



Ordinary people associate addiction with loss of free will



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ABSTRACT

Introduction: It is widely believed that addiction entails a loss of free will, even though this point is controversial among scholars. There is arguably a downside to this belief, in that addicts who believe they lack the free will to quit an addiction might therefore fail to quit an addiction.

Methods: A correlational study tested the relationship between belief in free will and addiction. Follow-up studies tested steps of a potential mechanism: 1) people think drugs undermine free will 2) people believe addiction undermines free will more when doing so serves the self 3) disbelief in free will leads people to perceive various temptations as more addictive.

Results: People with lower belief in free will were more likely to have a history of addiction to alcohol and other drugs, and also less likely to have successfully quit alcohol. People believe that drugs undermine free will, and they use this belief to self-servingly attribute less free will to their bad actions than to good ones. Low belief in free will also increases perceptions that things are addictive.

Conclusions: Addiction is widely seen as loss of free will. The belief can be used in self-serving ways that may undermine people's efforts to quit.

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1. Lay people associate addiction with loss of free will

A widespread view among health professionals is the idea that addiction is a disease caused by problems when the brain encounters certain foreign substances commonly known as addictive drugs (e.g. Jellinek, 1960; Leshner, 1997; Volkow & Fowler, 2000). Although this message has been widespread to the public, among scholars this view is hardly uniformly accepted. A large and growing literature supports an alternative view in which addiction is primarily a disorder of choice (e.g., Baumeister & Vonasch, 2015; Heyman, 2009; Schaler, 2000). Given the apparent conflict between these scientific perspectives, scholars should perhaps exercise restraint in promoting one view over the other to the general public. The widespread notion that addiction is a disorder of the brain may lead addicts to harbor destructive beliefs that they cannot control themselves, and that they do not possess the free will needed to override their addictive behaviors. Hence, the resulting disbelief may then thwart the very capacities that are needed

to cure or overcome addictions. In this article, we present evidence that addicts and the general public believe that addiction entails a loss of self-control and free will, and that disbelief in free will is associated with higher drug use, fewer successful attempts to quit, and more unsuccessful attempts to quit alcohol and drugs. We also show that addicts use this belief self-servingly to justify and excuse their own problematic addictive behaviors. Finally, we show that this tendency to downplay one's own free will in response to addiction may be a self-fulfilling prophecy whereby believing less in free will increases the perceived power of addictive substances and decreases perceptions of one's own self-control.

1.1. Free will

Most people believe in free will, by which they typically mean the ability to make free choices and to choose one's own actions, without unusual constraint (Feldman, Baumeister, & Wong, 2014; Monroe & Malle, 2010). Free will is central to ideas of justice and responsibility: a person cannot be found guilty of a crime if the person lacked the ability to control his or her actions, which is the basis of the insanity defense (Roberts, Golding, & Fincham, 1987). People need free will in order to be held responsible for good behaviors, too. As one sign, people who disbelieve in free will are less grateful to others who help them because they think those others did not freely choose to help (Mackenzie,

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Vohs, & Baumeister, 2014). People are responsible for their actions if they can control them—if they could not do otherwise, there is little reason for them to try, and little reason for others to applaud or condemn their efforts (Greene & Cohen, 2004; Shariff et al., 2014).

The common notion of free will may differ from the idea that many scientists and philosophers dispute (e.g., Crick, 1994; Wegner, 2002). The scholarly debate about free will primarily revolves around the question of whether free choice is possible within a deterministic universe (e.g., Nichols & Knobe, 2007). However, to the layperson, free will is seemingly about freedom of choice (Feldman et al., 2014; Monroe & Malle, 2010). Here, we are not taking a position in the debate of whether free will exists. Regardless of whether free will actually exists, most people believe it does, and this belief affects their behavior, generally by giving them a greater sense of agency and responsibility for their actions (Baumeister & Brewer, 2012).

1.1.1. Free will and self-control

Belief in free will may be especially important for overriding, controlling, and stopping addictive behaviors. A core aspect of belief in free will is the idea that one is capable of controlling one's own actions (Feldman et al., 2014; Monroe & Malle, 2010). People use self-control to direct their own lives toward optimal outcomes, and people who fail to use self-control suffer from myriad bad outcomes, including worse school and job performance, lower incomes, more likelihood of criminality, and higher rates of substance abuse and addiction (Tangney, Baumeister, & Boone, 2004). Good self-control aids with quitting an addiction (Brandon et al., 2003; Muraven, 2010), presumably because an addiction is characterized by strong desires (Robinson & Berridge, 2000) that must be overridden by self-control.

Because successful self-control depends in part on believing that one is capable of self-control, discouraging the idea that people have this capacity could undermine self-control. Indeed, undermining people's belief in free will decreases their self-control (Rigoni, Kühn, Gaudino, Sartori, & Brass, 2012). This, in turn, may explain why disbelief in free will increases cheating behavior (Vohs & Schooler, 2008) and prejudice (Zhao, Liu, Zhang, Shi, & Huang, 2014), behaviors that a person with a strong belief in free will would be more likely to resist.

Because disbelief in free will impairs self-control, and self-control helps resist addictive behaviors, encouraging disbelief in free will might undermine addicts' efforts to reduce substance use or to quit altogether. In contrast, people who strongly believe in free will might be less likely to become addicted, and more likely to successfully quit if they do become addicted. Consistent with this idea, self-efficacy toward quitting, or the specific belief that one is capable of quitting, increases the rate at which people quit tobacco (e.g. DiClemente, 1981; Garvey, Bliss, Hitchcock, Heinold, & Rosner, 1992) and alcohol (e.g. Solomon & Annis, 1990). Therefore, one of our hypotheses was that believing in one's capacity for free will would increase quitting success.

1.1.2. Free will and decision-making

The ability to make one's own decisions is also central to most people's belief in free will (Feldman et al., 2014; Monroe & Malle, 2010), and likely plays an important role in aiding quitting. Most addicts quit drugs (even hard drugs like heroin) without therapy or formal treatment (Heather & Robertson, 1981; Zinberg, 1984). For example, after the Vietnam War, 20% of US army veterans were addicted to heroin. The army prepared for an epidemic of drug use, but upon returning home, the vast majority managed to quit on their own, leaving a mere 1% who remained heroin addicts (Robins, Helzer, & Davis, 1975).

For people who use therapy to help themselves quit, there are many kinds of addiction therapies. One key aspect of all of the successful treatments is that the addict must decide to quit (Heather, Rollnick, & Winton, 1982, 1983; Miller & Rollnick, 2012). If the addict does not decide to quit, he or she will generally relapse soon after treatment, even if the drug is completely removed from his or her body. In order for people to choose to quit, they must believe that it is possible to 1) make such a

choice and 2) follow through with it (i.e., they must believe in free will and self-control).

1.2. Public messages about free will and addiction

Even though belief in free will in general is widespread, there is reason to believe this belief may be circumscribed for addiction. In media, anti-drug campaigns, and even in scholarly works, the notion that addiction involves a loss of free will is widespread. The very first of the 12 steps of Alcoholics Anonymous is "We admitted we were powerless over our addiction - that our lives had become unmanageable." This very popular program has disseminated this message for years. The message strongly suggests: Addicts have no free will. A later step involves transferring control to a higher power, such as a religious entity. However, intervention by higher powers is not an accepted scientific theory, and so any success has in facilitating recovery from alcohol addiction is presumably due to inspiring members to use their own agency (a.k.a. free will) to resist drinking—despite the anti-free-will rhetoric.

