

The Network Theory of Willpower

Nick Byrd

1 INTRODUCTION

Various things might influence our ability to act (A):

- Whether A is logically possible.
- Whether A is something we are capable of doing (Honoré 1964, Mele 2003)
- Whether we can resist A* — where A*-ing is incompatible with A-ing (Mele 1990)
- Whether we are overdetermined to do A* — where A*-ing is incompatible with A-ing (Frankfurt 1969)
- [your suggestion here]
- Willpower

What is willpower?

Willpower is the thing that, when sufficiently strong, accounts for one's ability to fulfill an intention, controlling for 1-5 (n.b., this is broader than the 'willpower' that people have in mind when using 'self-control' — i.e., the ability to overcome and/or resist strong desires).

What is the *nature* of willpower?

Willpower is the (causal) effect of a network of variables.

2 ARMCHAIR APPROACH

Anecdotal and introspective evidence indicates that willpower is related to many variables. Consider anecdotal evidence.

2.1 Anecdotal Evidence

Stress

After a long and frustrating day at work, we might fail to fulfill some of our intentions. For example, after a stressful day, we might come home and eat significantly more than our intended limit.

Fatigue

If we are sleep deprived, then we might feel abnormally tired and we might fail to fulfill some of our intentions. For example, when we stay up significantly past our normal bedtime or repeatedly fail to achieve recommended amounts of sleep, then we might not feel strong enough to fulfill some of our commitments. When our alarm clock is making noise after a night or very little sleep and we intend to get up, we might find ourselves unable.

Hunger

When we go abnormally long periods of time between meals and we become increasingly hungry, we might fail to fulfill a variety of intentions. For example, we might be so hungry that we have trouble focusing on or caring about the needs of those around us, so have trouble being patient and conscientious.

3.2 Additional Findings

In addition to findings that confirm armchair reflection, there are other interesting results.

Exercise

Results from a longitudinal study suggest that exercise regimens might, in the long run, *increase* or *improve* one's willpower (Oaten and Cheng 2006). That is, undergraduates who were participating in an exercise regimen demonstrated a greater likelihood of successfully fulfilling a wide range of ordinary intentions — e.g., eating healthy, abstaining from impulse spending, prioritizing study over friends or television — than participants who were not participating in an exercise regimen (ibid.).

Blood Glucose

By fortunate “accident” some researchers realized that blood glucose is related to ego-depletion effects (Wier 2012). This prompted studies which found that blood glucose really was depleted by various ego-depleting tasks — even if only by a marginally significant (*p* < *0.05*) amount (Gailliot et al 2007, Study 1, 2). Further, in some cases there was a marginally significant relationship between lower blood glucose and performance on a demanding task (ibid., Studies 4-6, not Study 7). And finally, by comparing the performance of participants who ingest glucose in between ego-depletion tasks with participants who ingest a placebo in between ego-depletion tasks, it was found that marginally significant ego-depletion effects in the placebo group were not present in the glucose group — which suggests that ingesting glucose can partially undermine ego-depletion effects (ibid., Study 8). These results indicate that blood glucose levels are related to willpower dynamics. Interestingly, blood glucose levels can also account for significant variance in other variables that might relate to willpower, like the ability to regulate aggressive impulses (Bushman, DeWall, Pond, and Hanus 2014). These effects are only marginally significant and the effect sizes — when they were reported are small (defined as *d* ≈ *0.3*, Cohen 1977). Further, researchers disagree about what to infer from these results (Haggar, Wood, Stiff, and Chatzisarantis 2010; Kurzban 2009). So, while blood glucose is significantly related to the sterngth of willpower, it is by no means the only variable related to willpower.

