*Edward Nęcka**

Self-Control Scale AS-36: Construction and validation study

Abstract: *This paper presents a validation study of a new questionnaire of self-control as an individual trait. The questionnaire has two parallel versions, one based on self-reports (AS-36) and another one based on informant reports (AS-36-3). Each version consists of three subscales, called Inhibition (12 items), Switching (12 items), and Goal Monitoring (12 items). Eight samples of participants (N = 935 altogether) took part in the validation study. Both versions obtained satisfactory indices of internal consistency, assessed with Cronbach's alpha and split-half coefficients. Self-control assessed with this scale proved to be entirely independent of general intelligence. However, AS-36 and AS-36-3 scores tended to correlate with other self-report measures of trait self control, such as Tangney, Baumeister, and Boone's (2004) self-control scale. We conclude that AS-36 is a valid and reliable tool, suitable for assessment of self-control in both research and diagnostic settings.*

Key words*: ....*

Introduction

The essence of self-control

Self-control is the ability of people to control their own behaviour in relative autonomy from external pressures, from their innate or learned automatisms, and physiological impulses (Baumeister & Tierney, 2011; Krug & Carter, 2010; Muraven & Baumeister, 2000). It manifests itself, for instance, in the ability to refrain from unnecessary or harmful responses, in the ability to postpone gratification, in skilful regulation of emotions, as well as in attentive treatment of other people and behavioural adjustment to a social context.

Self-control does not work spontaneously and effortlessly. On the contrary, getting out of the automatic mode of behaviour requires work, understood literally as the consumption of available energy resources (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Gailliot *et al.*, 2007). Therefore, exercising self-control is tiresome, sometimes leading to total exhaustion of resources and unintended falling back into the mode of automatic control of behaviour.

The automatic control mode is not in itself reprehensible or harmful. We entrust many of our everyday activities to our "autopilot", which uses previously learned patterns of behaviour, habits or reflexes. In this way, we perform many routine actions, sometimes quite complex, but still standard and repetitive. Thanks to this autopilot system we can save valuable energy resources of the organism and allocate them to non-standard operations, requiring an intensive focus of attention and engagement of executive functions. We pay for the privilege of attentive carrying out of non-conventional actions by a sort of "mindlessness" of standard actions. This can lead to problems only when, for instance, we try to implement conventional solutions in some new or non-typical conditions, or when standard conditions change into non-standard ones. In such cases it is required to turn on the self-control system immediately, and get out of the automatic control mode.

The level of self-control is not equal in all people. It is also not fixed in an individual, but constantly fluctuates. It seems that self-control can be regarded, on the one hand, as a permanent trait, and, on the other hand, as a temporary state. The distinction between a state and a trait is nothing new in psychology. It seems that it corresponds very well to reality, e.g., in the case of anxiety (Spielberger, Gorsuch, Lushen, Vagg, & Jacobs, 1983) or depression (Clark, Vittengl, Kraft, & Jarrett, 2003). Of course, self-control as a trait is permanent only in a relative sense, because it is developing, is being shaped in ontogenesis, and – perhaps – can be trained (Muraven, Baumeister,

---

* **Jagiellonian University, Institute of Psychology**

& Tice, 1999). However, such changes occur in the long term, as do modifications of other individual characteristics (intelligence, personality, temperament). In contrast, self-control as a state seems to be subject to short-term fluctuations, depending on situational and social context, or the psychophysical state of the organism. This paper presents a method of measuring self-control as a relatively permanent individual trait, varying between individuals.

This trait reveals itself on three levels of organisation which require separate research perspectives. The top floor of the analysis refers to *behavioural control*, or personal self-control (Chuderski, 2010). At this level, self-control is directly observable in behaviour. The self-control is exercised by the whole agent, and particular cognitive and executive functions (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000) – such as inhibition, switching between tasks, and updating the contents of working memory – are "at the service" of self-control attributed to the whole agent. This lower *cognitive level of self-control* cannot be directly observed. One can only develop behavioural indicators of occurrence, progression, and effectiveness or ineffectiveness of these control functions. The control functions performed at the cognitive level are essential for effective self-control by the whole agent; they constitute the mental substrate of this control. The lowest floor of the analysis refers to *self-control in the brain*, that is, the neural substrate of the executive functions of the mind. Cognitive processes are carried out by the brain, thus there one should look for correlates or mechanisms of self-control, both in the case when it is effective, and when it is dysfunctional.

Understanding the essence of self-control requires research at all three levels of analysis, because they complement one another. The first step of such research should, however, consist of developing valid and reliable tools for examining personal (behavioural) self-control, especially in its relatively permanent form, i.e., regarded as an individual trait. When we know how to measure the individual level of self-control as a personal trait, we can ask how it is exerted at the two other levels, cognitive and neuronal. Therefore, there is a need to develop tools for measuring self-control. This paper presents the results of research on such a tool, which has been called the AS-36 questionnaire.

A theoretical model of self-control

The questionnaire was designed on the basis of a theoretical model of self-control, which draws on two assumptions. First, we can distinguish two types of self-control: reactive and proactive. Reactive self-control is one's ability to adjust one's own behaviour to external requirements, especially to prohibitions. The best example of this type of self-control is inhibition of undesirable responses, which manifests itself in resisting temptations or refraining from making unpleasant remarks to people. In this case, we speak colloquially about self-restraint, prudence or temperance. In contrast, proactive self-control is one's ability to set oneself goals and achieve them in spite of obstacles and restrictions. In this case, we speak colloquially about perseverance, consistency in action, and far-sightedness.

