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Short communication

Ego depletion, attentional control, and decision making in sport

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ABSTRACT

Objectives: Athletes differ at staying focused on performance and avoiding distraction. Drawing on the strength model of self-control we investigated whether athletes do not only differ inter-individually in their disposition of staying focused and avoiding distraction but also intra-individually in their situational availability of focused attention.
Design/method: In the present experiment we hypothesized that basketball players ($N = 40$) who have sufficient self-control resources will perform relatively better on a computer based decision making task under distraction conditions compared to a group who's self-control resources have been depleted in a prior task requiring self-control.
Results: The results are in line with the strength model of self-control by demonstrating that an athlete's capability to focus attention relies on the situational availability of self-control strength.
Conclusions: The current results indicate that having sufficient self-control strength in interference rich sport settings is likely to be beneficial for decision making.

Athletes need to stay focused on performance while blocking out irrelevant distraction in sport, for example when taking the decisive free throw in basketball when a flashlight goes off or when making a tactical decision while the opposing audience is calling an apparent rule violation. Recent research has indicated that athletes differ at staying focused and avoiding distraction in the aforementioned situations (Furley & Memmert, 2012). In addition, a further line of research (Schmeichel & Baumeister, 2010) suggests that athletes might not only differ inter-individually in their disposition of staying focused and avoiding distraction but also intra-individually: which means that the same athlete might differ in his/her situational availability of focused attention.

Pertinent to such theorizing, converging evidence demonstrates that focusing attention in interference rich environments is dependent on the availability of sufficient self-control resources. A variety of studies have shown that self-control resources have a limited capacity and get depleted when used and are therefore no longer available for subsequent task performance that requires effortful attention (Baumeister, Vohs, & Tice, 2007 for a review). Therefore, Baumeister et al. (2007) have proposed the strength model of self-control. In a nutshell the theory uses the metaphor of a muscle to explain how self-control resources get depleted when used over an extended period of time, and finally results in a state which has been termed ego-depletion. While the model has previously been successfully applied to exercise and health-related behaviors (Hagger, Wood, Stiff, & Chatzisarantis, 2009, 2010a) there is currently a lack of understanding on self-control and ego-depletion in sport performance, and particularly, in sport decision making.

Of relevance to the present study, Vohs et al. (2008) demonstrated that making demanding decisions in complex environments also draws on the limited pool of domain-general self-control resources. Given that Vohs et al. (2008) were able to show that complex decision making depleted self-control resources that were no longer available in subsequent tasks requiring effortful attention, we assumed that in turn decision making in sports should also suffer when self-control has been depleted by a previous attention-demanding task, due to the domain-general nature of the self-control capacity pool proposed by Baumeister et al. (2007).

Efficient decision making is of decisive importance in team sports. This is for example evident in the fact that one of the most important predictors of losses in basketball is bad decision making leading to turnovers (Ibáñez et al., 2008) – especially in close games (Lorenzo, Gómez, Ortega, Ibáñez, & Sampaio, 2010). Thus, it is important to investigate the situational variables that might

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contribute to decision making impairments in sport. Hence, we test the prediction derived from the strength model of self control in a computer based decision making task that has previously been shown to require controlled attention (Furley & Memmert, 2012). Specifically, we hypothesized that basketball players who have sufficient self-control resources (non-depletion group) will perform relatively better on a computer based decision making task under distraction conditions compared to a group (ego-depletion group) of basketball players who's self-control resources have been depleted in an unrelated prior task requiring self-control.

Method

Participants

Forty basketball players (20 male and 20 female; $M = 22.85$; $SD = 3.6$) with an average of 9 years of playing experience at an amateur to semi-professional level took part in the study. Neither gender nor age significantly influenced the pattern of results. The study was carried out in accordance with the Helsinki Declaration of 1975.