Executive Function

Functional magnetic resonance imaging (fMRI) reveals that certain intentional actions involving executive function activate various areas of the prefrontal cortex (Kane & Engle 2002). A review of studies involving positron emission topography (PET), recordings of movement-related cortical potentials (MRCPs) and transcranial magnetic stimulation (TMS) support the notion that intentional action is realized by portions of the PFC (Kahanshahi 1998). The same review reports that multiple subcortical areas — the thalamus and basil ganglia — are also central to willed actions (ibid.). It is presumed that these are areas of the brain which consumes significant amounts of glucose during ego-depleting tasks (Galliot et al 2007).

Circadian Rhythm

Performance variance on tasks that require executive function is significantly related to time of day, and more specifically, circadian rhythm (Blake 1967;

Gut Biochemisty

Empirical investigations reveal that the presence of certain naturally occurring molecules in the gut and brain is specifically related to alcohol-dependence in rodents (Adachi et al 1995; Mathurin et al 2000; Rao et al 2004; Wheeler 2003; Yan et al., 2010). And in alcohol-dependent humans, the presence of certain molecules in the gut is significantly related to alcohol cravings, the onset of alcohol withdrawal, and the end of alcohol withdrawal (Leclercq et al 2012; Leclercq, Saeger, Delzenne, de Timary, and Stärkel 2014). These results might provoke one to ask whether willpower variance is also significantly related to certain molecules in the gut.

Hormones

Other empirical investigations find that, in women, certain hormones are differentially associated the reinforcing effect of addictive drugs (Lynch and Sofuoglu 2010). Specifically, “higher levels of estrogen are associated with more reinforcing effects of addictive drugs, whereas higher levels of progesterone are associated with less reinforcing effects” (Mendrek, Dinh-Williams, Bourque, and Potvin 2014). These results indicate that it could be worthwhile to test whether willpower variance is also significantly related to hormonal variations.

Kinds of Intentions

Forming new year's resolutions predicted significantly more success in changing a problem (Norcross, Mrykalo, and Blagys 2002). Similarly, forming “implementation intentions” (Gollwitzer 1993) predicts significantly more success in fulfilling difficult goals (Gollwitzer & Brandstätter 1997; Koestner, Lekes, Powers, and Chicoine 2002). So, the variation in success with which willpower is exercised might be significantly related to the nature of the intention one is attempting to fulfill.

Social Support

A variety of studies have shown that social support is related to significant improvement in fulfilling one's intentions (Norcross, Ratzin, & Payne 1989; Norcross & Vangarelli 1988) and motivation (Caplan, Robinson, French, Caldwell, and Shinn 1976, 3; Harackiewicz 1979). Empirical investigations also support the the claim that the “need to belong” is significantly related to motivation (Baumeister 1995). If willpower is what accounts for our success in fulfilling intentions, then it could be worthwhile to consider the relationship between social support and willpower.

3.3 Conclusion

Experimental findings suggest that willpower is related to a variety of variables, none of which seem to singularly capture the nature of willpower.

4 THE NETWORK

Investigations of willpower have probably revealed only fragments of the willpower network. So, even when experiments reveal net willpower effects, it might be that only fragments of the willpower network were being considered (Baumeister and Leary 1995). When experiments control enough variables, they might be able to isolate node-level effects like glucose depletion (Gailliot et al 2007).

and the same network structure can capture both positive and negative dynamics.

Another note-worthy feature of network fragments is that they can overlap. Some of the nodes within this causal network could share connections with hitherto unmentioned nodes in the network (e.g., circadian rhythm, blood glucose levels, etc.) and thereby connect with the larger willpower network.

4.1 Selected Implications

External Nodes

Some nodes in the willpower network could include other agents, e.g., social support. However strange this may seem at first, this makes great sense of both anecdotal experience and empirical results. Weight Watchers (Ahem, Olson, Aston, and Jebb 2011) and Alcoholics Anonymous (Scott, Connors, and Miller 2003) are familiar examples of how external social support can improve agents' willpower.