Scholars, too, frequently advocate the idea that addiction undermines free will. For one example, a scientist and the head of the National Institute of Drug Abuse, publically blogged "that because of drug use, a person's brain is no longer able to produce something needed for our functioning and that healthy people take for granted, *free will*" (Volkow, 2015). For another example, a review of addiction argued that addiction causes diminished choice (Kalivas & Volkow, 2005). The scientific reasoning behind the popularly disseminated message that addiction undercuts free will comes from the disease model of addiction (Jellinek, 1960; Leshner, 1997; Volkow & Fowler, 2000).

The disease model treats addiction like any other disease—it is caused by physical ailments in the brain, which, if healed, should cure the disease. Thinking of addiction as a disease of the brain implies that addicts lack free will. After all, one characteristic of most diseases is that the main symptoms are involuntary—one cannot will away a sore throat or heart attack. If addiction is a disease, this implies that addicts cannot will away their addictive behaviors. Moreover, brain disorders are commonly viewed as undermining free will (Shariff et al., 2014).

The disease model assumes that people lack free will because the drugs change their brain, causing addiction (Leshner, 1997, 1999; Robinson & Berridge, 2000). It is clear that changes in brain functioning are associated with addictive behaviors. However, addiction primarily changes the brain in areas responsible for processing information about reward and desire, not motor areas that are directly related to behavior (Koob & Le Moal, 2001; Wise, 2002). Thus, it is inaccurate to say that addiction controls a person's behavior, though addiction affects what people desire and therefore what they tend to choose. If addiction is a disease, its main symptom is disordered choice—not lack of choice.

A new model of addiction, usually thought to conflict with the disease model (but see Kennett, 2013), holds that addictive behaviors primarily stem from free choices to use drugs (Heyman, 2009; Lewis, 2011; Schaler, 2000). According to the choice model, addiction involves loss of control over wanting drugs, but the person remains in control of behavior and maintains free will. Having desires to use drugs surely makes the choice to abstain more difficult for addicts, and disordered choice more common, but people retain the ability to control their actions and abstain (for a review of controlled processes in addiction, see Baumeister & Vonasch, 2015). This view of addiction as being consistent with free will is supported by the effectiveness of drug treatment programs, many of which target changing the person's mind about taking the drugs, which only indirectly changes the person's brain (Miller & Rollnick, 2012). It is also consistent with the data showing that most addicts successfully quit without any formal treatment of their physical symptoms or of their brain (Heather & Robertson, 1981; Zinberg, 1984). Moreover, it is consistent with most former addicts' experiences—addicts are able to abstain for years, even though the cravings may abate but never completely cease (Cutler, 2005).

The two models of addiction remain actively debated among scientists, and it is possible that the evidence may one day conclusively show that addiction does or does not impair free will. The point, though, is that the current evidence has not yet definitively shown that addiction is incompatible with free will. Furthermore, public messages stating that science has discovered that people suffering from addiction have lost free will may have unforeseen negative consequences. A particularly worrisome possibility is that if laypeople internalize the message that addiction removes their free will, they may self-servingly use this as an excuse to justify their addiction problems, or even fail to seek treatment for their addiction because they view it as impossible to control.

1.3. Stages of addiction

The disease model implies a certain course that each addiction will take over time, depending on the stage of a person's addiction. We divide the life course of an addiction into four heuristic stages (Baumeister & Vonasch, 2015). The first (pre-addiction) stage occurs when a person first learns about a substance and begins trying it. The second stage (stable addiction) is the stage at which a person is generally considered an addict, characterized by regular use of the substance and no serious attempt to quit. The third stage (quitting the addiction) involves trying to resist urges to use the substance. The fourth stage (post-quitting, avoiding relapse) occurs after one has quit and is trying to remain sober and not relapse.

To the extent that the members of general public have embraced the disease model of addiction, they may believe that free will is diminished when someone moves from the first (pre-addiction) to the addiction stage. Along the same lines, they may believe that free will remains low during the third stage (struggling to quit), because the person remains ensnared by the addiction. The level of free will in the fourth stage may be intermediate: People might believe that the ex-addict has recovered some free will by quitting but remains somewhat under the influence of inner pressures to resume using. Indeed, the popular and simplistic notion that once a person is an addict, he or she is always an addict seemingly implies that free will is never fully recovered.

1.4. Present research overview

Unforeseen negative consequences may stem from internalizing the idea that free will is lost during addiction. People who struggle with addiction may put less effort into quitting if they think they lack the ability. Thus, people who disbelieve in free will may be especially prone to become addicted, and also disinclined to put in the effort required to quit. Study 1 used a correlational method to test the hypothesis that lack of belief in free will is associated with higher levels of drug and alcohol use, but lower rates of successful quitting. This would suggest the possibility that lowered belief in free will in the context of addiction could be contributing to people's addiction problems.

To test and elucidate the hypothesis linking disbelief in free will to addictive problems, we conducted five follow-up experiments. These tested a possible causal pathway to explain the correlation in Study 1. Study 2 tested the hypothesis that people believe that seeking drugs is less free than seeking non-drug rewards like dinner. Study 3 tested the hypothesis that people think consuming alcohol is less free than consuming non-addictive things, like meat, even if the behavior is described in otherwise identical terms. It tested the additional hypothesis that consuming alcohol is especially unfree once an addiction has begun—i.e., addiction most reduces free will in the stable use, quitting, and relapse stages, more so than in the pre-addiction stage.

Further studies were concerned with the hypothesis that addicts may use their ostensible lack of free will to justify and excuse their bad behavior, rather than using their bad behavior as a motivating reason to quit the addiction. Study 4 tested the hypothesis that people who succumbed to an addictive impulse (rather than resisting it) would claim that their addiction had impaired their free will, especially when

they thought succumbing to their temptation was morally bad. Study 5 tested the hypothesis that people who wrote about a time when succumbing to an addiction caused a bad problem would attribute less free will to themselves than people who wrote about a time when succumbing to an addiction did not cause them a problem. Last, Study 6 tested the hypothesis that people who read statements arguing against the existence of free will would tend to see assorted non-drug behavior as being more addictive than people who did not read any statements about free will. This would open the possibility for a self-fulfilling prophecy—people who are led to disbelieve in free will would see drugs as more addictive, and because they see them as more addictive, they might believe less in free will and their own ability to quit.

2. Study 1: personal history of addiction and belief in free will

Study 1 tested the relationship between people's belief in free will and their history of addiction to alcohol, tobacco, and other drugs. People's beliefs in free will can be separated into belief in general free will (the belief that people in general are capable of free choice and action) and belief in personal free will (the belief that oneself is capable of free choice and action) (Rakos, Laurene, Skala, & Slane, 2008). Believing in free will (especially personal free will) might increase perceptions of self-control and the ability to freely choose to quit. Therefore, we hypothesized that people who strongly believed in general and personal free will would be less likely to have been addicted to alcohol, tobacco, or other drugs or activities in the past, and more likely to have successfully quit. Because religious people and political conservatives believe more in free will (Carey & Paulhus, 2013) and more strongly oppose drug use than secular liberals (Kendler, Gardner, & Prescott, 1997), we included measures of religiosity and political ideology to control for these factors in our analyses. In short, we predicted a negative correlation between free will belief and history of addiction, even after controlling for political and religious views.