Second, self-control requires reconciling many diverse behavioural tendencies, which correspond to the goals pursued by the person, and these goals, in turn, correspond to the person's needs. Striving to satisfy our needs, and simultaneously complying with prohibitions, orders and expectations in the environment, we must constantly organize our activities in the temporal dimension (i.e., in time), and also in the hierarchic dimension. The temporal order is related to the urgency of our needs and their corresponding goals, whereas the hierarchic order is related to their importance. Reconciling one system with the other can be difficult, as in the case when someone pursues primarily urgent goals, ignoring their important goals, or vice versa. Effective self-control requires careful creation and application of a "timetable" for activities (*contention scheduling*, Norman and Shallice, 1986), because neither the temporal nor the hierarchic order forms itself spontaneously. The elementary manifestation of human ability to create and apply an order within one's own actions is task switching (e.g., Arrington & Logan, 2005). Dysfunctions of task switching cause perseveration, i.e., persistent carrying out of activities which previously were proper, but are currently inadequate because of a significant change of circumstances. A manifestation of rigidity, complementary to perseveration, is *learned irrelevance* (see, e.g., Słabosz *et al*., 2006), consisting in the inability to reuse a rule which previously turned out to be useless, but now again requires applying. Perseveration and learned inadequacy can be observed in intensified form in patients with disorders of control functions (e.g., Sandson & Albert, 1984), although in lesser intensity they can also be seen in healthy and able individuals.

The proposed theoretical model suggests that in the measurement of self-control it is necessary to capture at least three different abilities. The first comes down to setting and pursuing long-term goals, along with corresponding actions. This would be a manifestation of proactive self-control, oriented to future results, and requiring independent planning and sticking to previously set goals. The second is the ability to switch from one action to another, chosen from a number of available options. The creation of a logical "timetable" of many parallel actions of various importance and time requirements is an extremely complex cognitive function, and any dysfunctions in this area result in a low level of flexibility and persistent sticking to patterns of behaviour which are inadequate in current situation. The third ability consists of resisting the influence of external and internal distractors. In order to be able to efficiently work towards long-term goals, one has to be able to resist temptations and impulses to pursue alternative or even competitive goals. This ability may be called inhibition and it may apply both to one's own behaviour (inhibiting a dominant response) and to external events (ignoring distractions). These three fundamental control abilities were taken into account during the construction of the AS-36 questionnaire.

Measurement of self-control

At this point, we need to ask a question about the sense of creating a self-report tool for examining self-control, when psychologists have at their disposal many experimental tasks, such as those used by Miyake and his team (Miyake *et al.*, 2000), as well as by other researchers (e.g., Chuderski, Taraday, Nęcka & Smoleń, 2012). It seems that we can identify four reasons justifying the decision to create a new tool.

First, computerized experimental tasks have never been intended for use in psychometric research on individual differences, that is, they were not designed as tests. Their use as tests presents methodological problems, mainly associated with low external validity of these tools. A typical cognitive task should have primarily theoretical validity, which is needed for the study of basic cognitive processes. For example, the flanker task (Eriksen & Eriksen, 1974) was designed to examine the process of coping with attention distractors, depending on the number of distractors, their nature, and spatial distance from the target stimulus. The flanker task is very well suited for this purpose because of its high theoretical validity, that is, its concordance with the construct. However, its use as a diagnostic or psychometric tool raises questions about its external validity, that is, if on its basis we can predict global features of behaviour.

Second, examining individual differences in the area of executive functions makes sense only to the extent that it allows us to better understand personal self-control (i.e., manifested at the level of individual behaviour). If we could predict the level of personal self-control on the basis of performance of tasks engaging executive functions, the self-control could be tested exclusively at the cognitive level, using an appropriately selected battery of tasks. But the problem is that the relationship between personal self-control and cognitive self-control may be insignificant (see Nęcka *et al.*, 2012). One important meta-analytical study (Duckworth & Kern, 2011) showed that the intercorrelations among various measures of self-control were rather weak, particularly if executive functions tasks are concerned. So, it seems questionable whether computerized cognitive tasks measuring the level of development of the so-called executive functions, e.g., the Stroop task (1935), the flankers task (Eriksen & Eriksen, 1974), or the antisaccade task (O'Driscoll *et al.*, 1995; Orylska & Racicka, 2014), give us an insight into the level of development of personal self-control, visible at the level of individual behaviour.

Third, computerized cognitive tasks are time consuming and technically demanding. Conducting tests with the use of a reasonable battery of such tools must last at least an hour, or even longer in the case of elderly people. In the latter case, there is also the problem of lower capability to use computer equipment. What is needed is a tool, which would be easy and quick to use, suitable for screening of large samples.

Fourth, computerized cognitive tasks examine self-control at the cognitive level, whereas the self-control processes occur also at two other levels of analysis: those of the brain and behaviour. At the moment, the neuronal level is not really interesting to us, but the behavioural dimension of cognitive self-control is something that should be well measured, but not always is.