Unconscious Nodes

Not all nodes in the willpower network will be consciously accessed or accessible. So, it should not be surprising when experimental investigations of willed actions reveal nodes in the willpower network that are unconscious and therefore not easily revealed via armchair approaches, e.g., blood glucose, neural correlates of willpower, etc (Bargh 1989, 1990; Bargh and Pietromo 1982; Bargh and Gollwitzer 1994; Bargh, Gollwitzer, Lee-Chai, Barndollar, and Trötschel 2001; Bargh, Green, and Fitzsimons 2008; Bargh and Huang 2009, 2013; Bargh, Lombardi, and Higgins 1988; Bargh, Lombardi, and Tory 1988; Bargh and Williams 2006; Bargh and Chartrand 1999; Chartrand and Bargh 1996; Huang and Bargh 2014; Bargh and Morsella 2008; Wegner, Bargh, Gilbert, Fiske, and Lindsey 1998, Schlegel et al 2015).

Unification

The present investigation has appealed to empirical work from seemingly disparate areas of cognitive science, biology, and biochemistry. There is no reason to think that a more exhaustive review of empirical work would not reveal additional domains of science that are investigating details of willpower networks. This goes to show how the network theory of willpower might (a) make sense of findings from armchair and experimental approaches to willpower and (b) unify the approaches themselves by highlighting the shared features of otherwise unrelated investigations.

5 CONCLUSION

The network theory of willpower can not only predict that willpower is related to a variety of variables and that none of these variables seem to provide a singular or complete account of the nature of willpower; it can also offer a principled explanation of these facts. In addition to accounting for these facts, the theory makes sense of multiple armchair and experimental investigations of willpower. The theory is also flexible enough to survive new discoveries and practical enough to confer benefits beyond academia. The network theory is superior to any theory that offers less than this.

Mood

Sometimes an overwhelmingly good mood can make it abnormally easy to fulfill our intentions. Indeed, a good mood might even trump the effects of some of the other variables like fatigue and hunger.

2.2 Introspective Evidence

In addition to our anecdotal evidence, we might appeal to our *experience* of what it is like to exercise willpower. When we introspect about this experience, we might find the following.

Ego-depletion

Think about exercise. One feeling stands out among the rest. As we exercise, we have a sense that our ability to (intentionally) continue exercising wanes. Sometimes — especially during endurance exercise — we sense that our ability to continue is so depleted that we feel as though all we can do is give up. It is not just that we have reached anaerobic threshold. We have an interoceptive sense that it is more than that. We are consuming some *other* resource. I think it is common for many people to refer to this resource with 'willpower.'

2.3 Conclusion

Anecdotal and introspective evidence provide some reason to think that willpower is related to multiple variables.

3 EXPERIMENTAL APPROACH

We can only learn so much from the armchair, so we might also look to experimentation to tell us about the nature of willpower.

3.1 Confirming The Armchair Findings

Science often starts by probing our intuitions and experiences to form some kind of theoretical expectation that can be tested. So it is not surprising that some experimenters have already investigated some of the phenomena that were observed in the armchair.

Fatigue

Sleep deprivation — the effects of which include negative mood and fatigue — degrades performance on the psychomotor vigilance task, which requires participants to remain constantly attentive to detect “randomly occurring stimuli” (Durmer and Dinges 2005).

Mood

Being in a participant in positive mood condition was related to persisting significantly longer on both required tasks and freely chosen tasks than being in a neutral mood conditions (Isen and Reeve 2005). Similarly, being in a positive mood condition was related to persisting significantly longer in a frustrated task than being in a neutral mood condition (Tice, Baumeister, Schmuelt, and Muraven 2007, Study 2). This result was replicated using different mood manipulations and different dependent measures (Ibid., Study 3, 4).