2.1. Method

Two hundred and three American participants were recruited via Amazon's Mechanical Turk. Eleven participants failed an attention check (i.e., did not mark '47' to the prompt: "Mark 47 on this scale"), leaving 192 participants (113 female) in the sample. Participants first completed a separate study before beginning the pertinent questions relating addiction to free will. Participants completed the Free Will and Determinism Scale (Rakos et al., 2008). This scale was chosen as the measure of belief in free will because it measures both general belief in free will ($\alpha = 0.92$) and belief in one's own personal free will ($\alpha = 0.89$).⁴ Participants then answered a series of yes/no questions about whether they had ever been addicted to tobacco, alcohol, or "other substances or activities, such as gambling." For example, the questions pertaining to alcohol were: "Do you currently drink alcohol? Have you ever drunk alcohol? Have you ever been a regular drinker (i.e., drunk alcohol daily)? Have you ever tried and failed to quit drinking? Have you ever successfully quit drinking? Do you want to quit drinking?" Likert measures of political conservatism/liberalism (social, economic, and overall), internal religiosity (i.e., How many times a week do you pray?), and external religiosity (i.e., How many times a month do you attend church?) were collected.

⁴ The two reverse-scored items related to religious/fatalistic determinism were excluded from analysis ("My decisions are influenced by a higher power" and "My choices are limited because they fit into a larger plan") because religious/fatalistic determinism is not the antithesis of free will, and should not be treated as such. Including these items, the scale reliability weakens ($\alpha = 0.72$).

2.2. Results

2.2.1. Alcohol

People who had been daily drinkers in the past ($M = 42.64, SE = 1.31$) had weaker general belief in free will than people who had never been daily drinkers ($M = 47.43, SE = 0.73, F(1, 174) = 10.12, p = 0.002, \eta_p^2 = 0.055$). Past daily drinkers ($M = 25.05, SE = 0.63$) had weaker personal belief in free will than people who were never daily drinkers ($M = 26.76, SE = 0.34, F(1, 187) = 5.70, p = 0.018$). Overall, then, frequent drinking was associated with lower belief in free will.

There was a significant interaction between having been a daily drinker in the past and having quit drinking in the past in predicting general belief in free will, $F(1, 170) = 6.38, p = 0.012, \eta_p^2 = 0.036$, see Table 1. Among former daily drinkers, participants who had successfully quit drinking ($M = 44.68, SE = 1.68$) believed more strongly in free will than participants who had not successfully quit drinking ($M = 39.65, SE = 2.04, F(1, 170) = 3.62, p = 0.059, \eta_p^2 = 0.021$). Thus, belief in free will was associated with successful quitting among former daily drinkers. However, among those who had successfully quit alcohol, there was no significant difference in belief in free will between those who had been daily drinkers and those who had not ($M = 45.03, SE = 1.54, F(1, 170) = 0.024, p = 0.88$). Thus, strong belief in free will was associated with quitting alcohol, regardless of whether one was previously a regular drinker.

Among participants who had never quit drinking, those who had been a daily drinker believed less in free will than those who were never a daily drinker ($M = 48.01, SE = 0.83, F(1, 170) = 14.40, p < 0.001, \eta_p^2 = 0.078$). Thus, continued daily drinking was associated with lower belief in free will. The pattern of results was consistent, even when controlling for internal ($F(1, 164) = 0.19, p = 0.66$) and external religiosity ($F(1, 164) = 0.79, p = 0.38$), and social conservatism, $F(1, 164) = 5.68, p = 0.018$.

The pattern of results was similar in predicting belief in personal free will (see Table 1). There was a significant interaction between past drinking regularity and successful quitting, $F(1, 183) = 4.73, p = 0.031$. Among participants who had never successfully quit drinking, those who were once regular drinkers ($M = 23.50, SE = 1.03$) believed less in personal free will than those who were never regular drinkers ($M = 26.92, SE = 0.39, F(1, 183) = 9.64, p = 0.002, \eta_p^2 = 0.050$). Among onetime regular drinkers, those who successfully quit believed marginally more in personal free will than those who did not, $F(1, 183) = 3.60, p = 0.059, \eta_p^2 = 0.019$.

Participants who had tried and failed to quit drinking ($M = 41.32, SE = 1.97$) believed less in general free will than participants who had never failed to quit drinking ($M = 46.80, SE = 0.69, F(1, 172) = 6.90, p = 0.009, \eta_p^2 = 0.039$). Participants who tried and failed to quit drinking ($M = 24.19, SE = 0.90$) also believed less in personal free will than participants who never failed to quit drinking ($M = 26.60, SE = 0.32, F(1, 185) = 6.35, p = 0.013, \eta_p^2 = 0.033$).

2.2.2. Smoking

In the present sample, smoking followed the same general trend as alcohol, but the results were not statistically significant in this sample. Participants who had tried and failed to quit smoking ($M = 44.64, SE = 1.23$) believed non-significantly less in general free will than those who had never failed to quit ($M = 46.83, SE = 0.78, F(1,$

$172) = 2.26, p = 0.135$). Participants who had tried and failed to quit smoking ($M = 25.56, SE = 0.57$) believed marginally less in personal free will than those who had never failed to quit ($M = 26.69, SE = 0.36, F(1, 185) = 2.81, p = 0.096, \eta_p^2 = 0.015$).

2.2.3. Other drugs and activities

Participants who had been addicted to a substance or activity other than tobacco or alcohol ($M = 43.51, SE = 1.42$) had weaker general belief in free will than participants who had not ($M = 47.02, SE = 0.73, F(1, 174) = 4.84, p = 0.029, \eta_p^2 = 0.027$). Participants who had been addicted to a substance or activity other than tobacco or alcohol ($M = 24.97, SE = 0.67$) had weaker personal belief in free will than participants who had not ($M = 26.72, SE = 0.34, F(1, 187) = 5.42, p = 0.021, \eta_p^2 = 0.028$).

2.3. Discussion

The results offered preliminary support of the hypothesis that belief in free will relates to alcohol and drug use. People who had been addicted to alcohol espoused lower belief in free will than people who had never been addicted, and people who quit successfully had greater belief in free will than people who failed to quit. People who had tried but failed to quit smoking believed marginally less in their own personal free will. People who had been addicted to other drugs also believed less in free will.

These initial results are correlational and therefore cannot test the direction of causality. One possibility is that having a low personal belief in free will might discourage potential quitters from trying to quit alcohol and drugs. The remaining studies experimentally tested various aspects of this possible causal pathway linking lower belief in free will with less success in quitting alcohol and drugs. Additionally, people who had difficulty quitting alcohol and drugs may perceive themselves as therefore having little free will. They may in turn use their disbelief in free will to excuse and enable their addictive behaviors.

3. Study 2: drugs and perceptions of free actions

Study 2 tested the hypothesis that people think actions taken to service an addiction are less free than identical actions taken for similar reasons not pertaining to an addiction. In this study, participants read about a woman who drove recklessly across town to obtain mushrooms, either for drugs or dinner. All of her actions to obtain the mushrooms and her feelings were described identically. Based on the idea that people believe drugs reduce free will, we hypothesized that the woman's actions would be seen as less free and controlled when she did them to get drugs than when she did them to get dinner.

3.1. Method

We preregistered this study (<https://aspredicted.org/g638u.pdf>). We requested a sample of 200 participants from Mechanical Turk, which gives 80% power to detect an effect size of $d = 0.4$. Two hundred and one participants (98 male, 102 female, 1 non-binary) completed the study. All participants correctly completed the comprehension check item.

Table 1
Mean (SE) belief in free will among people with different personal histories of drug use.