A behavioural indicator of self-control is, for example, the marshmallow test (Mischel, 1974; Mischel, Shoda, & Rodriguez, 1989). Children at the age of around four years were given candy (a marshmallow) as a reward, with the explanation that if they wait for the return of an adult before they consume it, they will get a second marshmallow. Here, an indicator of self-control is the duration of reward delay – the longer the delay, the better the self-control. An analogous indicator of self-control in adults is the declared ability to postpone reward, e.g., financial gratification (Ostaszewski, Bąbel & Swebodziński, 2013; Rachlin, 2000). In studies of this type, the participants are to decide, for example, if they prefer a smaller sum right away, or a greater sum after some time, and the experimenters vary the size of the sums and the duration of delay. Quasi-experimental measures of behavioural self-control, especially the marshmallow test, have gained popularity and recognition, sometimes showing amazing capabilities to predict various aspects of success in life (Berman *et al.*, 2013; Mischel, Shoda, & Peake, 1988; Moffitt *et al.*, 2011). However, one can have doubts about the reliability of measuring self-control as a trait on the basis of a single exposure to temptation. Besides, such "tests" are limited to one aspect of self-control, which is undoubtedly important, but does not determine everything, namely, the ability to postpone gratification. Constructing a new tool, we were guided by the need to have a short and easy to use screening method, able to capture various aspects of the studied phenomenon. On this basis of this method, people could be qualified to tests with the use of more specialized tools.

The construction of the scale

The construction of the scale proceeded in several stages. At the beginning, a team of people created *starting material* in the form of more than 250 items. Their content referred to various aspects of self-control, such as:
– refraining from inadequate behaviour,
– suppressing "undesirable" thoughts,
– switching between tasks and actions,
– coping with at least two tasks performed simultaneously,
– remembering one's own obligations, dates, and deadlines,
– remembering one's own plans and intentions.

In the second stage, the starting material was analysed in terms of its content and language form. Identical or very similar items were removed, grammar forms were revised, linguistic errors were corrected, and items that were too long or too complicated (e.g., with double negatives) were eliminated. This work was done by one person. As a result, we obtained 200 items suitable for further research.

In the third stage, an *initial questionnaire* with 200 items was created on the basis of previously selected and corrected items. The tool was called the "Self-knowledge

Sheet" (*Arkusz samowiedzy*, AS) in order to mask the true purpose of the study. The questionnaire was provided with the following instruction: "Please indicate how much you agree or disagree with each statement below. Mark your answer in the box on the left side of each statement. If you cannot decide, enter 0". Below this instruction, there was a scale ranging from -3 (Strongly disagree), through -2 (Disagree), -1 (Somewhat disagree), 0 (Don't know), +1 (Somewhat agree), +2 (Agree), up to +3 (Strongly agree). Below the scale, there were 200 questionnaire items, each in a separate horizontal frame. On the left side of each item, there was a small box for the answer.

In the fourth stage, the initial questionnaire was used in *empirical research* which aimed to select the best items, establish their final list, and also establish the factor structure of the questionnaire. For this purpose, we examined several samples of participants, with a total number of 1,054 participants. These were students representing various fields of study, except for psychology; employees of several international companies operating in Poland; elderly residents of a care centre, without any diagnosed mental disorders; and people recruited through social media. The age of the participants ranged between 18 and 75, with a near normal distribution (M=40.03, SD=13.71; 44% female, 56% male). The participants completed the questionnaire in groups (students, employees of companies), or individually (care centre residents, people recruited through social media). The elderly people had the questionnaire items read to them, if they asked for it. The duration of completing the questionnaire ranged from 30 to 60 minutes.

In the next stage of the research, we conducted an *exploratory factor analysis*, aiming at reducing the number of items and identifying several factors. At this point, we did not specify the number of factors, and we did not apply rotation. We used the method of principal components. As a result of these analyses, we isolated 45 items with eigenvalues exceeding 1.00. The scree graph suggested separation of three factors. Accordingly, we did the factor analysis again, but this time with the imposed number of three factors and Varimax orthogonal rotation (with Kaiser normalization) in order to maximize the variation in factors and to minimize common variation of two or three factors. As a criterion for assigning items to the factors, we assumed factor loading with a value greater than +0.40, or less than -0.40. Moreover, we excluded items which were highly loading more than one factor. As a result, we obtained three factors with 15 items in each of them.

The content analysis of items loading individual factors led to the following *theoretical interpretation*:

1. **H-factor** (*Hamowanie*, i.e., Inhibition)
The H-factor represents our ability to refrain from actions which could have inadequate or even harmful consequences. It refers to verbal and non-verbal responses associated with social life or with achieving personal goals. It also refers to the ability to control one's own emotions. Moreover, the H-factor represents the ability to postpone gratification and satisfaction, that is, the ability to resist impulses and temptations.

Typical questionnaire items highly loading this factor include:
"I usually don't buy anything on impulse", or
"When I'm excited, I say things that I later regret" (inverted scale).

2. **P-factor** (*Przełączanie*, i.e., Switching).
The P-factor represents the ability to change the course of action or to switch from one activity to another. Such a change can be forced by external circumstances (an exogenous change), or can be volitional (an endogenous change). People who are not able to switch from one task to another present themselves as cognitively rigid, and not flexible in their behaviour. A low level of this dimension can also manifest itself in perseveration, that is, in constant repetition of actions which are long out of date or not properly adjusted to the context.

