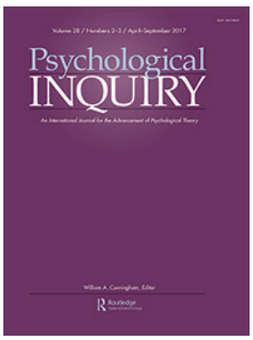

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Separating Identity and Value in the Identity-Value Model

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Elliot T. Berkman, Jordan L. Livingston, and Lauren E. Kahn (this issue) propose the identity-value model (IVM) as a way to link findings from social psychology that identity contributes to self-regulation with findings from neuroeconomics that choice is driven by a process of dynamic value integration. We commend the authors for bringing together these disparate literatures, for clearly laying out their assumptions and definitions, and for their thorough discussion of related theories from social psychology. In this commentary, we expand on what we see as the strengths of the model, namely, that decisions about self-control emerge from the same process as other value-based decisions and that the "self" is a multifaceted mental concept rather than a subpersonal autonomous agent. Then we turn to limitations of the IVM as it is currently proposed. We think the IVM could be strengthened by more detailed attention to (a) what data could falsify the model, particularly on a neural level, and (b) how the model could account for nuanced and apparently conflicting findings regarding construal level and self-control.

Choice Emerges from Dynamic Integration of Value Inputs

According to the IVM, when individuals evaluate actions, they consider how each action fits in with their perceived identity. This "identity-relevance" is then one attribute of an action, which is considered along with other attributes (e.g., effort, delay, magnitude of reward) to compute the overall, integrated, subjective value of that action. The action with the highest subjective value is then chosen. As Berkman et al. (this issue) state, "self-regulation is less the result of a battle between 'hot' impulses and 'cold' control (Metcalfe & Mischel, 1999) than it is an integration of value inputs from an arbitrary number of sources including self-relevance, primary rewards, social value, and effort costs" (p. 82). Despite a great deal of evidence in support of it, the notion that choice is the result of a valuation process that integrates varied inputs is still controversial in some circles. We are happy to see that the authors embrace this idea.

Berkman and colleagues (this issue) cite some of the most critical evidence for this valuation framework, including neuroimaging studies that show that activity in the ventromedial prefrontal cortex (vmPFC) correlates with the subjective value of an action, whether or not that action is considered a "self-controlled" one (Kable & Glimcher, 2007, 2010). The evidence for this valuation framework goes beyond individual neuroimaging studies, though. First, there is meta-analytic neuroimaging evidence. Two independent major meta-analyses have identified consistent neural correlates of subjective value in vmPFC and ventral striatum across 81 (Clithero & Rangel, 2014) and 206 (Bartra, McGuire, & Kable, 2013) published functional magnetic resonance imaging studies, respectively. These two regions are correlated with subjective value at the time of choice and at the time outcomes are received, for both primary (e.g., food) and secondary (e.g., money) outcomes (Bartra et al., 2013). Second, there is causal evidence from methods beyond neuroimaging. Individuals with damage to vmPFC have long been known to be impaired in complex decision-making tasks, such as the Iowa Gambling Task (Bechara, Damasio, Tranel, & Damasio, 1997). More recent studies have demonstrated a consistent and replicable impairment in basic preference decisions (Camille, Griffiths, Vo, Fellows, & Kable, 2011; Fellows & Farah, 2004; Henri-Bhargava, Simioni, & Fellows, 2012). The specific pattern of impairment is that individuals with vmPFC damage are more likely to make choices that violate transitivity, which is exactly the pattern that would be predicted from deficits in basic valuation processes (Camille et al., 2011).