Drug		Never regular user, never quit	Never regular user, quit	Past regular user, never quit	Past regular user, quit
Alcohol	General FW	48.01 (0.83)	45.03 (1.54)	39.65 (2.04)	44.68 (1.68)
	Personal FW	26.92 (0.39)	26.06 (0.71)	23.50 (1.03)	25.96 (0.79)
Tobacco	General FW	46.72 (0.91)	46.77 (2.13)	44.78 (2.07)	45.83 (1.29)
	Personal FW	26.28 (0.43)	27.11 (0.99)	25.77 (0.89)	26.55 (0.60)
Other	General FW	46.96 (0.77)	45.83 (3.52)	42.46 (2.60)	43.96 (1.69)
	Personal FW	26.61 (0.35)	28.38 (1.44)	24.36 (1.23)	25.22 (0.78)

Participants were randomly assigned to read one of two vignettes, in which a woman, Mary, drove recklessly across town in order to buy either magic mushrooms (i.e., drugs) or chanterelle mushrooms (i.e., dinner). Participants then answered five questions about whether Mary's reckless driving was free and controlled: (Mary was in control of her actions when she sped across town, Mary is responsible for her actions when she sped across town, Mary had free will when she sped across town, Mary was compelled to speed across town (Reverse coded), Mary had no choice but to speed across town (Reverse coded)). Responses were recorded on Likert scales (1 Strongly disagree to 7 Strongly agree). A comprehension check followed: "What did Mary buy from across town?"

3.1.1. Drugs vignette

Mary wanted to get high but had used her last dose of her favorite drug, psychedelic mushrooms. She drove around town for 2 h, but was dismayed to find that the three closest dealers were out of psychedelic mushrooms. She had to have them to get high! With little time to spare before she needed to get her fix, she peeled out of the parking lot and sped toward the next dealer, way across town. While she was on her way, she nearly rear-ended a car because she was going too fast. Finally, she got to the dealer's place, grabbed the mushrooms, paid for them, and raced home to use them.

3.1.2. No-drugs vignette

Mary was cooking dinner for her birthday and she wanted to make her favorite meal, roasted chanterelle mushroom ravioli. She drove around town for 2 h, but was dismayed to find that the three closest grocery stores were out of chanterelle mushrooms. She had to have them for her special dinner! With little time to spare before she needed to start cooking, she peeled out of the parking lot and sped toward the next store, way across town. While she was on her way, she nearly rear-ended a car because she was going too fast. Finally, she got to the store, grabbed the mushrooms, paid for them, and raced home to get them ready.

3.2. Results

The five questions about Mary's free will were compiled into an index measure of Mary's free will when she was speeding across town ($\alpha = 0.495$). Mary was rated as having more free will when she was driving to buy dinner ingredients ($M = 5.61$, $SE = 0.089$, $95\%CI: [5.44, 5.79]$) than when she was driving to buy drugs ($M = 5.17$, $SE = 0.087$, $95\%CI: [5.00, 5.34]$), $F(1, 199) = 12.69$, $p < 0.001$, $\eta^2 = 0.060$.

3.3. Discussion

Participants thought that a person was less in control and had less free will when she did things in order to get drugs than when she did the exact same things in order to get dinner. In other words, people thought the same person doing the same things had less free will if she was doing those things to get drugs. To our knowledge, this is the first experimental evidence that people believe drugs undermine free will.

4. Study 3: free will in stages of addiction

In this study, participants read four scenarios, depicting an action of consumption in each of the four heuristic stages of addiction (Baumeister & Vonasch, 2015). The action remained constant throughout all four stages, however, the type of the consumed substance was experimentally manipulated to be stereotypically addictive (alcohol), figuratively addictive (chocolate), or non-addictive (meat).

We tested two hypotheses. The first hypothesis was that participants would attribute less free will and control to the consumption of a clearly addictive substance (alcohol), than to the consumption of a

non-addictive substance (meat) or a figuratively addictive substance (chocolate). That is, regardless of stage of addiction, alcohol (and to a lesser extent, chocolate) would be seen as reducing free will and control.

The second hypothesis assumed that participants would view the onset of regular use as the point at which addiction begins to impair free will. Therefore, we hypothesized that participants would attribute reduced free will and control to people consuming alcohol in the stable, quitting, and relapse stages, compared to the pre-addiction stage. Furthermore, the reduction in free will and control from the pre-addiction stage to the stable stage should be more precipitous for alcohol than the possible reduction from the pre-stage to the stable stage when consuming a non-addictive substance (meat).

4.1. Method

4.1.1. Participants

We recruited a sample of 121 participants from a web panel of a German university (88 female), aged between 18 and 50 years ($M = 26.0$, $SD = 4.1$). 103 of them were college students, the rest employed persons. Participants were reimbursed with a 4 Euro Amazon online voucher.

4.1.2. Procedure

Participants were randomly assigned to one of three *substance* conditions (alcohol, meat, chocolate) and completed a sequence of four scenarios. The sequence contained the within-factor *stages*. In each scenario, a fictional protagonist (Mary) was portrayed as being in a context that represented all typical characteristics of the respective stage of an addiction. This introduction was followed by a second paragraph, describing how Mary consumed a large amount of the respective substance. This action was identical in all four stages. To illustrate, we put the detailed wording of each stage (i.e., translated from the German original) in the alcohol condition below.

4.1.2.1. Pre-addiction. Mary has never tried alcohol before. She knows nothing certain about the effects of drinking alcohol, but she is very curious about it. She intends to try it out. She expects that there are some things about alcohol that she will like, but that there also might be some negative things such as its bad taste or a hangover after consumption. She begins to experiment a little with alcohol and consumes it now and then. Some people in Mary's environment endorse her trying alcohol.

It is Friday night and Mary drinks a large amount of alcohol.

4.1.2.2. Stable addiction. Mary has a lot of experience with drinking alcohol. She knows about the effects and likes the experience of drinking alcohol. She cannot imagine not drinking alcohol and intends to keep drinking it. Mary drinks alcohol every night. It has blended into her daily routine and she tries to bring it into agreement with her other interests, especially the negative effects like hangovers. Nobody in Mary's environment acknowledges a problem with her drinking alcohol and people believe her when she says she could quit anytime she wants.

It is Friday night and Mary drinks a large amount of alcohol.

4.1.2.3. Quitting stage. Mary has a lot of experience with drinking alcohol. Recently, she is torn about its effects. On the one hand she craves to drink alcohol, but on the other hand she has experienced negative consequences to her health and her life. She can imagine living without alcohol and intends to quit drinking it. However, her drinking behavior has become erratic, with periods of abstinence followed by repeated lapses and heavy consumption again. Some people in Mary's environment disapprove of her consumption of alcohol and strongly advise her to quit it.

It is Friday night and Mary drinks a large amount of alcohol.

4.1.2.4. Relapse stage. Mary has had a lot of experience with drinking alcohol. She used to drink it regularly but she ceased drinking alcohol a year ago. She is convinced that alcohol has mostly negative effects on her life and her health. She intends to stay abstinent. Sometimes though, she still feels a craving for alcohol and thinks about drinking it. Therefore, she tries to avoid instances where she comes in contact with things that remind her of drinking alcohol or which are tempting. Most people in Mary's environment endorse her intention not to drink any alcohol, while some do not see a problem in consuming alcohol every now and then.

It is Friday night and Mary drinks a large amount of alcohol.

Across the between factor *substance*, those scenarios differed only in the wording of the substance ('drink alcohol', 'eat meat', 'eat chocolate'; e.g., "It is Friday night and Mary eats a large amount of chocolate") and in the quality of the negative side-effects of each substance, which were mentioned in the pre and stable stages (i.e., alcohol: bad taste, hang-over; meat: unhealthy, ethically questionable; chocolate: overweight potential, bad teeth).

The scenarios followed a fixed sequence: pre-addiction, stable addiction, quitting stage, and relapse stage.