Typical questionnaire items related to this factor include:
"I can use someone else's vehicle or equipment (e.g., telephone) without any problems" or
"When something interrupts my work, I need several minutes to focus on my job again" (inverted scale).

3. **M-factor** (*Monitorowanie*, i.e., Goal Monitoring, Goal Maintenance).
This factor refers to the so-called prospective control, which is future-oriented. Goal Monitoring consists of remembering one's own intentions and objectives, meeting deadlines and obligations, and also in realistic planning and controlling the implementation of plans. People who receive low scores on this subscale are characterized by a poor ability to cope with obligations and deadlines. They also have problems with prospective memory about their own intentions and objectives.

Examples of the questionnaire items highly loading this factor include:
"I always meet a fixed deadline" or
"Sometimes I don't know what I wanted to do or say a moment earlier" (inverted scale).

This version of the scale was used in several empirical studies. In an unpublished study involving a sample of 191 people (including 83 women) aged from 20 to 80 (median=46), the three factors obtained satisfactory reliability measured by Cronbach's alpha coefficient. The alpha values were as follows: 0.87 (H-factor), 0.81 (P-factor), and 0.84 (M-factor). The reliability of the whole questionnaire obtained an alpha value = 0.89. The indicators were satisfactory, therefore this version of the questionnaire was used in the study aimed at determining whether self-reports correspond to objective measures of cognitive control (Nęcka *et al*., 2012). The answer to this question proved to be negative. Participants in that study completed the questionnaire and performed three computerized tasks engaging cognitive control. No significant correlations between objective measures and self-description were found. This result can be interpreted as a lack of proof of the questionnaire's validity, or –

alternatively – as evidence that cognitive tasks are not useful as psychometric tests.

The results of the unpublished study involving 191 participants also suggested that all three scales of the questionnaire could be reduced to 12 items without significant decrease in reliability. Accordingly, the number of items in the questionnaire was reduced, and we obtained the final version of the tool, consisting of 36 items, 12 on each of three dimensions. This version of the scale was named AS-36 (*Arkusz samowiedzy*, Self-knowledge Sheet, 36 items). In this form, the scale was used in the validation and standardization studies described[1].

Standardization and validation studies

Participants

The final 36-items Self-Control Scale, called AS-36 (*Arkusz samowiedzy*, Self-knowledge Sheet, 36 items), was used in the studies aiming to determine its reliability and validity, as well as the norms allowing interpretation of single results. In these studies, a total of N=935 participants voluntarily took part; their age ranged between 18 and 66 (M=27.68; SD=7.85); and they included 606 women and 329 men. Only 392 participants disclosed their level of education; in this group one person had elementary education, 172 participants (44%) had secondary education, and 219 participants (56%) had higher education. All the participants belonged to one of the following samples:

1. People recruited through social media and websites for job seekers (N=34). These people were receiving net payment of 50 PLN for 2–2.5 hours of work which consisted in completing psychological questionnaires and performing a cognitive task in the fMRI scanner. The AS-36 scale was being completed at the very beginning of the procedure.
2. A sample analogous to the preceding one, separately recruited (N=32).
3. A sample analogous to the preceding two samples, separately recruited (N=29).
4. People recruited through advertisements and social media (N=102). These people were receiving net payment of 100 PLN for participation in two sessions. They were completing tests and questionnaires, and participated in research with the use of magnetic resonance imaging (fMRI). The AS-36 scale was being completed at the first session, before the resonance study.
5. Employees from several branches of an international bank operating in Poland (N=90), recruited during an off-site training. The participants did not receive any financial compensation.
6. Students participating in the study on functioning in close relationships (N=243), recruited through the Institute of Psychology system of recruiting participants; they did not receive any financial compensation.
7. People recruited through social media networking and an Internet portal for job seekers (N=145). These participants received net payments of 20 or 30 PLN for completing a battery of questionnaires and tests, which included the AS-36 scale.
8. People (N=260) recruited through the portal SurveyMonkey, which allows for remote data collection via the Internet. These participants did not receive any payment, and they completed only the AS-36 scale.

Reliability analysis

Reliability analysis was performed on all the data collected from 935 participants. Additionally, we examined whether particular samples differed in reliability. We used Cronbach's alpha index and split-half reliability indices (See Table 1). Cronbach's index in relation to the overall score had the value a=0.797, whereas in relation to particular subscales it had the following values: H Scale, a=0.623; P scale, a=0.742; M Scale, a=0.777. Therefore, we can say that the examined tool shows a good level of internal consistency in the case of the overall score and the dimensions of switching and goal monitoring. The inhibition dimension obtained less satisfactory, but still acceptable estimate of internal consistency. Also, the split-half reliability analysis revealed a generally high level of internal consistency of the examined tool. Moreover, the analysis of particular questionnaire items did not reveal even a single item which would significantly decrease the reliability of both the overall score and the three particular dimensions.