The "dynamic" nature of valuation refers to the fact that even choices between relatively stable options (e.g., between a salad and a candy bar) take some time to make, with reaction times being longer when choices are between two equally attractive options. As the authors note, there is considerable behavioral (i.e., choice and reaction time) and neural evidence showing that such one-time, binary choices can be understood as resulting from a dynamic, integration-to-bound, valuation process (Hutcherson, Bushong, & Rangel, 2015; Krajbich & Rangel, 2011; Krajbich, Armel, & Rangel, 2010). However, many self-control dilemmas are not one-off choices, but rather they involve decisions to stick with difficult tasks or to continue to work toward or wait for delayed goals, in the face of ever-present and immediately available temptations. Recent work in our lab has shown that these kinds of decisions can also be understood through a dynamic valuation framework, in this case one in which information about the options *changes* over time. For example, in a recent line of research, individuals decided, over a series of trials, whether to continue to wait for a larger monetary reward arriving at an uncertain time or to take a smaller amount of money and move on to the next trial. In this task, the *passage of time itself* can be informative and can have a positive or negative influence on waiting in different

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conditions of the task, which establish different expectations about the possible times that the larger, delayed outcome may arrive. In one condition, continuing to wait was always worthwhile, but in another, waiting past a certain point only reduced your payoff. We found that people's waiting behavior was influenced by how the value of the awaited reward changed over time and that activity in the vmPFC tracked these fluctuations in value throughout the delay period (McGuire & Kable, 2012, 2013, 2015). These studies extend the dynamic value integration framework, and the role of the vmPFC within this framework, to a broader range of choice situations critical for self-control.

Multiple, Conflicting Selves Can Influence Behavior

Another place where we are in enthusiastic agreement with Berkman and colleagues is in their characterization of the self as a multifaceted, higher-level, mental concept. Baumeister, a noted theorist of self-control, has proposed that the self is a unified construct, that a person has identity only in relation to other people, and that the self may not reside in the brain (Baumeister, 2011). The notion that self may be noncorporeal strikes us as unscientific, and, as one of us has argued elsewhere (Kurzban, Duckworth, Kable, & Myers, 2013), the related characterization of the self as a causal agent distinct from the person sounds suspiciously like a homunculus. Berkman et al. contest Baumeister's characterization of the self by acknowledging that different aspects of the self-concept can be active at different times, that social identity is just one part of identity, and that the self has a neural (though nonlocalized) basis. As the authors demonstrate throughout their article, an important benefit of returning to the idea of the self as mental concept is that it is easily integrated with a large psychological literature on conceptual knowledge and conceptual representations (Medin & Smith, 1984; Murphy, 2002).

Treating the self as a mental concept also provides an interesting reinterpretation of the claim that intertemporal decisions emerge from a conflict between present and future selves (Ainslie, 2005; Fudenberg & Levine, 2006; Hershfield, 2011). This claim has sometimes been construed as suggesting a conflict between two agents, which can then be modeled using game theory (Fudenberg & Levine, 2006; Ross, 2005, 2008). Considering the self as a mental concept, rather than as a subpersonal agent, suggests an alternative interpretation of this claim in terms of the activation or accessibility of different concepts. If activation of a future self concept makes beneficial attributes of future outcomes more accessible (e.g., through the common association with the future), this could explain several findings in this domain. For example, as the authors discuss, viewing an aged digital rendering of oneself leads to more patient choices (Hershfield et al., 2011). In addition, when people report feeling more connected with their future selves, they make more patient decisions (Ersner-Hershfield, Wimmer, & Knutson, 2009; Hershfield, 2011) and have more accumulated assets (Ersner-Hershfield, Garton, Ballard, Samanez-Larkin, & Knutson, 2009). Manipulations that increase perceived similarity between one's present and future selves, such as reading a passage suggesting that identity is stable over time, also elicit more patient choice (Bartels & Urminsky, 2011). There is neuroscience evidence consistent with the interpretation of these manipulations as enhancing patient choice by making positive attributes of future outcomes more salient. Two studies have reported that people who show increased activity in vmPFC when thinking about their future selves are more likely to make more patient decisions (Ersner-Hershfield et al., 2009; Mitchell, Schirmer, Ames, & Gilbert, 2011). We recently demonstrated that this association does not specifically depend on activation of the self concept: people who exhibited more activity in vmPFC when thinking about the far future, relative to the near future, were also more patient (Cooper, Kable, Kim, & Zauberman, 2013).