Materials and stimuli

Decision making task under distraction conditions

We used the same decision making task as in Furley and Memmert (2012) displaying stills from televised basketball games. Every picture involved a player holding the ball with various tactical decision options. Two basketball experts had concordantly rated the most appropriated decision for the respective stills utilized in the task (Furley & Memmert, 2012). The player holding the ball was marked with a bold yellow arrow so that participants could identify the ball-holder immediately. Altogether 116 basketball stills were depicted in random order for the decision making task. Participants had to make their tactical decisions by pressing a corresponding key on the keyboard: the “c” button to *shoot*; the “n” button to *cut/dribble*; and the “space” bar to *pass* the ball. Participants were instructed to respond as quickly and accurately as possible in the three-alternative-forced-choice decision task as successful sport decision making can be described as a balance between situation appropriate and quick decisions (Furley & Memmert, 2013). Every basketball stimulus was presented for 1000 ms and preceded by a 750 ms fixation cross. Responses were collected during the actual stimulus presentation and during the following fixation period. The stimulus presentation did not terminate after the response was given and thus the presentation duration was always identical.

During the tactical decision making task a distracting auditory message was presented to the participants through stereo headphones at a constant volume. The distracting auditory stream contained 240 words that were transformed by software into two different monotonous digital voices (a female and a male voice) available from the AT&T Research website (http://www2.research.att.com/~ttsweb/tts/demo.php) at a rate of 75 words per minute and lasted during the entire tactical decision making task. The onset of the distracting auditory stream started simultaneously with the tactical decision making task. Further, we placed 20 different animal names such as bee, carp, or camel (cf. Ninio & Kahneman, 1974) in the distracting auditory message in order to explore group differences in animal name recall as a function of ego-depletion. After half of the task the digital voice changed either from male to female or from female to male in a counterbalanced order.

Procedure and measures

Subjects were tested individually in a quiet laboratory and randomly assigned to the experimental groups. Subsequent to signing the consent sheet and a questionnaire gathering demographic data, participants were informed that they were going to perform a computer based study investigating tactical decision making skills in basketball under distraction conditions. The instructions for the task were presented on a 15 inch computer screen. E-prime professional (Version 2.0; Psychological software, 2007) was used to present the stimuli and collect the responses on a 15 inch computer screen placed approximately 60 cm away from the subjects.

Experimental manipulation

For the experimental manipulation we adapted a task from Englert and Bertrams (2012): We informed participants that they had to retype a neutral text displayed on the computer screen as quickly and as accurately as possible into a dialog field on the screen. The purpose of this task was disguised as controlling for motor reaction time in the computer based decision making task. Both groups had to transcribe the exact same text with the slight difference that participants in the ego-depletion group ($N = 20$) were asked to always omit the letters “e” and “n” – the two most frequent letters in German texts – when transcribing the text. Whereas, participants in the non-depletion group ($N = 20$) did not get any specific instructions on how to copy the text. This manipulation has proven to require different amounts of self-control (Englert & Bertrams, 2012) as participants have to suppress their usual typing habit in the ego-depletion condition. Previous research (Hagger, Wood, Stiff, & Chatzisarantis, 2010b) on the self-control strength model has demonstrated comparable carry-over impairments when the depletion task and the performance task were in the same domain ($d = 0.59$, e.g., both cognitive tasks) or if they were from different domains ($d = 0.63$, e.g., one cognitive and one behavioral task). Therefore, according to the strength model of self-control, this sport unspecific task should be sufficient to induce sport decision making impairments.

Manipulation check and control measures

In order to verify that the two transcribing conditions required different levels of self-control strength we administered three digital differential scales (based on established manipulation checks in the self-control literature, see Hagger et al., 2010b) ranging from the poles “not at all” to “very much so”: “How effortful did you find the typing task?”, “How difficult did you find the typing task?”, and “How much did you have to suppress your regular typing routine during the typing task?”. To further control for group differences in typing skills participants had to rate their typing skills on a digitalized scale ranging from “not at all good” to “very good”.

Finally, we attempted to rule out two alternative explanations on how the experimental manipulation might influence subsequent decision making as it seems feasible that the different transcription instructions had an effect on self-efficacy, or on experienced affect of the participants. Therefore, participants had to rate two items assessing self-efficacy ranging from “not at all” to “very much”: “How successful do you think you performed in the transcription task?” and “How confident are you in performing well on the subsequent task”. To control for differences in experienced affect subsequent to the transcription task we administered a digitalized version of the Positive and Negative Affect questionnaire (PANAS; Watson, Clark, & Tellegen, 1988). One subscale measured momentary positive affect (10 items; $\alpha = .82$ was satisfactory and comparable to previous research) and the other subscale measured momentary negative affect (10 items; $\alpha = .82$ was satisfactory and comparable to previous research). Participants rated every item (e.g., "active" or "worried") on digitalized scales that were presented as 5-point Likert scales from 1 (not at all) to 5 (extremely).