Table 1. Reliability analysis of the AS-36 scale and its three subscales (N = 935)

	Ca	S-B	G
AS-36	0.797	0.803	0.803
Subscale H	0.623	0.657	0.656
Subscale P	0.742	0.771	0.770
Subscale M	0.777	0.713	0.713

Explanations:
Ca   the Cronbach alpha coefficient
S-B the Spearman-Brown split-half reliability coefficient
G   the Guttman split-half reliability coefficient
H   Inhibition
P   Switching
M   Goal monitoring

Since Cronbach's alpha is heavily dependent on the length of scales, we decided to supplement the reliability indices with mean interitem correlations, which are good estimations of content saturation of scales (John & Benet-Martinez, 2000). The mean interitem correlations were as follows: .31, .41, and .48, respectively for the H, P, and M subscales.

---

[1] The scale can be obtained from the author for academic purposes.

Validity analysis

The convergent validity of the scale AS-36 was assessed through the correlation analysis of the results obtained with its use with the score in the self-control scale developed in the laboratory of Roy Baumeister (Tangney, Baumeister, & Boone, 2004). Moreover, for comparison purposes, we used the conscientiousness scale from the NEO-FFI questionnaire, because the nature of this personality trait is close to self-control as a trait. The tests on a sample of 145 participants (the sample no. 7) showed a strong covariance of the overall score in the scale AS-36 with the results in Baumeister's scale (r=0.71, p<0.001), and almost as strong a correlation with the conscientiousness scale (r=0.63, p<0.001). Therefore, it can be concluded that the scale AS-36 allows measurement of self-control in a manner similar to other tools used for this purpose. At the same time, some interesting differences between the subscales emerged (see Table 2).

The divergent validity was assessed through the correlation analysis of the results in the scale AS-36 with the scores in intelligence tests and in the scales of other – beside conscientiousness – personality traits. The tests on a sample of 102 participants (the sample no. 4) showed a lack of significant correlations of the overall score in the scale AS-36 with the results in the advanced version of Raven's test (r=0.08, p=0.59), and also with the results in Chuderski's Figural Analogies Test (r=-0.06, p=0.58). In the same sample, we also observed a significant negative correlation (r=-46, p=0.002) between the overall score in the scale AS-36 with the trait anxiety measured by the STAI questionnaire (Spielberger *et al.*, 1983). Moreover, in the sample no. 7, we found no significant correlation between the overall score in the scale AS-36 with the results in the advanced version of Raven's test (r=0.04, p=0.64) and Choynowski's (1967) Words Knowledge Test (r=0.11, p=0.18). In the same sample, we also found a negative correlation with neuroticism (r=-0.47, p<0.001). Therefore, it can be concluded that the scale AS-36 does not show any correlations with the fluid intelligence, nor with the crystallized intelligence, whereas it shows a reverse covariance with personality dimensions associated with anxiety and emotional instability (see Table 2).

Descriptive statistics and correlation analyses

Table 3 shows basic descriptive statistics in relation to the overall score and to particular subscales. We see a sufficiently large variation of results, demonstrated by a large difference between the minimum and maximum scores and by the value of standard deviation in relation to the mean, minimum and maximum. These observations rule out a ceiling effect, or a floor effect, and justify the use of the scale AS-36 as a tool for measuring inter-individual differences. Some concern may be caused by a left-sided asymmetry in the distribution, manifested by the negative index of skewness, especially in the scales of Switching and Goal Monitoring. The Inhibition scale, and especially the overall score, showed a much better fit to the normal distribution. Left-skewness of the distribution of the P and

Table 2. Results of the validity analysis of the scale AS-36

	AS-36 H	AS-36 P	AS-36 M	AS-36
Convergent validity (N = 145)				
S-S	.65***	.18*	.68**	.71***
C	.38**	.22*	.70**	.63***
Divergent validity (N = 102)				
RAPM	-.07	.28*	-.01	.08
TAO	.08	-.08	-.10	-.06
TZS	.16	.03	.02	.09
N	-.34**	-.34**	-.33**	-.48**
STAI	-.38*	-.26	-.36*	-.46**

Explanations:

S-S   Self-Control Scale (Tangney, Baumeister & Boone, 2004)
C   Conscientiousness (NEO-FFI)
RAPM   Raven's Advanced Progressive Matrices
TAO   Figural Analogies Test (*Test Analogii Obrazkowych*)
TZS   Words Knowledge Test (*Test Znajomości Słów*) (Choynowski, 1967)
N   Neuroticism
STAI   Trait anxiety
H   Inhibition
P   Switching
M   Goal monitoring
* p < 0.05 (two-tailed), ** p < 0.01 (two-tailed), *** p < 0.001 (two-tailed)

M scales indicates that there is a slight overrepresentation of scores above the mean, which may result from the fact that the participants overestimate themselves, or from the fact that in the case of these two subscales the questionnaire items referred to relatively simple, everyday situations, in which majority of healthy people are doing well or very well. Another problem is a slight deviation from the normal distribution in the form of kurtosis: the results in all the subscales, and particularly in the overall scale, show a leptokurtic distribution, that is, the tendency of participants to aggregate around the average values, rather than at the extremes. It should be expected that the application of the scale AS-36 in a study involving people who are less efficient or belong to vulnerable groups (e.g., drug addicts) would weaken the leptokurtic character of the distribution.