Dissociation Between "Self" and "Value" Signals in vmPFC is Necessary to Test the Model

Berkman and colleagues lay out ample evidence that is consistent with the IVM. However, a good theory not only has broad explanatory scope but also leads to further testable and falsifiable predictions. The IVM would be strengthened by further laying out behavioral or neural predictions that are testable. Specifically, what evidence or pattern of data could falsify the IVM?

To our reading, the aspect of the IVM that is most amenable to test, and most differentiates the IVM from other models, is its commitment to subjective value as the psychological and neural mechanism by which identity-relevance affects behavior. We can imagine testing the IVM by showing that a manipulation (a) affects the identity-relevance of an action, (b) alters the corresponding valuation signal of that action in vmPFC, and (c) leads people to be more likely to choose that action. In this case, we think the change in vmPFC activity is a unique prediction of the IVM, relative to other models, and that finding a manipulation of identity-relevance that influenced behavior but did not change activity in vmPFC would count as evidence against the IVM.

Here, the overlap in neural regions involved in self-related processing and in valuation that Berkman and colleagues discuss might actually be problematic for testing the IVM. In the test of the IVM we propose, it would be impossible to separately evaluate the first two predictions—that a manipulation enhances identity-relevance and that it increases value-related neural activity in vmPFC—if neural activation in vmPFC associated with self-relevance and subjective value is indistinguishable. That is, testing the IVM requires a neural signal of value that is not also a signal of self-relevance; vmPFC activity cannot be used as a readout of subjective value, if the same activity could just as likely reflect an enhancement of self-relevance. If self- and value-related neural signals completely overlapped, it would be impossible to falsify the IVM by showing that a manipulation enhanced identity-relevance but did not change neural value signals. So, in contrast to the authors' statement that "it may even be that identity and value are inseparable … in which case our case for focusing particularly on the role of identity in self-regulation is even stronger" (p. 82), we think that such a level of neural inseparability would represent a weakness rather than a strength for the IVM.

Perhaps it is auspicious for the IVM, then, that there is evidence that seemingly overlapping self-related and value-related

signals in vmPFC can be distinguished (Bartra et al., 2013; Murray, Schaer, & Debbané, 2012). As the authors mention, when people view persuasive messages, activity in vmPFC correlates with the extent of behavior change after viewing those messages (Cooper, Bassett, & Falk, 2017; Cooper, Tompson, O'Donnell, & Falk, 2015; Falk et al., 2015). This could be because when people interpret messages as more self-relevant, they are more likely to respond to them, or because when people find messages more valuable, they respond to them. Recent studies have begun to address this question by examining two separate, nonoverlapping regions of the vmPFC that are related to valuation and self-reflection. The valuation region was drawn from the Bartra et al. (2013) meta-analysis, whereas the self-reflection region was taken from either the Murray et al. (2012) meta-analysis or a well-validated self-localizer (judging personality traits as describing oneself or not; Cooper et al., 2015). Activity in both of these regions during persuasive ad viewing predicted subsequent behavior change (Cooper et al., 2015), although *functional connectivity* between valuation regions (vmPFC and ventral striatum) and not between self-related regions (mPFC and posterior cingulate cortex) predicted behavior change (Cooper et al., 2017). In another set of studies, activity in a self-relevant region of medial PFC while people looked at news articles predicted whether they selected and shared those articles online (Baek, Scholz, O'Donnell, & Falk, 2017; Scholz et al., 2017), but this relationship was mediated entirely through activity in a valuation region in PFC (Scholz et al., 2017). These studies did not manipulate self-relevance, but their results are consistent with the IVM. Similar methods could be used to test neurally whether manipulations enhance both identity-relevance and subjective value, as predicted by the IVM.