Ego-depletion

Performing a demanding task immediately prior to a new, unrelated, demanding task was related to significantly lower performance on the new task compared to control conditions (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Vohs & Heatherton 2000). A variety of ecologically valid tasks that can deplete willpower: abstaining from tempting foods, regulating emotion, and interracial social interaction, to name a few (Ibid., ibid., Gordijn, Hindriks, Koomen, Dijksterhuis, & Knippenberg 2004; Johnson & Richeson 2009; Richeson et al 2003; Richeson & Shelton 2003; Richeson & Trawalter 2005; Richeson, Trawalter, & Shelton 2005).

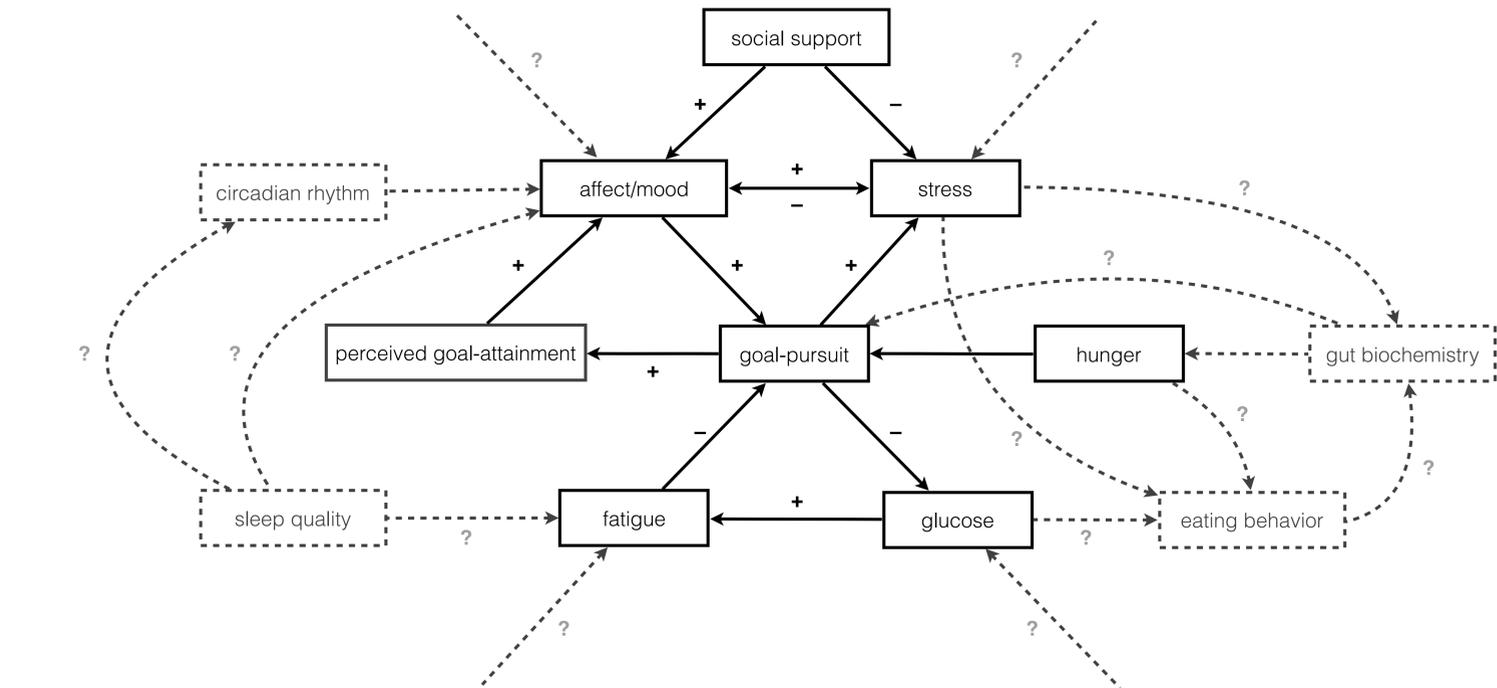


FIGURE 1: SKETCH OF THE WILL-POWER NETWORK

Blatter and Kahochen 2007; Colquhoun 1981; Schmidt et al 2007). Since executive function requires some amount or strength of willpower, it would be unsurprising if similar experiments found that variance in *willpower* is similarly related to circadian rhythm.

