

Once More, with Feeling! Reply to Ainslie

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Abstract Ainslie's contribution offers a useful refinement of his powerful model of intertemporal bargaining. However, he focuses mostly on the cognitive mechanisms of choice. I suggest that these interact with emotional, personality, and developmental dynamics that cannot be ignored, either psychologically or neurally.

Keywords Ainslie's contribution · Extending "intertemporal bargaining" · Importance of emotional dynamics · Importance of developmental dynamics · Personality features · Desire and dopamine · Character of internal dialogue · Cooperation vs. defiance

Ainslie's classic book, *Breakdown of Will* [1], may have influenced my thinking about addiction more than anything else. The critical role of delay discounting has been recognized by others who study addiction and impulsive behavior. But Ainslie's emphasis on the hyperbolic shape of the discounting curve, rising suddenly in proximity to immediate rewards, seems to clinch the insidious nature of addiction most persuasively. My emphasis on "now appeal" in *The Biology of Desire* [2] was inspired by Ainslie's account of hyperbolic discounting. I saw the addict's challenge as breaking away from the lure of a recurring "now" by expanding the horizons of temporal awareness, into the past as well as the future. And in this

thinking I was guided by Ainslie's most profound contribution to understanding the inner world of addiction: the idea of intertemporal bargaining. Both reading the record of my own thoughts during my years of addiction, and when listening to others currently struggling to quit, I find that the idea of intertemporal bargaining (or intertemporal negotiation) captures the back-and-forth internal debate – should I or not? – better than any other construct.

In his commentary, Ainslie [3] makes it clear that he and I [4] agree on the fundamental cognitive mechanisms that embed the addictive habit as well as those that help people move beyond addiction. He also introduces refinements that further extend his model of intertemporal bargaining. He notes the value of "bundling" future reward expectations to augment their reach, the metacognitive processes that can further increase the appeal of delayed rewards, the derivation of "personal rules" and "good stories" to shore up the habit strength of such choices and increase the attraction of future payoffs, and the iterative, self-perpetuating nature of both "good" and "bad" choices. For me, these elaborations add useful layers of detail and precision to a model that has already proved invaluable.

However, Ainslie chooses not to focus on the emotional currents, the circular trajectories of self-blame, shame, defiance, and loss that interact with cognitive mechanisms of choice. He also pays little heed to the developmental accumulation of these factors, expressing themselves in personality dynamics that lock in addictive patterns. I try to build these factors into my modeling, partly by referring to the functions of neural systems responsible for feelings, urges, and fears, and partly by

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using the narratives addicts tell about their experience as a legitimate – in fact necessary – data base.

Emotional factors are critical for contextualizing both delay discounting and intertemporal bargaining. Delay discounting is not just a cognitive bias that can be modeled by various algorithms. It's the plunging of one's desire into the pursuit of a singular goal. We must understand how desire itself narrows the frame of relevant possibilities. Desire by its nature hooks onto particular objects or people or activities, and it plays a crucial mediating role in the feedback cycle of goal pursuit, satisfaction, loss, and subsequent goal pursuit that characterizes addictive habit formation. That spiraling of desire for specific targets, tightening over time, is the process by which delay discounting becomes not only a cognitive bias but a relentless distortion of how one experiences the world.

In neural terms, desire is the product of dopamine uptake to the striatum, and the brain changes thought to accompany addiction hinge on changes in dopamine uptake and reception, both in the striatum and in the prefrontal cortex. I see the development of addiction as a process of forgetting how to think outside the "now." And I take this process to be the psychological correlate of a loss of communication between prefrontal regions – responsible for judgment – and the striatum – responsible for desire – induced by alterations in dopaminergic function. It's no accident that dopamine both sparks the desire to pursue goals and narrows the beam of attention to what's immediately available. When it does that repeatedly, the temporal horizon shrinks progressively as the brain retunes itself. For me, this neuro-psychological process lies at the heart of addiction. Thus, dopamine, desire, and delay discounting, the three D's, constitute a cohesive trinity for studying the nature of addiction, and no member of that trinity should be ignored.

The role of emotional factors in personality development also seems critical for understanding intertemporal bargaining. Who are these voices, these selves, one in the here-and-now and the other tuning in from an imagined

future? When I work with clients struggling with addiction, I try to help them focus on the emotional quality of these voices. Are they denigrating or forgiving, scornful or kind, aggressively insistent or warmly self-accepting? These features of one's internal voices seem absolutely critical to the outcome of intertemporal bargaining. A future voice that accepts and forgives the emotional maelstrom, the craving and shame, in which the present self is enmeshed, has a chance to invite cooperation rather than defiance or despair: "Let's just try to think about next week rather than now. I know it's difficult, but let's give it a try." I also try to help clients trace the history of these internal dialogues and notice where and how the voices themselves evolved. This project is of course tied to many past and current themes in clinical psychology, but I've seen it work well with people stuck in addiction. At its best, this therapeutic process can reveal where one's personality development comes from, not just to excavate historical facts but to promote self-forgiveness in lieu of the harsh self-judgments that fuel addiction.

Ainslie's finely crafted cognitive model seems an ideal framework for understanding how choice gets pulled this way and that by time, reward perception, practice, and self-talk. Such models capture what we need to know about the frivolous rationality of bad choices. I hope this kind of modeling will also provide a template for uncovering the more personal, emotional, and developmental dynamics that befuddle addicts and those who try to help them.

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