4.1.3. Measures

Following each scenario, the participants answered five items, which referred to Mary's action. The first two items were the dependent variables: attributions of *free will* ("Mary had free will when she drank/ate a large amount of alcohol/meat/chocolate") and *control* ("Mary was in control of her actions when she drank/ate a large amount of alcohol/meat/chocolate"). The remaining items, "Mary exerted much willpower when she drank/ate a large amount of alcohol/meat/chocolate", "What is the extent of willpower that Mary will have to resort to generally in her current situation?" and "Mary experienced much freedom when she drank/ate a large amount of alcohol/meat/chocolate" were included for exploratory purposes and are not discussed further here.

All items were rated on 7-point Likert scales (1 strongly disagree – 7 strongly agree; 1 none at all – 7 very much for the general willpower item).

4.2. Results

Mixed ANOVAs (stage x substance) on all measures tested main effects and interactions. Paired-sample and independent samples *t*-tests elucidated the effects within the stages and substance manipulations. Because the assumption of sphericity was violated in all mixed ANOVAs, we report all Greenhouse-Geisser corrected *p*-values.

4.2.1. Free will

On ratings of Mary's free will, ANOVA revealed a highly significant main effect for the within factor *stage* ($F(3, 354) = 25.14, p < 0.001, \eta^2_p = 0.18$), a small significant interaction ($F(6, 354) = 2.48, p =$

$0.028, \eta^2_p = 0.04$), and a highly significant between-subjects effect for *substance* ($F(2, 118) = 8.81, p < 0.001, \eta^2_p = 0.12$), see Fig. 1.

Across all stages of addiction, participants attributed less free will to Mary when she consumed alcohol than when consuming meat, $F(1, 79) = 19.03, p < 0.001, \eta^2_p = 0.19$. Likewise, they attributed less free will to Mary when she consumed chocolate than when meat $F(1, 79) = 9.00, p = 0.004, \eta^2_p = 0.10$. There was no significant difference in free will judgments between alcohol and chocolate, $F(1, 79) = 1.30, p = 0.257$. Mary was seen as having less free will in consuming alcohol and chocolate (one genuinely addictive and one nominally so) than in consuming meat, across all stages of addiction.

Although drinking alcohol was judged as less free than eating meat in general, a significant interaction revealed that this difference in judgment differed by stage, $F(3, 237) = 3.98, p = 0.010, \eta^2_p = 0.05$. In the alcohol condition, from pre-addiction to stable addiction, free will judgments decreased significantly ($t(39) = 2.35, p = 0.024, d = 0.37$), and remained lower than pre-addiction levels in the quitting ($t(39) = 4.25, p < 0.001, d = 0.68$) and relapse stages ($t(39) = 2.61, p = 0.013, d = 0.42$). In contrast, in the meat condition, from pre-addiction to stable addiction free will judgments significantly increased, $t(40) = 2.25, p = 0.030, d = 0.36$. Thus, participants judged that alcohol reduces free will at the onset of addiction (the stable addiction stage), and this reduction in free will continues throughout the quitting and relapse stages. Moreover, the loss of attributed free will at the stable addiction stage occurs for addictive substances like alcohol, but not non-addictive substances like meat, even though the patterns of consumption were the same.

4.2.2. Control

The next ANOVA examined attributions of Mary's control over her behavior. It revealed a highly significant large effect for *stage*, $F(3, 354) = 74.69, p < 0.001, \eta^2_p = 0.39$, no significant interaction, $F(6, 354) = 1.63, p = 0.151$, and a highly significant main effect for *substance*, $F(2, 118) = 10.76, p < 0.001, \eta^2_p = 0.15$, see Fig. 2.

Across all stages, participants attributed more control to Mary when she consumed meat than when she consumed alcohol, $F(1, 79) = 26.79, p < 0.001, \eta^2_p = 0.25$. Mary was also attributed more control when consuming meat than chocolate, $F(1, 79) = 8.92, p = 0.004, \eta^2_p = 0.10$. There was no significant difference in control judgments between alcohol and chocolate, $F(1, 79) = 1.89, p = 0.173$. Mary was seen as having less control in consuming alcohol and chocolate than in consuming meat, across all stages of addiction.

In the alcohol condition, control judgments decreased with the onset of addiction. In the alcohol condition, from pre-addiction to stable addiction, control judgments decreased significantly ($t(39) = 3.90, p < 0.001, d = 0.62$), and remained lower than pre-addiction levels in the quitting ($t(39) = 7.45, p < 0.001, d = 1.18$) and relapse stages, $t(39) = 5.51, p < 0.001, d = 0.87$. Like for free will, participants judged that alcohol reduces control at the onset of addiction (the stable addiction stage), and this reduction in control continues throughout the

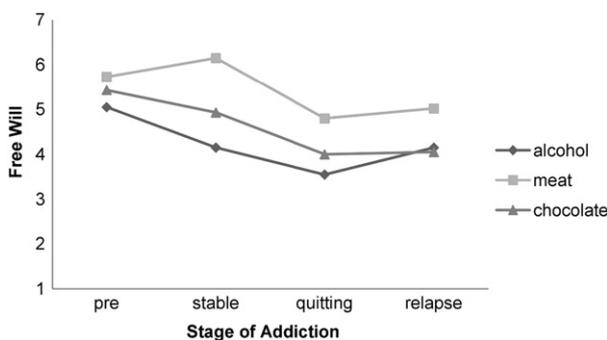


Fig. 1. Attributions of free will to similar consumption actions varied by addiction stage and substance consumed.

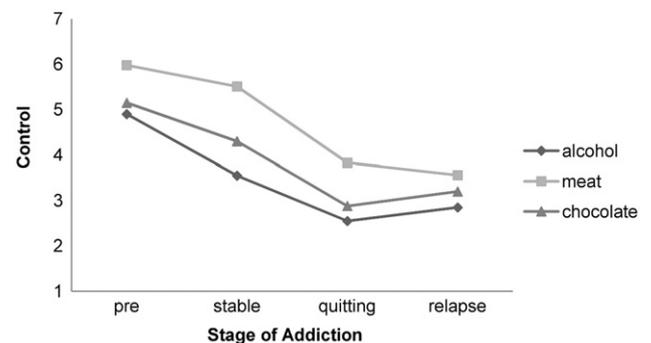


Fig. 2. Attributions of control over similar consumption actions varied by addiction stage and substance consumed.

quitting and relapse stages. Attributions of control also decreased somewhat in the meat condition from pre-addiction to stable addiction, $t(40) = 2.15, p = 0.038, d = 0.35$.

4.3. Discussion

A person was seen as having less free will and control when she consumed an addictive substance (alcohol) than a non-addictive substance (meat). This conceptually replicated the findings of Study 2: People think addictive things reduce free will. People think people are less in control of their decisions to drink alcohol than to eat meat. Somewhat surprisingly, but consistent with its figuratively addictive nature, people viewed chocolate as reducing free will and control nearly as much as alcohol. Perhaps this is because chocolate bears at least some of the characteristics of clinical addiction, such as craving (e.g., Bruinsma & Taren, 1999).

The results also supported the hypothesis that participants would view alcohol as being especially impairing of free will and control once the person began to act as though addicted. The person drinking alcohol was judged to be out of control and lacking free will when she drank in the stable, quitting, and relapse stages, even though in the pre-addiction stage that same action was viewed as relatively free and controlled. Although judged control also declined in these stages for meat and chocolate, the decline in judged free will was less for meat than for alcohol. The regular use, quitting, and relapse stages are apparently seen as inherently reducing free will to some degree, but more so when the substance is addictive. The largest difference between substances was seen at the stable use stage, with participants thinking that regular alcohol users have lost free will and control, whereas regular meat eaters retain control and free will.

