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Towards a goal-directed account of weak-willed behavior

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People often engage in behavior that is not in their best interest – so-called suboptimal or irrational behavior. Examples (of partially overlapping categories) are action slips (e.g., typing in one's old password), costly or recalcitrant emotional behavior (e.g., costly aggression, avoidance in fear of flying), arational behavior (e.g., slamming the door out of anger), impulsive/compulsive behavior (e.g., costly aggression, addiction), and weak-willed or akratic behavior. The latter category comprises behaviors that people engage in despite the fact that they have a correct judgment that other behavior would be more optimal. People know smoking and drinking is bad for them, but they do it anyway. They know exercising is good for them, but they fail to get off the couch.

To explain suboptimal behaviors, theorists have turned to dual process models (Heyes & Dickinson, 1990), in which behaviors can be produced either by (a) a stimulus-driven process in which a stimulus activates the association between the representation of stimulus features and the representation of a response (S→[S-R]→R) or (b) a goal-directed process in which the values and expectancies of the outcomes of one or more behavior options are weighed before an action tendency is activated (S → [S:R-O → R]→R). Note that the term habit is used for stimulus-driven processes that have been installed via an overtrained operant conditioning procedure in which performance of the same response given a certain stimulus repeatedly led to the same outcome. This procedure is supposed to stamp in the S-R association while the outcome is no longer represented or activated.

To diagnose whether a process is stimulus-driven or goal-directed, researchers typically conduct a devaluation test or a contingency degradation test (Hogarth, 2018). If devaluation of the outcome of a behavior or a degradation of the likelihood that the behavior will lead to the outcome subsequently reduces (/does not reduce) the behavior, it is inferred that the value and

expectancy of the outcome of the behavior were represented (/not represented) and hence that the behavior was caused by a goal-directed (/stimulus-driven) process.

Traditional dual-process models have a default-interventionist architecture, with the stimulus-driven process as the default and the goal-directed process as an occasional intervenor. This architecture is rooted in the idea of a trade-off between automaticity and optimality, which are both tied to the computational complexity of the processes. Stimulus-driven processes are seen as simple and therefore automatic but at the same time rigid (because they are insensitive to outcome devaluation and contingency degradation) and therefore more likely to produce suboptimal behavior. Goal-directed processes, on the other hand, are seen as complex and therefore nonautomatic but at the same time flexible (because they are sensitive to outcome devaluation and contingency degradation) and therefore more likely to produce optimal behavior. The automatic nature of the stimulus-driven process makes it the default process. However, because this process is more likely to lead to suboptimal behavior, it must sometimes be corrected by the goal-directed process. The problem is that this goal-directed process is seen as nonautomatic, which means that it can only intervene when there is enough opportunity, capacity, and/or motivation (Moors, 2016; Moors & De Houwer, 2006). When these factors are low, the organism has no choice but to switch from the goal-directed process to the stimulus-driven process.

Empirical evidence for the default-interventionist model comes in the form of dissociations showing that when opportunity, capacity, and/or motivation are high, the goal-directed process determines behavior whereas when these factors are low (because of time pressure, stress, sleep deprivation etc.) the stimulus-driven process takes over (e.g., Schwabe & Wolf, 2009; but see below).

According to the traditional model, people continue to smoke against their better judgment because their behavior is caused by a stimulus-driven process (a habit) in which the sight of cigarettes directly activates the tendency to smoke, and the goal-directed process that induced the tendency to refrain from smoking (at the service of a health goal) was unable—"too weak"—to successfully intervene (Baumeister, 2017; Everitt, Dickinson, & Robbins, 2001; Tiffany, 1999; Wood & Rünger, 2016).

Recently, I proposed an alternative dual process model (Moors, 2017a, b; Moors, Boddez, & De Houwer, 2017; Moors & Fischer, in press) with a parallel-competitive architecture, which is rooted in the idea that stimulus-driven and goal-directed processes can both be automatic (for arguments, see Moors et al., 2017). If both processes can be automatic there should be a substantial number of cases in which they operate in parallel and enter in competition with each other. The model moreover assumes that when both processes do enter in competition, the goal-directed process should win because goal-directed processes are automatic and optimal whereas stimulus-driven processes are only automatic and the system should prioritize the process with the most advantages. In this model, the goal-directed process is the default determinant of behavior and will determine the lion share of behavior whereas the stimulus-driven process determines behavior only in exceptional cases.

In line with this view, evidence for stimulus-driven processing based on habit learning seems to be weak. In animal outcome devaluation studies, for instance, stimulus-driven drug seeking behavior is confined to highly specific conditions such as a no-choice procedure (a single action leading to a single outcome: drugs), and it is fragile in that it is quickly taken over by a goal-directed process when the devalued outcome (which is left away in the test phase) is reintroduced (Hogarth, 2018). These conditions do not resemble those in human natural environments: We always have a choice between drugs and natural rewards, and we never get a break from the devalued outcome (e.g., hangover, guilty feelings).

In humans, evidence for the role of stimulus-driven processing in drug seeking and other behavior is even weaker (Hogarth, 2018). A recent series of five attempts to find evidence for habit learning in humans failed (de Wit et al., 2018). Several prior studies that did report evidence for stimulus-driven processing used a task design (the "fabulous fruit game"; de wit, Niry, Wariyar, Aitken, & Dickinson, 2007) that turned out to be unsuitable for detecting stimulus-driven processing (De Houwer, Tanaka, Moors, & Tibboel, 2017).

