements, without biases such as learning effects. It opens new avenues for the study of the physical self, from a dynamical point of view.

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