5. Study 4: addiction and motivated reduction of belief in free will

Study 4 tested the hypothesis that personal experience with addiction reduces belief in one's own free will. It sought preliminary evidence for our suggestion that this is done in a self-serving way, so as to downplay one's own responsibility for bad behavior. Prior research has demonstrated that free will beliefs can be driven by desires to hold other people morally responsible for their bad behavior (Clark et al., 2014). By this same logic, people could selectively believe in free will as a means of downplaying their own responsibility for their own morally questionable behavior. As addictive behavior often negatively impacts family, friends, professional performance, finances, and personal health, succumbing to addiction may be perceived as morally wrong, and therefore people may desire to reduce their own personal responsibility for such behavior. In Study 4, participants were randomly assigned to recall either a prior experience in which they succumbed to an addiction or a prior experience in which they overcame an addiction. They then reported belief in their own free will and rated the moral badness of their behavior. We hypothesized that recalling an experience in which one succumbed to an addiction would reduce belief in one's own free will, and that this would be mediated by the perceived moral badness of succumbing to addictive behavior (controlling for other potentially relevant factors).

5.1. Method

This study was preregistered (<https://aspredicted.org/imqb7.pdf>). Three hundred and two participants were recruited via Amazon's Mechanical Turk. One participant failed an attention check, leaving 301 participants (140 female) in the sample. By random assignment, half the participants were told to write a paragraph about a recent time when they either succumbed to an addiction or extreme temptation. The rest were assigned to write about a time when they overcame an addiction or extreme temptation. On 7-point scales, participants then rated the importance of resisting the temptation or addiction (1 Not at

all important to 7 Of the utmost importance), how positive or negative the consequences of their behavior were (1 Extremely negative to 7 Extremely positive), and how morally bad or morally good their behavior was (1 Extremely morally bad to 7 Extremely morally good). Participants then completed the Personal Will subscale of the Free Will and Determinism Scale (Rakos et al., 2008), as in Study 1.⁵ Embedded in the Rakos et al. scale was an attention check item "Select 'Almost always true' if you are paying attention".

5.2. Results

Participants wrote about similar temptations in both conditions. Common temptations included: breaking diets, eating unhealthy foods, overspending, sex, alcohol, cigarettes, and other drugs. Participants who wrote about a recent time in which they succumbed to an addiction believed less in their own free will ($M = 4.24, SE = 0.06$) than participants who wrote about overcoming an addiction ($M = 4.42, SE = 0.04$), $t(299) = 2.49, p = 0.013$, Cohen's $d = 0.288$.⁶ Relative to participants in the overcome condition, those in the succumb condition also rated resistance of the addiction/temptation as less important ($M = 5.39, SE = 0.14$ vs. $M = 4.52, SE = 0.14$), $t(200) = 4.43, p < 0.001$, Cohen's $d = 0.626$,⁷ the consequences more negative ($M = 5.32, SE = 0.16$ vs. $M = 3.06, SE = 0.13$), $t(200) = 11.17, p < 0.001$, Cohen's $d = 1.580$, and their behavior as morally worse ($M = 4.93, SE = 0.12$ vs. $M = 3.71, SE = 0.09$), $t(200) = 8.10, p < 0.001$, Cohen's $d = 1.146$.

We next sought to determine whether the moral badness of succumbing to addiction accounted for reduced perceptions of one's own free will. Using the PROCESS macro (Hayes, 2013), a bootstrap mediation (10,000 resamples) found a significant indirect effect of condition on belief in one's own free will through moral badness, 95% CI: $[-0.20, -0.02]$, which held after controlling for importance and consequences, 95% CI: $[-0.12, -0.001]$.

5.3. Discussion

Participants recalled a previous experience with an addiction or strong craving. By random assignment, half were assigned to recall an experience in which they successfully resisted, while the rest recalled an experience in which they succumbed. Recalling succumbing caused people to rate their *current* level of free will as lower than recalling a successful resistance. Moreover, the findings were mediated by the moral badness of the action and its consequences. These findings support the assertion that addicts' beliefs about free will are defensively motivated, presumably to help one dodge responsibility for past misdeeds. When people recalled giving in to temptation and the morally negative consequences of their actions, they shift toward denying free will.

Autobiographical narrative methods are appealing because they invoke actual experiences people have had, outside the laboratory. Their drawback is that researchers do not know how people selected which episodes to narrate (e.g., Baumeister & Newman, 1994). It is conceivable that people selected episodes characterized by objectively less personal freedom when furnishing stories with bad than good consequences. We tried to make the instructions as parallel as possible. Still, this drawback is inherent in the autobiographical methods, and convergence across multiple methods is the best remedy for the imperfections inherent in nearly all social science methods.

⁵ As in Study 1, the religious items were not included.

⁶ With entire Personal Will Subscale, $t(299) = 1.64, p = 0.103$, Cohen's $d = 0.190$.

⁷ We originally intended to collect only 200 participants total, but due to a programming error, we ended up with 302 participants for our main DV and our intended participant target (200) for all other measures.

6. Study 5: free will belief and self-serving tendencies in addiction

Study 5 was a direct test of the idea that the reduced belief in free will associated with addiction is selective and self-serving. Participants wrote about their own experiences in which they gave in to a strong temptation or addiction that was either problematic or not. Insofar as giving in to addictive temptation is sufficient to indicate loss of free will, there should be no difference as a function of the recalled consequences. In contrast, if denying free will is a defensive strategy for reducing personal responsibility, people should mainly do it when their actions led to negative consequences. If there were no negative consequences, there is no need to deny responsibility. Hence a difference between conditions in free will attributions would suggest that people deny free will in order to absolve themselves of responsibility for negative consequences.

6.1. Method

6.1.1. Participants

We preregistered this study (<https://AsPredicted.org/44n4h.pdf>). We recruited a sample of 200 participants from Mechanical Turk (74 female), aged between 18 and 69 years ($M = 33.1$, $SD = 9.7$). All participants completed the study and correctly answered the two attention check items (e.g., ‘Please indicate 2’). Participants were reimbursed with \$1.50 for participation.

6.1.2. Procedure

Participants were randomly assigned to one of two conditions of a recall and writing task. In the *problematic condition*, participants were prompted to write about a recent experience in which they gave in to a strong temptation or an addiction and it caused a problem in their life. The instructions asked participants to write down this action with as much detail as possible, while reiterating that they should write about an addiction or temptation that caused problems and where something bad happened to the participant or to other people.

In contrast, in the *unproblematic condition* participants wrote in detail about giving in to an addiction or strong temptation, but one that caused them no problems afterwards. In other words, while they gave in to an addiction, everything else should have been fine, with no negative repercussions.

To check that participants followed the instructions, two raters read the two-hundred resulting stories and coded them for compliance with instructions. All disagreements about coding were resolved by discussion. The majority of participants wrote stories that were *fully compliant* with the instructions ($n = 166$; problematic condition: 78, unproblematic: 88), while nineteen participants were *somewhat compliant* (unproblematic: 8, problematic: 11) and fifteen participants delivered *invalid* stories (unproblematic: 6, problematic: 9). The results section reports the analyses for the *fully compliant* ($N = 166$) subsample. For scientific openness, [Table 3](#) (below) also reports the results of the full sample ($N = 200$) and the nearly compliant sample ($N = 185$).

6.1.3. Measures

After writing their story, the participants answered the main dependent measures: *free will* (“I had free will when I ... <think here of the action you just wrote about>”), and *control* (“I was in control of my actions when I ... <think here of the action you just wrote about>”), which were rated on 7-point Likert scales (1 strongly disagree – 7 strongly agree). For exploratory purposes not directly relevant to the present project, we measured experienced freedom and perceived importance of self-control.