Higher-Level Construal Does Not Always Promote Self-Control

The IVM could also be strengthened by more directly engaging with apparently conflicting findings regarding construal levels and self-control. In their article, the authors point to a line of work showing that abstract or high-level mind-sets promote self-control (i.e., high-level goals; Fujita & Carnevale, 2012; Fujita, Trope, Liberman, & Levin-Sagi, 2006). A recent study from our group (Parthasarathi, McConnell, Luery, & Kable, 2017) is consistent with this idea. We showed that individuals with more vivid, or concrete, visualization abilities had higher discount rates, or an increased propensity to select smaller, immediate rewards at the expense of larger, delayed ones. Moreover, 4 weeks of practice with visualization tended to improve those abilities and to increase discount rates.

We found the results of our study somewhat surprising, however, given several studies that have now shown that episodic future thinking about specific events *increases* choice of delayed rewards (Benoit, Gilbert, & Burgess, 2011; Palombo, Keane, & Verfaellie, 2015; Peters & Büchel, 2010; Sasse, Peters, Büchel, & Brassen, 2015). In one of these studies, people imagined upcoming events on their calendar, and the more vividly these events were imagined, the more discount rates decreased (Peters & Büchel, 2010). In another study, people were asked to imagine concrete ways to spend their future monetary rewards (e.g., "at a pub with friends"), and providing this context led those rewards to be rated as more emotionally intense and to be chosen more often (Benoit et al., 2011).

Furthermore, fantasizing about achieving goals in the future has been shown to *decrease* motivation to pursue those goals, even though this future-oriented thinking can be very abstract (Oettingen, 2012; Oettingen & Mayer, 2002). For example, overweight women who fantasized more positively about losing weight lost fewer pounds (Oettingen & Wadden, 1991), and patients who fantasized more positively about their recovery following hip replacement surgery did less well in recovery (Oettingen & Mayer, 2002). In contrast, outlining concrete steps to achieve goals, including the obstacles that will be faced and how best to confront those obstacles, has been shown to increase goal achievement (Duckworth, Kirby, Gollwitzer, & Oettingen, 2013; Oettingen, 2012). According to construal-level theory, this sort of "how-to" thinking is concrete and low level—exactly opposite of the kind of construal the IVM suggests would promote self-regulation.

It will be a challenge for the IVM to explain how abstract or high-level construal can promote self-regulation in some contexts, whereas concrete or low-level construal can promote self-regulation in other contexts, in a manner that is testable and subject to falsification. But rising to this challenge would strengthen the IVM. One possibility is that an abstract mind-set that is irrelevant to the choice leads to more future-oriented choices, perhaps by priming thinking about the ideal self, but that abstract thinking about a future reward itself increases impulsivity, perhaps by making that reward feel psychologically more distant. Just as affect can modulate choice in different ways depending on the tendencies associated with that affective state and where that affect is attributed (Lempert & Phelps, 2016; Phelps, Lempert, & Sokol-Hessner, 2014), the effects of construal level on choice may be similarly context-dependent.

Conclusion

There is a large literature on both the value of identity-relevant behaviors and on the role of identity-relevance in self-regulation, but until now a mechanistic model for these phenomena had not been proposed. We think the IVM is a promising model to fill this void. We note two particular strengths of the IVM. First, it incorporates a valuation framework from neuroeconomics that has an established neural foundation. Second, it treats the "self" as a high-level mental concept. This allows for the activation of different identities to lead to different behaviors without positing the existence of one, or several, autonomous agents in the brain.

We also noted two ways in which the IVM can be strengthened. First, we urge Berkman and colleagues to lay out further testable predictions that are unique to their model. Here we have suggested one such neural test that depends on the dissociation of value and self-related signals in vmPFC. Finally, we are curious to see if the IVM can account for context-dependent findings regarding the influence of high-level construal on self-regulation in a manner that is falsifiable. Despite these challenges, we believe the IVM is a significant and timely contribution to the fields of social neuroscience and neuroeconomics,

and we look forward to reading the research that attempts to validate and refine it.