Table 4 shows the results of correlation analyses. We see that the scales of Inhibition and Switching are not mutually correlated, whereas the scale of Goal Monitoring is significantly, although not strongly, correlated with the other two. The overall score is correlated with all three subscales, which is obvious, considering that it is their sum. Nevertheless, it is worth noting that the Goal Monitoring scale is most strongly correlated with the overall score, whereas the Switching scale is least correlated. Correlation

analyses suggest that in some cases – besides the overall score – it is worth analysing the results in particular subscales, because they can give us important information about diverse development of particular dimensions of personal self-control.

Third-person version

Assuming that people may not have sufficient insight into their own traits (Vazire, 2010), and therefore they may have difficulties in giving reliable answers about themselves, we made an attempt to construct a third-person version of the self-control scale. It was created as a mutation of the first-person version, through replacing grammatical forms of the questionnaire items (cf. Ball *et al*., 1997). The purpose of this operation was to develop a tool which could complement self-reports by peer-reports, or reports made by other persons. Of course, this requires involvement of people who know the proper participant well. This can be a colleague, a family member, a friend or a close friend, or just a spouse (or a partner). Whereas in the case of self-reports, there is a problem whether the self-knowledge of a participant is sufficiently wide and adequate, in the case of a third-person description there is an additional question concerning a possible bias in

Table 3. Descriptive statistics of the scale AS-36 (N = 935)

	Min	Max	Mean	SD	Skewness	Kurtosis
AS-36 H	-27	31	4.07	8.42	-0.17	0.21
AS-36 P	-24	36	13.96	9.21	-0.38	0.17
AS-36 M	-31	33	9.31	10.41	-0.49	0.25
AS-36 Total	-60	94	27.34	19.95	-0.17	0.66

Explanations:
H   Inhibition
P   Switching
M   Goal monitoring
Min Minimum
Max Maximum
SD   Standard deviation

Table 4. Correlation matrix of the scale AS-36 (N = 935)

	AS-36 H	AS-36 P	AS-36 M	AS-36 Total	Age
AS-36 H	–	.08	.43**	.67**	.23**
AS-36 P	–	–	.27**	.62**	-.14*
AS-36 M	–	–	–	.81**	.19**
AS-36 Total	–	–	–	–	.13*

Explanations:
H Inhibition
P Switching
M Goal monitoring
*   p < 0.05 (two-tailed)
** p < 0.01 (two-tailed)

responses. It seems that, despite these concerns, the scale in the third-person version, called AS-36-3, can be a valuable complement of data obtained from self-reports (see Vazire, 2006). It can also be used in the studies on consistency of the two scores.

Data were obtained from a total number of 726 people who had earlier been taken into account in the validation studies of the first-person version. Whenever there were two sources of external information about the participants, we also performed analyses concerning the level of correlation between two independent third-person descriptions.

Reliability analysis

The reliability of the full scale AS-36-3, assessed by Cronbach's alpha index is a=0.778. No item significantly increased the a index after its exclusion, which means that no item significantly decreased the reliability of the scale. In particular subscales, the reliability was as follows: H scale (Inhibition), a=0.647; P scale (Switching), a=0.741; M scale (Goal Monitoring), a=0.790. Also, in the case of the subscales, we did not find any questionnaire item significantly decreasing their reliability. As to the content saturation measures, the mean interitem correlations were .33, .41, and .49, respectively for the H, P, and M subscales.

Descriptive statistics and correlation analyses

Table 5 shows basic descriptive statistics of the scale AS-36-3. We can see similar tendencies as in the first-person version, perhaps with a little weaker indicators of the results range. Nevertheless, there are undoubtedly reasons to consider the scale AS-36-3 as a tool sufficiently good to examine individual differences. Again, we see a left-skewness of the distribution in the case of P and M scales, but the leptokurtic character of distributions disappeared. This may mean that in the third-person assessment the trait of self-control is distributed in a manner more resembling the normal distribution, whereas in self-reports participants avoid giving extreme answers. The important thing is that that the distribution of results in the overall scale does not differ significantly from the normal distribution (K-S=0.20, insignificant).

Table 6 shows correlations between the three subscales and the overall score in the scale AS-36-3. These correlations do not differ significantly from those found in the first-person version. The Switching scale reveals rather weak correlations with the other scales, and the Goal Monitoring scale – relatively the strongest correlations. The latter is also most strongly correlated with the overall score.

In the case of 530 people, we obtained self-reports (AS-36) and the data from a friend (AS-36-3). The third-person version was completed by someone who had

Table 5. Descriptive statistics of the scale AS-36-3 (N = 726)

	Min	Max	Mean	SD	Skewness	Kurtosis
AS-36-3 H	-22	29	2.28	8.88	-0.11	-0.18
AS-36-3 P	-16	36	11.50	9.47	-0.30	-0.20
AS-36-3 M	-30	35	9.03	10.75	-0.47	0.09
AS-36-3 Total	-52	76	22.81	19.81	-0.26	0.02

Explanations:
H   Inhibition
P   Switching
M   Goal monitoring
Min Minimum
Max Maximum
SD   Standard deviation

Table 6. Correlation matrix of the scale AS-36-3 (N = 726)