The following page assessed demographics, as well as two manipulation check items on valence (“How positive or negative were the consequences of your behavior in the scenario you just described?” from 1 extremely negative to 7 extremely positive; “How morally bad or morally good was your behavior in the scenario you just described?” from 1

extremely morally bad to 7 extremely morally good), and an attention check (“Please indicate 3 on the scale”).

6.2. Results

6.2.1. Manipulation checks

Both manipulation checks showed significant effects in the expected directions. Participants in the problematic condition ($M = 2.51$, $SD = 1.41$) judged the consequences of their action as more negative than those in the unproblematic condition ($M = 4.34$, $SD = 1.37$), $t(164) = 8.45$, $p < 0.001$, $d = 1.32$. The action in the unproblematic condition was likewise judged as more morally good ($M = 4.06$, $SD = 1.02$) than in the problematic condition ($M = 3.24$, $SD = 1.31$), $t(164) = 4.48$, $p < 0.001$, $d = 0.70$.

6.2.2. Free will

Participants in the problematic condition ($M = 5.63$, $SD = 1.71$) reported that they had less free will when they acted than participants in the unproblematic condition, $M = 6.15$, $SD = 1.26$, $t(164) = 2.25$, $p = 0.026$, $d = 0.35$; see [Table 3](#).

6.2.3. Control

Participants in the problematic condition ($M = 5.04$, $SD = 1.75$) reported that they had less control over their actions than participants in the unproblematic condition ($M = 5.92$, $SD = 1.43$), $t(164) = 3.57$, $p < 0.001$, $d = 0.56$; see [Table 3](#).

6.2.4. Essay topics

One might be concerned that participants in the problematic condition would write about more inherently addictive topics (e.g., cigarettes, alcohol, marijuana, and other drugs) than participants in the unproblematic condition would write about (e.g., spending too much money, video games). However, participants in the unproblematic condition and the problematic condition wrote about similar topics with similar frequencies. In fact, there were more unproblematic essays about cigarettes, marijuana, and alcohol than problematic essays (see [Table 2](#)). To be sure, there were more people (5) who cited “harder” drugs as their problem, but the pattern of results remains if these participants are excluded from analyses (the effect of condition on control remains significant, $t(159) = 3.24$, $p = 0.002$; the effect of condition on free will becomes marginal, $t(159) = 1.95$, $p = 0.053$).

6.3. Discussion

Study 5 suggested that the denial of free will in connection with succumbing to addiction is motivated by the wish to escape from personal responsibility for negative consequences. Participants all wrote about succumbing to an addictive or strong craving, but half were randomly assigned to choose an episode with negative consequences while the rest chose an episode that did not have bad consequences

Table 2

Essay topics by condition.

Essay topic	Unproblematic condition	Problematic condition
Alcohol	13	11
Food	35	16
Marijuana	7	2
Cigarettes	6	5
Other drugs	0	5
Gambling	4	11
Spending	10	9
Romantic relationship	3	7
Video games	14	21
Pornography	1	1
Caffeine/coffee	6	4
Sex	3	1
Other	6	5

Table 3

Summary of the results. Giving in to addiction/temptation and experiencing problems predicts decreased free will, control. Results are given for full sample, the nearly compliant and the fully compliant subset.

Condition mean and (SD)					
Question	Unproblematic	Problematic	<i>t</i>	<i>p</i>	<i>d</i>
<i>Free will</i>					
Entire sample	6.01 (1.45)	5.69 (1.65)	1.44	0.152	0.21
Nearly compliant	6.09 (1.33)	5.67 (1.68)	1.89	0.060	0.28
Fully compliant	6.15 (1.26)	5.63 (1.71)	2.25	0.026	0.35
<i>Control</i>					
Entire sample	5.69 (1.68)	5.11 (1.75)	2.37	0.019	0.34
Nearly compliant	5.77 (1.57)	5.11 (1.77)	2.68	0.008	0.40
Fully compliant	5.92 (1.43)	5.04 (1.75)	3.57	<0.001	0.56

Note. Entire sample: *N* = 200, nearly compliant sample: *N* = 185, fully compliant sample: *N* = 166.

(for self or others). Ratings of one's free will at that time and control over those actions differed significantly, with participants saying they had less control and less free will when succumbing turned out badly than when it turned out fine. Thus, they selectively disbelieved in free will when they needed to justify their addictive behavior.

7. Study 6: free will belief and perceptions of control and addiction

The studies thus far have shown that addiction affects beliefs about free will. Study 6 reversed the causal arrow, to examine effects of free will beliefs on addiction. More precisely, it tested the hypothesis that disbelief in free will would lead people to perceive various temptations as more addictive. Half the participants read a bogus news article claiming that science was showing free will to be an illusion, while the rest read no article. In an ostensibly separate context, participants then rated how addictive various activities are, as well as their own self-control. We predicted that participants who read the anti-free-will article would give higher ratings of addictiveness and lower ratings of their own self-control.

7.1. Method

One hundred and fifty undergraduates (55 female) participated in an online study in exchange for course credit.⁸ Participants were led to believe they would be participating in two separate, unrelated studies. To help uphold the cover story, participants first completed a filler personality measure (the Need for Cognition Scale; Petty, Cacioppo, & Kao, 1984), then were randomly assigned to read either an anti-free will argument or no argument. Participants in the anti-free will argument condition were informed that they would read a paragraph describing the latest scientific opinion on free will and then read a short passage describing research that apparently opposes the existence of free will "...Scientists can predict the choices a person will make, before the person is aware they have even made a choice... Researchers have also demonstrated that priming participants to think about an event before it occurs causes them to believe they caused the event to happen, when really they had no influence... If scientists have accurate information about biological factors (e.g., genes), environmental factors (e.g., socioeconomic status), and situational factors (e.g., social influences), they are remarkably accurate at predicting individual behavior." Those participants were then asked whether they had heard of the research before and to write their reaction to the research in a few sentences. All participants then completed the free will belief subscale of the Free Will and Determinism-Plus Scale (FAD-Plus; Paulhus & Carey, 2011), which contains seven items measuring general free will belief (e.g., "People have complete free will."), rated on 5-point scales (1 Strongly

⁸ Our target number of participants was 200, but due to time constraints, we had to terminate the study after recruiting only 150.

disagree to 5 Strongly agree), $\alpha = 0.79$. Participants were then informed that they were finished with the first study and given an opportunity to report any thoughts or comments they had about it before moving on to the second study.

In the "second study", participants were presented with a list of 13 activities and items (video games, gambling, coffee, shopping, marijuana, junk food, social media, sex, alcohol, cigarettes, texting a romantic interest, television, pornography; $\alpha = 0.89$) that sometimes can be considered addictive or difficult to resist and asked to rate each item on how addictive they think it is (1 Not at all addictive to 9 Extremely addictive). Participants then completed the brief version of the Self-Control Scale (Tangney et al., 2004), which consists of 13 items (e.g., "I am good at resisting temptation), measuring perceptions of one's own self-control, rated on 5-point scales (1 Not at all to 5 Very much), $\alpha = 0.77$. Last, participants reported demographics and were debriefed.

7.2. Results

7.2.1. Manipulation check

The argument condition had a small, but non-significant effect on our measure of free will belief in the expected direction, with participants in the anti-free will condition believing slightly less in free will ($M = 5.53$, $SE = 0.14$) than participants who read no argument ($M = 5.71$, $SE = 0.15$), $t(147) = 0.85$, $p = 0.396$, Cohen's $d = 0.140$.

7.2.2. Addiction

The argument manipulation had a significant effect on perceptions of addictiveness. Participants in the anti-free will condition rated the full set of 13 items as more addictive ($M = 6.28$, $SE = 0.18$) than participants in the no argument condition ($M = 5.73$, $SE = 0.18$), $t(148) = 2.15$, $p = 0.033$, Cohen's $d = 0.353$.