References

Ainslie, G. (2005). Précis of breakdown of will. *The Behavioral and Brain Sciences*, *28*(5), 635–50–73. doi:10.1017/S0140525×05000117

Baek, E. C., Scholz, C., O'Donnell, M. B., & Falk, E. B. (2017). The value of sharing information: A neural account of information transmission. *Psychological Science*. Advance online publication. doi:10.1177/0956797617695073

Bartels, D. M., & Urminsky, O. (2011). On intertemporal selfishness: How the perceived instability of identity underlies impatient consumption. *Journal of Consumer Research*, *38*(1), 182–198. doi:10.1086/658339

Bartra, O., McGuire, J. T., & Kable, J. W. (2013). The valuation system: A coordinate-based meta-analysis of BOLD fMRI experiments examining neural correlates of subjective value. *NeuroImage*, *76*, 412–427. doi:10.1016/j.neuroimage.2013.02.063

Baumeister, R. F. (2011). Self and identity: A brief overview of what they are, what they do, and how they work. *Annals of the New York Academy of Sciences*, *1234*(1), 48–55. doi:10.1111/j.1749-6632.2011.06224.x

Bechara, A., Damasio, H., Tranel, D., & Damasio, A. R. (1997). Deciding advantageously before knowing the advantageous strategy. *Science (New York, N.Y.)*, *275*(5304), 1293–1295. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9036851

Benoit, R. G., Gilbert, S. J., & Burgess, P. W. (2011). A neural mechanism mediating the impact of episodic prospection on farsighted decisions. *The Journal of Neuroscience*, *31*(18), 6771–6779. doi:10.1523/JNEUROSCI.6559-10.2011

Camille, N., Griffiths, C. A., Vo, K., Fellows, L. K., & Kable, J. W. (2011). Ventromedial frontal lobe damage disrupts value maximization in humans. *Journal of Neuroscience*, *31*(20), 7527–7532. doi:10.1523/JNEUROSCI.6527-10.2011

Clithero, J. A., & Rangel, A. (2014). Informatic parcellation of the network involved in the computation of subjective value. *Social Cognitive and Affective Neuroscience*, *9*(9), 1289–1302. doi:10.1093/scan/nst106

Cooper, N., Bassett, D. S., & Falk, E. B. (2017). Coherent activity between brain regions that code for value is linked to the malleability of human behavior. *Scientific Reports*, *7*, 43250. doi:10.1038/srep43250

Cooper, N., Kable, J. W., Kim, B. K., & Zauberman, G. (2013). Brain activity in valuation regions while thinking about the future predicts individual discount rates. *The Journal of Neuroscience*, *33*(32), 13150–13156. doi:10.1523/JNEUROSCI.0400-13.2013

Cooper, N., Tompson, S., O'Donnell, M. B., & Falk, E. B. (2015). Brain activity in self- and value-related regions in response to online anti-smoking messages predicts behavior change. *Journal of Media Psychology*, *27*(3), 93–109. doi:10.1027/1864-1105/a000146

Duckworth, A. L., Kirby, T., Gollwitzer, A., & Oettingen, G. (2013). From fantasy to action: Mental Contrasting with Implementation Intentions (MCII) improves academic performance in children. *Social Psychological and Personality Science*, *4*(6), 745–753. doi:10.1177/1948550613476307

Ersner-Hershfield, H., Garton, M. T., Ballard, K., Samanez-Larkin, G. R., & Knutson, B. (2009). Don't stop thinking about tomorrow: Individual differences in future self-continuity account for saving. *Judgment and Decision Making*, *4*(4), 280–286. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19774230

Ersner-Hershfield, H., Wimmer, G. E., & Knutson, B. (2009). Saving for the future self: Neural measures of future self-continuity predict temporal discounting. *Social Cognitive and Affective Neuroscience*, *4*(1), 85–92. doi:10.1093/scan/nsn042