In order to give their ratings on all of the scales, participants had to move a mouse cursor from the middle of the scale towards either end of the scale and provided their rating by clicking the left mouse button. The E-prime software transformed the ratings into a value (with 2 decimals) between 0 reflecting the left end of the scale and 1 reflecting the right end of the scale. The utilized scales were continuous, ranging from 0.00 to 1.00 and were visually presented either as 11 points (manipulation check and control measures) or 5 points (PANAS) in order to assist participants in providing a clear indication of their ratings.

Decision making task procedure

To familiarize themselves with pressing the corresponding keys in the decision making task, participants first performed a practice trial containing 30 trials without the distracting auditory message. The 30 practice stimuli were additional to the 116 experimental stimuli and none of them were repeated throughout the procedure. After the practice block, participants were informed about the distracting auditory message and that their decisions and reaction times would now be recorded. Participants were explicitly told to try to ignore the distracting auditory message and concentrate on the tactical decision making task. Both accuracy and speed on the tactical decision making task were emphasized. After completing the decision making task, subjects were asked several questions regarding the distracting auditory message: (i) did you notice anything unusual about the distracting message? If yes, what?; (ii) Did you notice that the voice of the speaker of the irrelevant message changed? Finally, we had two questions in counter-balanced order asking whether participants heard any (iii) country names (although no country names were present) and whether they heard any (iv) animal names (20 animal names present in the stream). If yes, they were asked to type these into a dialog box on the computer.

Data analysis

We analyzed the manipulation check, control variables, and dependent measures with a series of independent sample *t*-tests. Nonparametric data was either analyzed with the Mann–Whitney's *U* test or Pearson's chi square test. It is important to note that our predetermined sample size of $N = 40$ was calculated based on the medium-to-large effects found in the ego-depletion literature (Hagger et al., 2010b), and we therefore only had a post-hoc (1-β) power of 0.65 to detect medium-to-large effects (i.e., $d = 0.6$ or 0.7, cf. Faul, Erdfelder, Lang, & Buchner, 2007).

Results and discussion

Manipulation check and preliminary analysis

First, we assured that random allocation of participants to the experimental groups resulted in comparable levels of basketball experience and skill level. An independent *t*-test revealed no differences in playing experience as a function of group ($t(38) = 0.273$; $p = .786$, two-tailed, $d = 0.104$; non-depletion $M = 8.96$, $SD = 3.5$ vs. ego-depletion $M = 8.6$, $SD = 3.4$). Further, we defined skill level as the current league of the player and coded 1 as low league (below league 6), 2 as medium league (league 5 and 6), and 3 as high league (league 4 and above). The experimental groups did not differ regarding their skill level ($U = 245.000$, $z = -1.325$, $p = .231$; non-depletion 30% low league, 55% medium league, and 15% high league vs. ego-depletion 20% low league, 45% medium league, and 35% high league). In addition, the distribution of playing position (center, point-guard, forward) was equally distributed across both groups ($\chi^2 < 1$), assuring that for example point-guards who are generally considered to be good decision makers were not confounded with one of the experimental groups.

In line with our expectation we found significant group differences on all of our manipulation check measures. Subsequent to the transcription task ego-depleted participants described the task to have been more effortful than non-depleted participants ($t(34.186) = -2.769$, $p = .009$, two-tailed, $d = 0.876$; non-depletion $M = 0.60$, $SD = 0.21$ vs. ego-depletion $M = 0.76$, $SD = 0.15$), as more difficult ($t(38) = -2.143$, $p = .039$, two-tailed, $d = 0.658$; non-depletion $M = 0.65$, $SD = 0.19$ vs. ego-depletion $M = 0.75$, $SD = 0.10$), and most importantly that they substantially had to suppress their normal typing routine ($t(38) = -2.967$, $p = .005$, two-tailed, $d = 0.956$; non-depletion $M = 0.66$, $SD = 0.22$ vs. ego-depletion $M = 0.84$, $SD = 0.15$). Hence, our experimental manipulation had the intended effect of requiring relatively more self-control (Hagger et al., 2010b) for the ego-depletion group compared to the non-depletion group.