	AS-36-3 H	AS-36-3 P	AS-36-3 M	AS-36-3 Total
AS-36-3 H	–	.03	.37**	.67**
AS-36-3 P	–	–	.11*	.56**
AS-36-3 M	–	–	–	.77**

Explanations:
H Inhibition
P Switching
M Goal monitoring
*   p < 0.05 (two-tailed)
** p < 0.01 (two-tailed)

known the participant for at least six months, had lived with the participant, or had collaborated with him or her every day. In the case 197 people, we collected self-reports and the data obtained independently from two friends of the participant. Therefore, it was possible to examine the correlations between a self-report and two independent descriptions in the third-person version. In the last column in Table 7, we see the relationships between independent assessments of two friends, completing the AS-36-3 questionnaire on the participant. Concordance of the assessments can be considered, at most, moderate, as the correlation coefficients are in the range from r=+0.35 to r=+0.51. The assessments are most strongly correlated for the Goal Monitoring scale, and least strongly – for the Switching scale. Overall scores obtained from two friends correlate with each other at the level of r=+0.38. This result is weaker than that which was obtained in the studies on neuroticism (r=0.63, Ball *et al.*, 1997), but in those studies the third-person results were obtained from people who had known the proper participants for over 11 years. In the remaining fields of Table 7, we see the correlation coefficients between self-reports (AS-36) and the third-person description (AS-36-3), separately for the first (1), and the second (2) friend. These coefficients should be regarded as low, except for the Goal Monitoring scale, where they have average values. For comparison, Ball and his colleagues (Ball *et al.*, 1997) report correlation coefficients between self-reports and third-person descriptions at the level of r=0.55. Thus, we can say that self-reported self-control has a weak correlation with self-control assessed by other people, which suggests that both versions should be used for thorough examination. The results of both versions can be interpreted separately, or

can be compiled in some way, using an averaged index or creating a latent variable obtained on the basis of all the data. Not very high indices of concordance between third-person description are a cause of concern, but they do not necessarily reflect badly on the tool itself – perhaps they just indicate that we do not have a good knowledge of other people, when it comes to assessment of their important individual traits.

Summary

Scale AS-36, presented in this paper, seems to be a sufficiently good tool to evaluate individual level of self-control understood as a trait. The obtained reliability indices are satisfactory, especially in the case of the overall score. The analysis of individual subscales should be performed with due caution, as the reliability of one of the subscales – the Inhibition – oscillates between 0.60 and 0.70, which is not a good result, although acceptable. Scale AS-36 also shows good indicators of divergent and convergent validity. As to stability, relevant investigations of the test-retest correlations are still to be done.

An important component of the proposed tool is a third-person mutation called AS-36-3, which was constructed by changing grammatical forms of the questionnaire items from the first person singular to the third person. This version is intended to allow evaluation of the level of self-control by informants who know the proper participant. In scientific research, this is intended to make evaluations more objective by getting out from the circle of self-report methods, which prevail in the study of personality. Whereas in applied studies and psychological practice, the AS-36-3 version is intended

Table 7. Correlations between the first-person version (AS-36) and the third-person version (AS-36-3) (N = 197)

		AS-36 H	AS-36 P	AS-36 M	AS-36	AS-36-3 (2)
AS-36-3 H	(1)	.16*				.39**
AS-36-3 P	(1)		.30**			.35**
AS-36-3 M	(1)			.37**		.51**
AS-36-3	(1)				.20**	.38**
AS-36-3 H	(2)	.19*				
AS-36-3 P	(2)		.24**			
AS-36-3 M	(2)			.46**		
AS-36-3	(2)				.28*	

Explanations:
AS-36   the first-person version
AS-36-3 (1) the third-person version, first friend
AS-36-3 (2) the third-person version, second friend
H   Inhibition
P   Switching
M   Goal monitoring
*   p < 0.05 (two-tailed)
**   p < 0.01 (two-tailed)

to facilitate gaining information about the level of self-control in people who have limited self-knowledge, or who do not have sufficiently strong motivation to disclose their traits. This can be important in clinical examinations in the case of people who manifest general or specific (e.g., related to addictions) deficits in self-control. However, such applications of the AS-36 scale and its third person mutation require further research on the external validity of the tool.

References

Arrington, C.M. & Logan, G.D. (2005). Voluntary task switching: Chasing the elusive homunculus. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31*, 683–702.

Ball, D., Hill, L., Freeman, B., Eley, T.C., Strelau, J., Riemann, R., Spinath, F.M., Angleitner, A., & Plomin, R. (1997). The serotonin transporter gene and peer-rated neuroticism. *NeuroReport, 8*, 1301–1304.

Baumeister, R.F., Bratslavsky, E., Muraven, M., & Tice, D.M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74*, 1252–1265.

Baumeister, R.F. & Tierney, J. (2011). *Willpower: Rediscovering the greatest human strength*. New York. Penguin Books. Polish edition: *Siła woli*. Poznań: Media Rodzina.

Berman, M.G., Yourganov, G., Askren, M.K., Ayduk, O., Casey, B.J., Gotlib, I.H., Kross, E., McIntosh, A.R., Strother, S., Wilson, N.L., Zayas, V., Mischel, W., Shoda, Y., & Jonides, J. (2013). Dimensionality of brain networks linked to life-long individual differences in self-control. *Nature Communications, 4*, 1–7.

Choynowski, M. (1967). *Test znajomości słów.* [The Words Knowledge Test] Warszawa: Pracownia Psychometryczna PAN.