7.2.3. Self-control

Participants in the anti-free will condition perceived themselves as having significantly less self-control ($M = 2.78$, $SE = 0.07$) than participants in the no argument condition ($M = 3.01$, $SE = 0.06$), $t(147) = 2.46$, $p = 0.015$, Cohen's $d = 0.406$.

7.3. Discussion

Study 6 found that inducing participants to disbelieve in free will caused them to rate various tempting activities as more addictive. It also caused them to rate their own self-control as lower. Perhaps surprisingly, it did not cause a significant drop in score on our manipulation check of belief in free will, possibly because we used a trait scale that was designed to measure stable beliefs rather than fluctuating attitudes, or perhaps because manipulating people's free will beliefs typically requires a strong manipulation (Schooler, Nadelhoffer, Nahmias, & Vohs, 2014). Nonetheless, the substantial changes on both dependent variables indicate that the manipulation did have impact.

Combined with the findings of the previous studies, Study 6 suggests bidirectional causality. Addiction leads to perceiving less free will, and disbelieving free will leads to seeing more addiction.

8. General discussion

Addiction is widely seen as loss of free will. In the present investigation, multiple studies, methods, and research designs consistently linked addiction with lack of free will. People who have been addicted in the past believe in general free will less than other people, while people who have successfully quit addictions show more belief in free will (Study 1). Identical behaviors by other people are rated less free when they involve obtaining drugs as compared to obtaining food (Study 2). Thus, desires for addictive substances connote loss of freedom.

Identical alcohol-consuming behavior is rated as less free when performed by an addict than by someone who has never been addicted

(Study 3)—and it is still rated as unfree even when performed by someone who had successfully quit. Thus, people do not apparently give much credence to the idea that one can go back to drinking alcohol in controlled, freely willed fashion after one has been addicted. (That would imply that quitting addiction restores the free will that was ostensibly lost during the period of addiction.) More broadly, people seem to think that the fact of addiction entails permanent loss of free will, both for their own and others' behavior.

A pair of studies on the consequences of addictive cravings suggested that the link between addiction and absence of free will may be motivated by self-serving biases. Recalling a personal experience of successfully resisting a strong or addictive craving made people believe more in their current free will, whereas recalling an episode of giving in to addictive craving made people believe less in their own current free will (Study 4). When people recalled a recent personal experience of yielding to an addictive craving or other temptation, their belief in free will changed in proportion to how self-serving that belief would be: That is, if the episode led to bad consequences, they denied free will, whereas if it turned out fine, they sustained belief in free will (Study 5). Thus, people invoke the idea that addiction means loss of free will specifically because it is useful for dodging responsibility for bad outcomes.

The popular view linking addiction to low free will seems to work in both directions. Whereas beliefs in free will and free choice were the dependent variable in Studies 2–5, they were the independent variable in Study 6. Inducing disbelief in free will led people to see more addiction in the world. Specifically, they saw 13 diverse activities as relatively more addictive, as compared to participants whose belief in free will had not been undermined. Reading arguments against free will (and then contemplating a list of possible addictions) also caused people to disparage their own self-control (Study 6).

8.1. Implications

Scientific writings about freedom of choice in addiction are often nuanced and complex, even those written by sincere advocates of the view that addiction undermines choice (e.g., Leshner, 1997; Volkow & Fowler, 2000). But the tentative, qualified, uncertain, and sometimes controversial aspect of scientific conclusions tends to disappear from reportage in the mass media (e.g., Collins, 2014). Some scientists presumably believe that it is plausible that under some circumstances, addiction impairs certain aspects of free will according to particular conceptualizations thereof—but our findings suggest that the general public has gotten the simpler message that addiction means no free will. Presumably the public's impression is due not only to scientific findings and opinions but also to the open advocacy of that view by addicted celebrities, service providers, and others. As our findings suggest, some of those people insisting that addiction destroys free will may be seeking to excuse or justify their own problem behavior.

Thus our findings suggest that the public's embrace of the doctrine that addiction destroys free will is partly motivated by the desire to escape responsibility and to enable beloved others (including favorite celebrities) to do likewise. Moral responsibility is one of the foundations of human society and culture (e.g., Tomasello, 2016), and so granting some individuals an exemption from such responsibility, especially for socially destructive behavior, is a socially risky strategy. It is an earnest moral and practical question whether more good or harm is done via the popular view of addiction as inimical to free will. Even if free will turns out to be entirely illusory, believing in free will may still aid people in quitting their addictions.

One appeal of the disease model is its implication that addicts are not to be blamed for their behavior, and therefore, it may reduce stigma. Conversely, one could interpret the choice model as supporting blame, or even punishment as a way of deterring addictive behaviors.

Thus, the consequences of promoting the choice model may not be uniformly positive. Whether the choice model would increase

stigmatization of addiction is an empirical question and future research may seek to test this possibility. Still, the main aim of the science of addiction should be to prevent and minimize the harmful consequences resulting from addictive behaviors. While reducing the stigmatization of addicts is itself a laudable goal, it is perhaps more important to prevent the illness and death that addiction causes. To the extent that the choice model has the potential to increase people's feelings of responsibility and accountability, it may reduce harmful addictive behaviors.

8.2. Limitations and future directions

The present studies used normal adult (nonclinical) samples, which may be considered either a strength or a weakness. Regardless, further studies with clinical and addict populations may be desirable to confirm and extend these findings. Further studies with at-risk populations may well establish whether disbelief in free will contributes to people becoming addicted. Longitudinal work may establish whether disbelief in free will precedes addiction or increases as a motivated, defensive, rationalizing belief—or both. Meanwhile, our findings that ex-addicts endorsed free will suggest that it may be worth exploring the possibility that increasing belief in free will would help enable addicts to quit.

The present studies were mainly online surveys, relying on self-reports and hypothetical vignettes. These may be appropriate for early tests of the hypotheses, but in view of the favorable results thus far, further confirmation with real events and objective measures would be desirable. Behavioral measures would of course greatly strengthen the research program (Baumeister, Vohs, & Funder, 2007).

8.3. Concluding remarks

Addicts do not end up with the lives that they want, and many of them find themselves using drugs despite having resolved not to do so. They are tempted to see this as loss of free will, which conveniently absolves them of responsibility for their actions. Our findings suggest that this view is at least partly motivated by self-serving rationalizations, especially insofar as people reduced their belief in free will more when needing to minimize responsibility (i.e., when their addictive behaviors had had bad consequences) than otherwise.

Perhaps the most pragmatically relevant finding is that while people associate becoming addicted with loss of free will, they associate quitting addiction with increased free will. If further work confirms that belief in free will contributes to successfully kicking an addictive habit, public policy may well want to re-think its current emphasis on addiction as a helpless condition of brain disease and impaired volition. It is tantalizing to think that society's legions of addicts might become empowered to recover control over their lives by promoting the belief that despite their addictive cravings, they still have free will.

Conflict of interest

Baumeister declares no conflict of interest but acknowledges that the appearance of conflict is possible. Based on his early writings about free will and addiction (e.g., Vohs & Baumeister, 2009), he was contacted by lawyers representing tobacco companies and asked to prepare a report on free will and addiction, with possible testimony to follow. He agreed after stipulating that he would summarize the research however he found it, without slanting it to serve their purposes. They agreed and he commenced work. The report was never completed, nor did he testify, and the lawyers terminated the relationship. Some material covered in this manuscript was read while he was working for them. At this point, however, he has no discernible financial interest in advocating any position regarding addiction.

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