Moreover, the preliminary analysis did not reveal group differences on reported typing skills ($t(38) = -0.416$, $p = .679$, two-tailed, $d = 0.153$; non-depletion $M = 0.51$, $SD = 0.18$ vs. ego-depletion $M = 0.54$, $SD = 0.21$), on how well the participants thought they did on the transcription task ($t(38) = 0.885$, $p = .382$, two-tailed, $d = 0.234$; non-depletion $M = 0.31$, $SD = 0.18$ vs. ego-depletion $M = 0.27$, $SD = 0.16$), and how confident they were in their subsequent performance towards the following decision making task ($t(38) = 1.287$, $p = .206$, two-tailed, $d = 0.378$; non-depletion $M = 0.59$, $SD = 0.18$ vs. ego-depletion $M = 0.52$, $SD = 0.19$).

In addition, no differences were evident on the digitalized PANAS as a function of ego-depletion following the transcription task on both the positive affect scale ($t(38) = -0.735$, $p = .735$, two-tailed, $d = 0.070$; non-depletion $M = 0.51$, $SD = 0.16$ vs. ego-depletion $M = 0.52$, $SD = 0.12$) and negative affect scale ($t(38) = 0.321$, $p = .750$, two-tailed, $d = 0.079$; non-depletion $M = 0.17$, $SD = 0.14$ vs. ego-depletion $M = 0.16$, $SD = 0.11$).

Main analysis

In line with our hypothesis the ego-depleted group performed reliably worse ($M = 37.05$ per cent optimal decisions, $SD = 0.11$) on the speeded tactical decision making task under distraction conditions compared to the non-depleted group ($M = 44.65$ per cent optimal decisions, $SD = 0.10$; $t(38) = 2.317$, $p = .026$, two-tailed, $d = 0.732$). We argue that this effect is caused by the fact that ego-depleted participants did not have sufficient self-control resources left to focus their attention sufficiently on their goal of making situation appropriate tactical decisions and blocking out the auditory distraction.

As we emphasized both accuracy and speed on the tactical decision making task, we further analyzed the response time data as a function of ego-depletion. Response times did not differ as a function of group ($t(38) = -0.257$, $p = .806$, two-tailed, $d = 0.078$; non-depletion $M = 791.83$ ms, $SD = 114.90$ vs. ego-depletion $M = 800.88$ ms, $SD = 116.6$). The same pattern emerged when only analyzing the response time data of the decisions corresponding with the expert ratings ($t(38) = -0.175$, $p = .862$, two-tailed, $d = 0.055$; non-depletion $M = 797.87$ ms, $SD = 112.9$ vs. ego-depletion $M = 804.19$ ms, $SD = 115.2$).

When analyzing the retrospective reports we did not find an association between ego-depletion and animal name detection in the distraction auditory stream ($t(38) = 0.737$, $p = .466$, two-tailed, $d = 0.232$). The non-depletion ($M = 0.55$; $SD = 0.69$) and the ego-depletion group ($M = 0.40$; $SD = 0.60$) on average only recalled half an animal name out of twenty correctly. Similarly, no differences between the non-depleted (80% noticed) and the ego-depleted group (85% noticed) were evident in detecting that the voice had changed in the to-be-ignored audio stream ($\chi^2 < 1$).

General discussion

The goal of the present research was to test the strength model of self-control (Baumeister et al., 2007) in a high interference decision making task in basketball. The results presented provide evidence for the hypothesis that sufficient self-control capacity is needed to focus attention on task performance and block out irrelevant distraction in a sport task. Hence, athletes did not only differ on an inter-individual level at focusing attention (see Furley & Memmert, 2012), but they also differed depending on the situational availability of self-control strength which led to decision making impairments in sport. To our knowledge the present research was the first to demonstrate that successful decision making depends on sufficient self-control resources in a high interference, time constrained sport situation. Although, we used a sport-unspecific depletion task, we found substantial carry-over effects on a sport-specific decision making task. This finding is in line with the central proposal of the strength model of self-control: that self-control is a domain-general internal resource that gets depleted when used, and therefore is no longer available to regulate subsequent behavior in whichever domain it is needed. However, as the task required athletes to make decisions via a key press based on televised stills from basketball, future research has to verify these first findings in more representative sport performance settings.