Perceived Goal-Attainment

Performance variance on other tasks that require executive function is also significantly related to perceived goal-achievement (Brunstein 1993; Brunstein Schultheiss, and Ruth 1998; McIntosh 1996; Oatley and Johnson-Laird 1996; Sheldon and Kasser 1995). Based on the present suppositions about willpower and executive function — coupled with anecdotal evidence (e.g., recall the discussion of mood from section 2.1) — this result raises the question of whether variance in willpower could also be significantly related to perceived goal-achievement.

Tyrosine

The relationship between large performance variance effects ($d \geq 0.5$, Cohen 1977) on Remote Association Task (Mednick 1962) — which presumably requires executive function — and ingestion of the amino acid tyrosine is highly significant ($p < 0.01$) (Colzato, Haan, & Hommel 2014). In this study, each participant was allowed the same amount of time to complete the task — 10 minutes (Colzato, *personal correspondence*) — so the performance variable does not exactly measure one's ability to persist. However, one could easily modify the experiment to test whether and how task persistence, a proxy of willpower, is related to tyrosine.

As we consider the variables that are related to willpower, we can begin to posit nodes in the network. For example, the fact that negative mood is correlated with weakened willpower (Tice et al 2007, Study 3) and that positive mood is correlated with increased willpower (Isen & Reeve 2005) merits positing that mood might could be a part of the willpower network (see Figure 1). Add to that the fact that decreased social support is significantly related to negative mood, and vice versa and we might posit that social support is connected to the mood node in the willpower network (Sarason, Levine, Basham, and Sarason 1983). Thus, mood and social support might constitute a fragment of the willpower network (Figure 1).

Once enough nodes of the willpower network have been posited, positive and negative causal network fragments might emerge. For example, the fact that goal-attainment is related to positive mood (Brunstein 1993; Brunstein Schultheiss, and Ruth 1998; McIntosh 1996; Sheldon and Kasser 1995) merits positing a node, goal-attainment, which is connected to the mood/social-support fragment. With a few more nodes, this fragment might form a mutually reinforcing causal network.

This self-reinforcing network dynamic could be negative, as follows: decreases in social support result in negative mood, which result in decreased goal-pursuit, which results in decreased goal-attainment, which — completing the circle — results in (additionally) negative mood. This mutually reinforcing nature of this negative cycle will be familiar to those experiencing depression (see Figure 1).

In principle, the same nodes, with different values (e.g., a high instead of a low value for social support), could become a mutually reinforcing positive causal network. It is worth pausing a moment to highlight this nuance: one

BIBLIOGRAPHY

Bargh, J. A. (1989). Conditional automaticity: Varieties of automatic influence in social perception and cognition. In J. S. Uleman & J. A. Bargh (Eds.), *Unintended thought* (pp. 3–51). New York, NY, US: Guilford Press.

Bargh, J. A. (1990). Automaticity: Preconscious determinants of social interaction. In E. T. Higgins & R. M. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior*, Vol. 2 (pp. 93–130). New York, NY, US: Guilford Press.

Bargh, J. A. & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist*, 54(7), 462.

Bargh, J. A., Green, M., & Fitzsimons, G. (2008). The selfish goal: Unintended consequences of intended goal pursuits. *Social Cognition*, 26(5), 534.

Bargh, J. A. & Huang, J. Y. (2009). The selfish goal. *The Psychology of Goals*, 127–150.

Bargh, J. A., & Huang, J. Y. (2013). The Evolutionary Unconscious: From "Selfish Genes" to "Selfish Goals" (pp. 1–75). University of New South Wales: Sydney Symposium of Social Psychology.