Chuderski, A. (2010). Samokontrola: własności, funkcje, mechanizmy i ograniczenia. [Self-control: properties, functions, mechanisms, and limits]. *Studia z Kognitywistyki i Filozofii Umysłu, 4*, 27–51.

Chuderski, A., Taraday, M., Nęcka, E., & Smoleń, T. (2012). Storage capacity explains fluid intelligence but executive control does not. *Intelligence, 40*, 278–295.

Clark, L.A., Vittengl, J., Kraft, D., & Jarrett, R.B. (2003). Separate personality traits from states to predict depression. *Journal of Personality Disorders, 17*, 152–172.

Duckworth, A.L., & Kern, M.L. (2011). A meta-analysis of the content validity of self-control measures. *Journal of Research in Personality, 45(3)*, 259–268.

Eriksen, B.A., & Eriksen, C.W. (1974). Effects of noise letters upon the identification of a target letter in a nonsearch task. *Perception and Psychophysics, 16*, 143–149.

Gailliot, M.T., Baumeister, R.F., DeWall, C.N., Maner, J.K., Plant, E.A., Tice, D.M., Brewer, L.E. & Schmeichel, B.J. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology, 92*, 325–336.

John, O.P., & Benet-Martínez, V. (2000). Measurement: reliability, construct validation, and scale construction. In H.T. Reis and C.M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (p. 339–369). New York: Cambridge University Press.

Krug, M.K., Carter, C.S. (2011). Anterior Cingulate Cortex contributions to cognitive and emotional processing: A general purpose mechanism for cognitive control and self-control. In R.R. Hassin, K.N. Ochsner & Y. Trope (Eds.), *Self-control in society, mind, and brain* (pp. 3–26). Oxford, UK: Oxford University Press.

Mischel, W. (1974). Processes in delay of gratification. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 7, pp. 249–292). New York: Academic Press.

Mischel, W., Shoda, Y., & Peake, P. (1988). The nature of adolescent competencies predicted by preschool delay of gratification. *Journal of Personality and Social Psychology, 54*, 687–696.

Mischel, W., Shoda, Y., & Rodriguez, M.L. (1989). Delay of gratification in children. *Science, 244*, 933–938.

Miyake, A., Friedman, N.P., Emerson, M.J., Witzki, A.H., & Howerter, A. (2000). The unity and diversity of executive functions and their contribution to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49–100.

Moffitt, T.E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R.J., Harrington, H., Houts, R., Poulton, R., Roberts, B.W., Ross, S., Sears, M.R., Thomson, W.M., & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *PNAS, 108*, 2693–2698.

Muraven, M., & Baumeister, R.F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126*, 247–259.

Muraven, M., Baumeister, R.F., & Tice, D.M. (1999). Longitudinal improvement of self-regulation through practice: Building self-control through repeated exercise. *Journal of Social Psychology, 139*, 446–457.

Norman, D.A. & Shallice, T. (1986). Attention to action: Willed and automatic control of behavior. W: R. J. Davidson, G. E. Schwartz, & D. Shapiro (red.), *Consciousness and self-regulation. Advances in research and theory* (pp. 1–18). New-York: Plenum Press.

O"Driscoll, G.A., Alpert, N.M., Matthysse, S.W., Levy, D.L., Rauch, S.L., & Holzman, P. S. (1995). Functional neuroanatomy of antisaccade eye movements investigated with positron emission tomography. *Proceeding of the National Academy of Sciences of the USA, 92*, 925–929.

Orylska, A. & Racicka, E. (2014). Zastosowania badań okulograficznych w diagnozowaniu ADHD u dzieci w wieku przedszkolnym i wczesnoszkolnym. [Applications of eye-tracking research in diagnosing ADHD in preschool and early school children] *Studia Psychologiczne, 52*(2), 5–17.

Ostaszewski, P., Bąbel, P., & Swebodziński, B. (2013). Physical and cognitive effort discounting of hypothetical monetary rewards. *Japanese Psychological Research, 55*, 329–337.

Psychological Assessment Resources. (2003). *Computerised Wisconsin Card Sort Task Version 4 (WCST)*.

Rachlin, H. (2000). *The science of self-control*. Cambridge, MA: Harvard University Press.

Sandson, J. & Albert, M.L. (1984). Varietes of perseveration. *Neuropsychologia, 22*, 715–732.

Słabosz, A., Lewis, S.J., Śmigasiewicz, K., Szymura, B., Barker, R.A., & Owen, A. M. (2006). The role of learned irrelevance in attentional set-shifting impairments in Parkinson's disease. *Neuropsychology, 20*, 578–588.

Spielberger, C.D., Gorsuch, R.L., Lushene, R., Vagg, P.R., & Jacobs, G.A. (1983). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Stroop, J.R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18,* 643–662.

Tangney, J.P., Baumeister, R.F., & Boone, A.L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*(2), 271–322.

Vazire, S. (2006). Informant reports: A cheap, fast, and easy method for personality assessment. *Journal of Research in Personality*, *40*, 472–481.

Vazire, S. (2010). Who knows what about a person? The self-other knowledge asymmetry (SOKA) model. *Journal of Personality and Social Psychology*, *98*, 281–300.