On a more theoretical level, the study indirectly investigated the relationship between decision making and the involvement of executive resources in time-constrained situations. Of relevance to this, ego-depletion has proven to lead to more intuitive processing by impairing deliberate processing (Pocheptsova, Amir, Dhar, & Baumeister, 2009). As various dual-process theories (Evans & Stanovich, 2013 for a recent review) assume that only effortful, deliberate processing requires the availability of sufficient executive resources, whereas intuitive processing does not depend on executive resources, the present research helps to clarify whether the momentary availability of executive resources facilitates sport decision making. Currently it is not clear whether athlete's decision making benefits from the availability of sufficient executive resources as contrasting predictions might be derived from the sport literature. On the one hand, Furley and Memmert (2012) results might be interpreted as indicative that decision making in speeded contexts benefits from the availability of sufficient executive resources, since working memory capacity was predictive of superior decision making in speeded sport tasks. On the other hand, a different line of research—utilizing an option-generation task (e.g. Raab & Johnson, 2007; Raab & Laborde, 2011)—might suggest that athletes would not benefit from the availability of sufficient executive resources, since evidence exists that they benefit from intuitive decisions (which are not believed to require executive resources, Evans & Stanovich, 2013). The present findings are in line with the former suggestion as athlete's decision-making did benefit from the situational availability of sufficient central resources in high-interference, time-constrained situations. However, future research is needed to establish the relationship between executive resources and decision making in sport, especially on the role that different levels of expertise might have (cf. Raab & Johnson, 2007) on this relationship.

Moreover, we speculated that ego-depleted participants might be able to recall more animal names as their attention "slipped" from focusing on the decision task and therefore would be available for processing the distracting auditory stream. We found that participants of both experimental conditions recalled not even one whole word, indicating a floor effect, and that our respective exploratory measure was of little use. It is still possible that the attention of depleted compared to non-depleted participants switched more frequently to the audio stream. Filter theories of selective attention (Broadbent, 1958) suggest that only highly salient and meaningful stimuli "pop out" from an ignored auditory stream (Moray, 1959; Wood & Cowan, 1995). As the animal names were meaningless to the participants, it seems feasible that depleted participants' attention might have "touched" them without deeper processing, so that the names could not be recalled after the task had been finished. The fact that both participants groups detected the voice change in the auditory stream is also accounted for by Broadbent's (1958) filter theory suggesting that focused attention is not required for detecting basic physical properties in the auditory stream (Furley & Memmert, 2012; Wood & Cowan, 1995).

The present main finding, in tandem with previous research, might point to future practical implications. Baumeister, Gailliot, DeWall, and Oaten (2006) report evidence that people can train their domain-general self-control capacity through specific techniques (e.g., regular self-control exertion over a two-week period) which can foster self-control performance in future tasks. Furthermore, research has shown that a depleted self-control resource can be replenished by adopting certain strategies (e.g., active relaxation; Tyler & Burns, 2008). Although, the practical implications of the findings remain speculative at present, the reviewed training interventions and behavioral strategies, highlight fruitful avenues for future research in sport, and, in the long run, might help athletes to regulate their attention more efficiently, and thus decide and perform at a higher level.

In conclusion, the strength model of self-control (Baumeister et al., 2007; for a review) is a useful framework for guiding research and deriving testable hypothesis in sport performance contexts, as self-control intuitively seems to be of high importance in competitive sports.

References

Baumeister, R. F., Gailliot, M., DeWall, C. N., & Oaten, M. (2006). Self-regulation and personality: how interventions increase regulatory success, and how depletion moderates the effects of traits on behavior. *Journal of Personality, 74*, 1773–1801. http://dx.doi.org/10.1111/j.1467-6494.2006.00428.x.

Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science, 16*, 351–355. http://dx.doi.org/10.1111/j.1467-8721.2007.00534.x.

Broadbent, D. E. (1958). *Perception and communication*. New York: Oxford University Press.

Englert, C., & Bertrams, A. (2012). Anxiety, ego depletion, and sports performance. *Journal of Sport and Exercise Psychology, 34*, 580–599.