Bargh, J. A., Lombardi, W. J., & Higgins, E. T. (1988). Automaticity of chronically accessible constructs in person x situation effects on person perception: It's just a matter of time. *Journal of Personality and Social Psychology*, 55(4), 599–605.

Bargh, J. A., Lombardi, W. J., & Tory, E. (1988). Automaticity of chronically accessible constructs in person x situation effects on person perception: It's just a matter of time. *Journal of Personality and Social Psychology*, 55(4), 599–605. doi:10.1037/0022-3514.55.4.599

Bargh, J. A. & Pietromonaco, P. (1982). Automatic information processing and social perception: The influence of trait information presented outside of conscious awareness on impression formation. *Journal of Personality and Social Psychology*, 43(3), 437–449. doi:10.1037/0022-3514.43.3.437

Bargh, J. A., & Williams, E. L. (2006). The automaticity of social life. *Current Directions in Psychological Science*, 15(1), 1–4.

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(5), 1252–1265. doi:10.1037/0022-3514.74.5.1252

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(6), 1773–1802. doi:10.1111/j.1467-6494.2006.00428.x

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117(3), 497–529. doi:10.1037/0033-2909.117.3.497

Baumeister, R. F., & Vohs, K. D. (2007). Self-Regulation, Ego Depletion, and Motivation. *Social and Personality Psychology Compass*, 1(1), 115–128. doi:10.1111/j.1751-9004.2007.00001.x

Bishop, M. (2015). *The Good Life: Unifying The Philosophy and Psychology of Well-being*. Oxford: Oxford University Press.

Blake, M. J. F. (1967). Time of day effects on performance in a range of tasks. *Psychonomic Science*, 9(6), 349–350. doi:10.3758/BF03278242

Blatter, K., & Cajochen, C. (2007a). Circadian rhythms in cognitive performance: Methodological constraints, protocols, theoretical underpinnings. *Physiology & Behavior*, 90(2–3), 196–208. doi:10.1016/j.physbeh.2006.09.009

Blatter, K., & Cajochen, C. (2007b). Circadian rhythms in cognitive performance: Methodological constraints, protocols, theoretical underpinnings. *Physiology & Behavior*, 90(2–3), 196–208. doi:10.1016/j.physbeh.2006.09.009

Brunstein, J. C. (1993). Personal goals and subjective well-being: A longitudinal study. *Journal of Personality and Social Psychology*, 65(5), 1061–1070. doi:10.1037/0022-3514.65.5.1061

Brunstein, J. C., Schultheiss, O. C., & Grässman, R. (1998). Personal goals and emotional well-being: The moderating role of motive dispositions. *Journal of Personality and Social Psychology*, 75(2), 494–508. doi:10.1037/0022-3514.75.2.494

Bushman, B. J., DeWall, C. N., Pond, R. S., & Hanus, M. D. (2014). Low glucose relates to greater aggression in married couples. *Proceedings of the National Academy of Sciences*, 111(17), 6252–6257. doi:10.1073/pnas.1400619111

Chaplan, R. D., Robleson, E. A., French Jr, J. R., Caldwell, J. R., & Shirn, M. (1976). Adhering to medical regimes: Pilot experiments in patient education and social support.

Chartrand, T. L., & Bargh, J. A. (1996). Automatic activation of impression formation and memorization goals: Nonconscious goal priming reproduces effects of explicit task instructions. *Journal of Personality and Social Psychology*, 71, 464–478.

Gailliot, M. T., Baumeister, R. F., Nathan, C., Maner, J. K., Ashby, E., Tice, D. M., ... 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(2), 325–336. doi:10.1037/0022-3514.92.2.325

Gollwitzer, P. M. (1993). Goal Achievement: The Role of Intentions. *European Review of Social Psychology*, 4(1), 141–185. doi:10.1080/14792779343000059

Hanson, C. (2009). Thinking about Addiction: Hyperbolic Discounting and Responsible Agency. *Rodopi*.

