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Title	Is resolve mainly about resisting hyperbolic discounting?
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Publication date	2021-04-26
Original Citation	Ross D. (2021) 'Is resolve mainly about resisting hyperbolic discounting?', Behavioral and Brain Sciences, 44, e52. doi: 10.1017/S0140525X20000837
Type of publication	Article (peer-reviewed)
Link to publisher's version	10.1017/S0140525X20000837
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Download date	2026-11-04 11:46:41
Item downloaded from	https://hdl.handle.net/10468/11257

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Commentary on George Ainslie

Word counts: Abstract: 60; Main text: 1003; References: 19; Entire text: 1153

Title: Is resolve mainly about resisting hyperbolic discounting?

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Abstract: Ainslie insightfully refines the concept of willpower by emphasizing low-effort applications of resolve. However, he gives undue weight to intertemporal discounting as the problem that willpower is needed to overcome. Non-humans typically don't encounter choices that differ only in the time of consumption. Humans learn to transform uncertainty into problems they can solve using culturally evolved mechanisms for quantifying risk.

Ainslie's essay displays again his matchless artistry in refining our conceptual resources for describing ambivalent choice behavior. Human willpower, as he argues, is more complex than metaphors drawn from energetic exertion can capture. In its most reliable applications it requires little effort at its moments of use. I once had to deliberately battle with myself to avoid a third glass of wine before bed each night. Now it's two and done with no conscious attention. My will rules absolutely and serenely. This is resolve, paying a steady dividend stream from an investment made long ago. I get a side payment: each sip of wine tastes better when there's no ambivalence about its goodness.

Other animals don't seem to get to enjoy such triumphs. As Ainslie points out, a dog is visibly uncomfortable while waiting to be allowed to eat a biscuit, apparently losing an opportunity to enjoy the anticipation. The dog's willpower seems limited

to active suppression of the urge to disobey her owner, and active suppression is unpleasant. Ainslie argues that the dog's foregone consumption utility stems from a lack of foresight. Human achievement of this capacity, he rightly says, is among the primary bases of the species' ecological dominance.

This is deeply insightful and persuasive. What is less so is Ainslie's explanation of it almost entirely in terms of hypothesized neural implementation of hyperbolic intertemporal discounting of reward value, to which the dog is said to be prisoner but which the human often manages to work around. Ainslie appeals to neuroimaging evidence for this hypothesis. But the evidence in question comes heavily pre-interpreted. For example, Kable & Glimcher (2007) *assume* that the measurements of BOLD differences they graph hyperbolically represent intertemporal discounting. That's fair enough in context: it's the maintained hypothesis of a rival model they collected their data to test and then criticize. But the signals might just as easily be related to preparation for reward harvesting rather than to utility differences associated with expected *time* of consumption.

Rats, pigeons, chimps, and bees do seem to discount future rewards hyperbolically *if* we assume that their choices are over time-indexed rewards. But these behavioral patterns can equally be modeled as responses to uncertainty more generally. Here is food the bee can harvest under circumstances where she's detecting no signs of danger. Who knows when she'll next be so lucky? The patch over the hill might be a richer source, which she could exploit only if she's patient and doesn't fill her pollen sacks right here. But the probability of a predatory wasp being *there* is higher than the probability of a wasp *here*, simply because she doesn't see one now.

Humans arguably have technologies that most animals lack for turning uncertainty into (roughly) quantified risk. The technologies in question are probably culturally evolved, rather than based on novel adaptations that could be measured in functional neural architecture. Humans divide labour and distribute roles based on explicit rules and normative principles that they encode in shared stories, or, lately and more reliably, in written regulations and numerical algorithms. Then, as Ainslie has emphasized for years, they can apply this governance by regulations to themselves. A person can explicitly insert herself into the virtual role of a boss or influential peer, and give herself orders. As Ainslie has also stressed insightfully, she can even construct a virtual tyrant over herself, against whom she looks for loopholes and might stage a disruptive revolt.

Of course animals, including humans, must pay attention to time. A songbird in a high latitude can in summer wait to venture out to forage until all owls have surely retired, but risks starving if she is equally patient for sunrise in mid-winter. But it isn't clear that she should, or does, represent this by computing an intertemporal discount function. She tolerates higher risk of predation in January than in July because burning energy while hiding in the bush is also risky. The mere prospect of time ahead is a source of risk, because intervals always include *events*, and event probabilities get harder to estimate as their interactions over time accumulate and must be multiplied.

Ainslie may be encouraged to take future time preference as a primitive instead of one of many arguments in a risk function because his favored metaphor for behavioral control at the scale of the whole organism is a marketplace. He understands interests in different consumption prospects as bidding against one another in a common currency. Then the only evident factor that could possibly make 2 seed pellets now preferable to 4 seed pellets in 2 hours is the difference between now and later. Humans *deliberately* create choices like this for themselves, because doing so turns uncertainty into risk and allows us to apply powerful tools we've collectively developed, mathematics and statistics. This is how humans pull off most of their highly distinctive feats: by actively transforming decision problems into terms for which their social environments provide solution rules. Most animals in the wild – though elephants, dolphins, corvids, and parrots might be exceptions – simply don't encounter option sets that differ only or mainly in time of consumption. In the lab we can try to force them to reckon with such problems, but it's difficult to fully succeed. The mouse who stays close to the wall of her cage evidently isn't getting the message that her predation risk is zero. And, in any event, she can't imagine a more authoritative mouse telling her to let rationality override her fear.

The internal marketplace metaphor certainly has its uses. A brain doing a job must allow itself to be distracted by new opportunities, but not too easily. And this requires that alternative objects of attention be comparatively valued in real time. Expected consumption time of rewards is a recurrently important variable, and one that we *know* is estimated by dopamine signals. But real markets, unless they involve only very simple informational dynamics, are highly volatile and inefficient unless they are well regulated. Resolve as Ainslie characterizes it requires good government.

Conflicts of interest: None

Funding statement: This research received no specific grant from any funding agency.

References

Kable, J., & Glimcher, P. (2007). The neural correlates of subjective value during intertemporal choice. *Nature Neuroscience* 10:1625-1633.