Evans, J. S. B., & Stanovich, K. E. (2013). Dual-Process theories of higher cognition: advancing the debate. *Perspectives on Psychological Science, 8*, 223–241. http://dx.doi.org/10.1177/1745691612460685.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175–191. http://dx.doi.org/10.3758/BF03193146.

Furley, P., & Memmert, D. (2012). Working memory capacity as controlled attention in tactical decision making. *Journal of Sport and Exercise Psychology, 34*, 322–344.

Furley, P., & Memmert, D. (2013). "Whom should I pass to?" the more options the more attentional guidance from working memory. *PLoS ONE, 8*(5), e62278. http://dx.doi.org/10.1371/journal.pone.0062278.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. (2009). The strength model of self-regulation failure and health-related behaviour. *Health Psychology Review, 3*, 208–238. http://dx.doi.org/10.1080/17437190903414387.

Hagger, M. S., Wood, C. W., Stiff, C., & Chatzisarantis, N. L. (2010a). Self-regulation and self-control in exercise: the strength-energy model. *International Review of Sport and Exercise Psychology, 3*, 62–86. http://dx.doi.org/10.1080/17509840903322815.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. D. (2010b). Ego depletion and the strength model of self-control: a meta-analysis. *Psychological Bulletin, 136*, 495–525. http://dx.doi.org/10.1037/a0019486.

Ibáñez, S. J., Sampaio, J., Feu, S., Lorenzo, A., Gómez, M. A., & Ortega, E. (2008). Basketball game-related statistics that discriminant between teams' season-long success. *European Journal of Sport Science, 8*, 369–372. http://dx.doi.org/10.1080/17461390802261470.

Lorenzo, A., Gómez, M. A., Ortega, E., Ibáñez, S. J., & Sampaio, J. (2010). Game related statistics which discriminate between winning and losing under-16 male basketball games. *Journal of Sports Science and Medicine, 9*, 664–668.

Moray, N. (1959). Attention in dichotic listening: affective cues and the influence of instructions. *Quarterly Journal of Experimental Psychology, 11*, 56–60. http://dx.doi.org/10.1080/17470215908416289.

Ninio, A., & Kahneman, D. (1974). Reaction time in focused and divided attention. *Journal of Experimental Psychology, 103*, 394–399. http://dx.doi.org/10.1037/h0037202.

Pocheptsova, A., Amir, O., Dhar, R., & Baumeister, R. F. (2009). Deciding without resources: psychological depletion and choice in context. *Journal of Marketing Research, XLVI*, 344–355. http://dx.doi.org/10.1509/jmkr.46.3.344.

Raab, M., & Johnson, J. G. (2007). Expertise-based differences in search and option-generation strategies. *Journal of Experimental Psychology: Applied, 13*, 158–170. http://dx.doi.org/10.1037/1076-898X.13.3.158.

Raab, M., & Laborde, S. (2011). When to blink and when to think: preference for intuitive decisions results in faster and better tactical choices. *Research Quarterly for Exercise and Sport, 82*, 89–98. http://dx.doi.org/10.1080/02701367.2011.10599725.

Schmeichel, B. J., & Baumeister, R. F. (2010). Effortful attention control. In B. Bruya (Ed.), *Effortless attention: A new perspective in the cognitive science of attention and action* (pp. 29–49). Cambridge, MA: MIT Press.

Tyler, J. M., & Burns, K. C. (2008). After depletion: the replenishment of the self's regulatory resources. *Self and Identity, 7*, 305–321. http://dx.doi.org/10.1080/15298860701799997.

Vohs, K. D., Baumeister, R. F., Schmeichel, B. J., Twenge, J. M., Nelson, N. M., & Tice, D. M. (2008). Making choices impairs subsequent self-control: a limited-resource account of decision making, self-regulation, and active initiative. *Journal of Personality and Social Psychology, 94*, 883–898. http://dx.doi.org/10.1037/0022-3514.94.5.883.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063–1070. http://dx.doi.org/10.1037/0022-3514.54.6.1063.

Wood, N., & Cowan, N. (1995). The cocktail party phenomenon revisited: how frequent are attention shifts to one's name in an irrelevant auditory channel? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*, 255–260. http://dx.doi.org/10.1037//0278-7393.21.1.255.