Harackiewicz, J. M. (1979). The effects of reward contingency and performance feedback on intrinsic motivation. *Journal of Personality and Social Psychology*, 37(8), 1352–1363. doi:10.1037/0022-3514.37.8.1352

Herdova, M. (n.d.). *Self-Control and Mechanisms of Behavior: Why Self-Control is not a Natural Mental Kind*.

Holton, R. (2003). How is Strength of Will Possible? In C. Tappolet & S. Stroud (Eds.), *Weakness of Will and Practical Irrationality* (pp. 39–67). Oxford.

Honore, A. (1964). Can and Can't. *Mind*, 73(292), 463–479.

Huang, J. Y., & Bargh, J. A. (2014). The Selfish Goal: Autonomously operating motivational structures as the proximate cause of human judgment and behavior. *Behavioral and Brain Sciences*, 37(02), 121–135. doi:10.1017/S0140525X13000290

Isen, A. M., & Reeve, J. (2005). The Influence of Positive Affect on Intrinsic and Extrinsic Motivation: Facilitating Enjoyment of Play, Responsible Work Behavior, and Self-Control. *Motivation and Emotion*, 29(4), 295–323. doi:10.1007/s11031-006-9019-8

Johnson, S. E., & Richeson, J. A. (2009). Solo status revisited: Examining racial group differences in the self-regulatory consequences of self-presenting as a racial solo. *Journal of Experimental Social Psychology*, 45(4), 1032–1035. doi:10.1016/j.jesp.2009.04.021

Koestner, R., Leves, N., Powers, T. A., & Chicoine, E. (2002). Attaining personal goals: Self-concordance plus implementation intentions equals success. *Journal of Personality and Social Psychology*, 83(1), 231–244. doi:10.1037/0022-3514.83.1.231

Kurzban, R. (2009). Does the brain consume additional glucose during self-control tasks? *Evolutionary Psychology: An International Journal of Evolutionary Approaches to Psychology and Behavior*, 9(2), 244–259.

Lynch, W. J., & Sofuoglu, M. (2010). Role of progesterone in nicotine addiction: Evidence from initiation to relapse. *Experimental and Clinical Psychopharmacology*, 18(6), 451–461. doi:10.1037/a0021265

McIntosh, W. (1996). When does goal nonattainment lead to negative emotional reactions, and when doesn't it? The role of linking and rumination. *Striving and Feeling: Interactions among Goals, Affect, and Self-Regulation*, 53–77.

Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review*, 69, 220–232.

Mele, A. R. (2003). Agents' Abilities. *Noûs*, 37(3), 447–470. doi:10.1111/1468-0068.00446

Mele, A. R. (1990). Irresistible Desires. *Noûs*, 24(3), 455–472. doi:10.2307/2215775

Mendrek, A., Dink-Williams, L., Bourque, J., & Potvin, S. (2014). Sex Differences and Menstrual Cycle Phase-Dependent Modulation of Craving for Cigarette: An fMRI Pilot Study. *Psychiatry Journal*, 2014, e72932. doi:10.1155/2014/72932

Norcross, J. C., Mryka, M. S., & Blagys, M. D. (2002). Auld lang Syne: Success predictors, change processes, and self-reported outcomes of New Year's resolvers and nonresolvers. *Journal of Clinical Psychology*, 58(4), 397–405. doi:10.1002/clp.1151

Norcross, J. C., Ratzin, A. C., & Payne, D. (1998). Ringing in the new year: The change processes and reported outcomes of resolutions. *Addictive Behaviors*, 14(2), 205–212. doi:10.1016/0306-4626(98)00054-0

Norcross, J. C., & Vangarelli, D. J. (1988). The resolution solution: Longitudinal examination of New Year's change attempts. *Journal of Substance Abuse*, 1(2), 127–134. doi:10.1016/S0899-3289(88)0016-6

Oaten, M., & Cheng, K. (2006). Longitudinal gains in self-regulation from regular physical exercise. *British Journal of Health Psychology*, 11(4), 717–733. doi:10.1348/1551076069481

Oatley, K., & Johnson-Laird, P. N. (1996). The communicative theory of emotions: Empirical tests, mental models, and implications for social interaction.