Falk, E. B., O'Donnell, M. B., Cascio, C. N., Tinney, F., Kang, Y., Lieberman, M. D., & Strecher, V. J. (2015). Self-affirmation alters the brain's response to health messages and subsequent behavior change. *Proceedings of the National Academy of Sciences of the United States of America*, *112*(7), 1977–1982. doi:10.1073/pnas.1500247112

Fellows, L. K., & Farah, M. J. (2004). Different underlying impairments in decision-making following ventromedial and dorsolateral frontal lobe damage in humans. *Cerebral Cortex*, *15*(1), 58–63. doi:10.1093/cercor/bhh108

Fudenberg, D., & Levine, D. K. (2006). A dual-self model of impulse control. *American Economic Review*, *96*(5), 1449–1476. doi:10.1257/aer.96.5.1449

Fujita, K., & Carnevale, J. J. (2012). Transcending temptation through abstraction: The role of construal level in self-control. *Current Directions in Psychological Science*, *21*(4), 248–252. doi:10.1177/0963721412449169

Fujita, K., Trope, Y., Liberman, N., & Levin-Sagi, M. (2006). Construal levels and self-control. *Journal of Personality and Social Psychology*, *90*(3), 351–367. Retrieved from http://psycnet.apa.orgjournals/psp/90/3/351

Henri-Bhargava, A., Simioni, A., & Fellows, L. K. (2012). Ventromedial frontal lobe damage disrupts the accuracy, but not the speed, of value-based preference judgments. *Neuropsychologia*, *50*(7), 1536–1542. doi:10.1016/j.neuropsychologia.2012.03.006

Hershfield, H. E. (2011). Future self-continuity: How conceptions of the future self transform intertemporal choice. *Annals of the New York Academy of Sciences*, *1235*, 30–43. doi:10.1111/j.1749-6632.2011.06201.x

Hershfield, H. E., Goldstein, D. G., Sharpe, W. F., Fox, J., Yeykelis, L., Carstensen, L. L., & Bailenson, J. N. (2011). Increasing saving behavior through age-progressed renderings of the future self. *Journal of Marketing Research*, *48*, S23–S37. doi:10.1509/jmkr.48.SPL.S23

Hutcherson, C. A., Bushong, B., & Rangel, A. (2015). A neurocomputational model of altruistic choice and its implications. *Neuron*, *87*(2), 451–462. doi:10.1016/j.neuron.2015.06.031

Kable, J. W., & Glimcher, P. W. (2007). The neural correlates of subjective value during intertemporal choice. *Nature Neuroscience*, *10*(12), 1625–1633. doi:10.1038/nn2007

Kable, J. W., & Glimcher, P. W. (2010). An "as soon as possible" effect in human intertemporal decision making: Behavioral evidence and neural mechanisms. *Journal of Neurophysiology*, *103*(5), 2513–2531. doi:10.1152/jn.00177.2009

Krajbich, I., Armel, C., & Rangel, A. (2010). Visual fixations and the computation and comparison of value in simple choice. *Nature Neuroscience*, *13*(10), 1292–1298. doi:10.1038/nn.2635

Krajbich, I., & Rangel, A. (2011). Multialternative drift-diffusion model predicts the relationship between visual fixations and choice in value-based decisions. *Proceedings of the National Academy of Sciences*, *108*(33), 13852–13857. doi:10.1073/pnas.1101328108

Kurzban, R., Duckworth, A., Kable, J. W., & Myers, J. (2013). An opportunity cost model of subjective effort and task performance. *Behavioral and Brain Sciences*, *36*(6), 661–679. doi:10.1017/S0140525×12003196

Lempert, K. M., & Phelps, E. A. (2016). The malleability of intertemporal choice. *Trends in Cognitive Sciences*, *20*(1), 64–74. doi:10.1016/j.tics.2015.09.005

McGuire, J. T., & Kable, J. W. (2012). Decision makers calibrate behavioral persistence on the basis of time-interval experience. *Cognition*, *124*(2), 216–226. doi:10.1016/j.cognition.2012.03.008