Richeson, J. A., Baird, A. A., Gordon, H. L., Heatherton, T. F., Wyland, C. L., Trawalter, S., & Shelton, J. N. (2003). An fMRI investigation of the impact of interracial contact on executive function. *Nature Neuroscience*, 6(12), 1323–1328. doi:10.1038/nn1156

Richeson, J. A., & Shelton, J. N. (2003). When Prejudice Does Not Play Effects of Interracial Contact on Executive Function. *Psychological Science*, 14(3), 287–290. doi:10.1111/1467-9280.03437

Richeson, J. A., & Trawalter, S. (2005). Why Do Interracial Interactions Impair Executive Function? A Resource Depletion Account. *Journal of Personality and Social Psychology*, 88(6), 934–947. doi:10.1037/0022-3514.88.6.934

Richeson, J. A., Trawalter, S., & Shelton, J. N. (2005). African Americans' Implicit Racial Attitudes and the Depletion of Executive Function after Interracial Interactions. *Social Cognition*, 23(4), 336–352. doi:10.1521/socj.2005.23.4.336

Sarason, I. G., Levine, H. M., Basham, R. B., & Sarason, B. R. (1983). Assessing social support: The Social Support Questionnaire. *Journal of Personality and Social Psychology*, 44(1), 127–139. doi:10.1037/0022-3514.44.1.127

Scalafini, A. (2013). Gut-brain nutrient signaling, Appetition vs. satiation, Appetite. <http://doi.org/10.1016/j.appet.2012.05.024>

Schmidt, C., Collette, F., Cajochen, C., & Peigneux, P. (2007). A time to think: Circadian rhythms in human cognition. *Cognitive Neuropsychology*, 24(7), 755–789. doi:10.1080/02643290701754158

Scott, J., Connors, G. J., & Miller, W. R. (2003). Participation and involvement in Alcoholics Anonymous. In T. F. Babor & F. K. Del (Eds.), *Treatment matching in alcoholism* (pp. 184–204). New York, NY, US: Cambridge University Press.

Sheldon, K. M., & Kasser, T. (1995). Coherence and congruence: Two aspects of personality integration. *Journal of Personality and Social Psychology*, 68(3), 531–543. doi:10.1037/0022-3514.68.3.531

Sripada, C. S. (2014). How is Willpower Possible? The Puzzle of Synchronic Self-Control and the Divided Mind. *Noûs*, 48(1), 41–74. doi:10.1111/1468-0068.12012.00870.x

Sripada, C. S. (2010). Philosophical Questions about the Nature of Willpower. *Philosophy Compass*, 5(9), 793–805. doi:10.1111/j.1747-9991.2010.00346.x

Tice, D. M., Baumeister, R. F., Shmueli, D., & Muraven, M. (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *Journal of Experimental Social Psychology*, 43(3), 379–384. doi:10.1016/j.jesp.2006.05.007

Trawalter, S., & Richeson, J. A. (2006). Regulatory focus and executive function after inter-racial interactions. *Journal of Experimental Social Psychology*, 42(3), 406–412. doi:10.1016/j.jesp.2005.05.008

Vohs, K. D., & Heatherton, T. F. (2000). Self-Regulatory Failure: A Resource-Depletion Approach. *Psychological Science*, 11(3), 249–254. doi:10.1111/1467-9280.00250

Wegner, D., & Bargh, J. (1998). Control and automaticity in social life. In D. Gilbert, S. Fiske, & G. Lindzey (Eds.), (4th ed., pp. 446–496). McGraw-Hill.