McGuire, J. T., & Kable, J. W. (2013). Rational temporal predictions can underlie apparent failures to delay gratification. *Psychological Review*, *120*(2), 395–410. doi:10.1037/a0031910

McGuire, J. T., & Kable, J. W. (2015). Medial prefrontal cortical activity reflects dynamic re-evaluation during voluntary persistence. *Nature Neuroscience*, *18*(5), 760–766. doi:10.1038/nn.3994

Medin, D. L., & Smith, E. E. (1984). Concepts and concept formation. *Annual Review of Psychology*, *35*(1), 113–138. doi:10.1146/annurev.ps.35.020184.000553

Mitchell, J. P., Schirmer, J., Ames, D. L., & Gilbert, D. T. (2011). Medial prefrontal cortex predicts intertemporal choice. *Journal of Cognitive Neuroscience*, *23*(4), 857–866. doi:10.1162/jocn.2010.21479

Murphy, G. L. (2002). *The big book of concepts*. Cambridge, MA: MIT Press.

Murray, R. J., Schaer, M., & Debbané, M. (2012). Degrees of separation: A quantitative neuroimaging meta-analysis investigating self-specificity and shared neural activation between self- and other-reflection. *Neuroscience & Biobehavioral Reviews*, *36*(3), 1043–1059. doi:10.1016/j.neubiorev.2011.12.013

Oettingen, G. (2012). Future thought and behaviour change. *European Review of Social Psychology*, *23*(1), 1–63. doi:10.1080/10463283.2011.643698

Oettingen, G., & Mayer, D. (2002). The motivating function of thinking about the future: Expectations versus fantasies. *Journal of Personality*

and Social Psychology, *83*(5), 1198–1212. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12416922

Oettingen, G., & Wadden, T. A. (1991). Expectation, fantasy, and weight loss: Is the impact of positive thinking always positive? *Cognitive Therapy and Research*, *15*(2), 167–175. doi:10.1007/BF01173206

Palombo, D. J., Keane, M. M., & Verfaellie, M. (2015). The medial temporal lobes are critical for reward-based decision making under conditions that promote episodic future thinking. *Hippocampus*, *25*(3), 345–353. doi:10.1002/hipo.22376

Parthasarathi, T., McConnell, M. H., Luery, J., & Kable, J. W. (2017). The vivid present: Visualization abilities are associated with steep discounting of future rewards. *Frontiers in Psychology*, *8*, 289. doi:10.3389/fpsyg.2017.00289

Peters, J., & Büchel, C. (2010). Episodic future thinking reduces reward delay discounting through an enhancement of prefrontal-mediotemporal interactions. *Neuron*, *66*(1), 138–148. doi:10.1016/j.neuron.2010.03.026

Phelps, E. A., Lempert, K. M., & Sokol-Hessner, P. (2014). Emotion and decision making: Multiple modulatory neural circuits. *Annual Reviews of Neuroscience*, *37*, 263–290. doi:10.1146/annurev-neuro-071013-014119

Ross, D. (2005). *Economic theory and cognitive science: Microexplanation*. Cambridge, MA: MIT Press.

Ross, D. (2008). *Midbrain mutiny: The picoeconomics and neuroeconomics of disordered gambling: Economic theory and cognitive science*. Cambridge, MA: MIT Press.

Sasse, L. K., Peters, J., Büchel, C., & Brassen, S. (2015). Effects of prospective thinking on intertemporal choice: The role of familiarity. *Human Brain Mapping*, *36*(10), 4210–4221. doi:10.1002/hbm.22912

Scholz, C., Baek, E. C., O'Donnell, M. B., Kim, H. S., Cappella, J. N., & Falk, E. B. (2017). A neural model of valuation and information virality. *Proceedings of the National Academy of Sciences of the United States of America*, *114*(11), 2881–2886. doi:10.1073/pnas.1615259114