Evidence for goal-directed processing is abundant, not only as the determinant of optimal but also as the determinant of suboptimal behavior such as drug seeking (see reviews by Hogarth, 2018). Before citing some of this evidence, let me first explain how the alternative dual process model accounts for suboptimal behavior. To do this, I need to elaborate a bit more on the goal-directed process.

The goal-directed process does not occur in isolation, but can be embedded in a cycle, starting with a comparison between a stimulus and a first goal (which is the representation of a valued outcome). If the stimulus and this first goal are discrepant, a second goal arises which is to reduce the discrepancy. This can be done either by acting to change the actual stimulus (i.e., assimilation), by changing the first goal (i.e., accommodation), or by changing interpretation of the stimulus (i.e., immunization), depending on which of these broad strategies has the highest expected utility. If the person chooses to act, the specific action option with the highest expected utility will activate its corresponding action tendency (which can be considered as a third goal). Once the action tendency is translated in an overt action, it produces an outcome, which is fed back as the input to a new cycle. The cycle is repeated until there is no discrepancy left. Note that all steps in the cycle can in principle occur outside of awareness.

People have many goals, some of which may conflict with each other. In the alternative model, self-regulation conflicts are not understood as conflicts between a stimulus-driven and a goal-directed process, but as conflicts between two goal-directed processes. If a health goal does not manage to make a person quit smoking, there must be another goal that is either more valued and/or that has a higher expectancy of being reached that wins the competition. Examples of other goals are a hedonic goal, a social goal, the goal for autonomy, etc. (Baumeister, 2017; Kassel, Stroud, & Paronis, 2003).

The multiple-goal argument has implications for the methods used to diagnose whether a behavior is caused by a stimulus-driven or goal-directed process. The upshot is that if a behavior is found to be insensitive to the devaluation of one outcome, it may still be driven by another outcome. If stress leads to eating beyond satiation, this may not indicate that eating was stimulus-driven (as argued by Schwabe & Wolf, 2009), but perhaps that eating is a strategy to reduce stress. Recent work has started to re-examine purported evidence of stimulus-driven processing by manipulating the fulfilment of other goals (see also Kopetz, Woerner, & Briskin, 2018,).

Critics may object that agents of weak-willed behavior typically do not attribute a higher value to their hedonic goal than to their health goal. And even if they do (but are unaware), this does present a puzzle.

One part of the solution is to consider that for many substance users, the hedonic goal is not the goal to add extra positive sparkles to an already bearable existence, but rather the goal to reduce unbearable stress or negative affect. What good is it to strive for a long, healthy life, if you cannot even survive another day?

Another part of the solution lies in the fact that behaviors are not only chosen on the basis of the values of their outcomes, but also on the basis of the expectancies that they will lead to these outcomes. So even if a smoker does not attribute a higher value to her hedonic goal than to her health goal, she may still estimate that one smoke is more likely to produce pleasure now than that abstinence is likely to avoid bad health later.

One may argue that behavior that is still at the service of some goal, does not qualify as *truly* suboptimal (because it contributes to goal satisfaction), but merely *appears* to be suboptimal. A smoker may be correct in estimating that one smoke is more likely to produce pleasure now than that abstinence is likely to avoid bad health later. Thus, the optimal decision would be to have another smoke, even if—paradoxically—an accumulation of such optimal decisions is likely to result in a suboptimal outcome in the end (Ainslie, 1938). There is room for debate of course whether optimality should only be considered in relation to "the end" or whether it is also optimal to satisfy short-term goals (Lemaire, 2016).

The reason why many decisions *appear* suboptimal is that the goal that is driving the behavior is not always obvious or conflicts with societal norms. A smoker may not realize how intense the stress is that she tries to alleviate by smoking, or she may not be aware that smoking is partly an act of rebellion in a way to affirm her autonomy (against "nanny state" coercion, Le Grand & New, 2015).

But goal-directed processes may also be invoked to explain *truly* suboptimal behavior. Such behavior can be understood as the result of noise or sand in the wheels of the goal-directed cycle. Several things may go wrong in this cycle.

First, a person may fail to notice a discrepancy between the stimulus and a goal and hence the need to take action, or she may fail to notice that a stimulus has different implications for different goals. However, this is typically not the place where things derail in the case of weak-willed behavior.

Second, a person may choose a less than optimal behavior option because more optimal behavior options are simply lacking from her behavior repertoire. It is possible that people who smoke to reduce their stress have not yet considered other, less costly behavior options to reduce their stress, such as vaping or yoga.

Third, given that expectancies and values are subjective, they may not correspond to objective likelihoods and values (Tversky & Kahneman, 1993). In many self-regulation conflicts, the choice is between one behavior option (e.g., smoking) that has a short-term, certain, positive outcome (e.g., hedonic pleasure) and another behavior option (e.g., abstinence) that has a long-term, uncertain, negative outcome (e.g., cancer). All else equal, short-term outcomes are seen as more likely (i.e., availability effect) and as more positive (i.e., temporal discounting effect) than long-term outcomes. Temporal discounting happens to be more pronounced in smokers, although it is unclear whether this is a predisposing factor or a defensive consequence of smoking (Baumeister, 2017). Likewise, certain effects are seen as more likely than uncertain effects (of course), but they are also more heavily weighted (i.e., certainty effect).

In addition to these content-less biases, smokers' expectancies about whether smoking will lead to specific other outcomes, such as hedonic outcomes (in the form of stress reduction or the absence of withdrawal symptoms), may also be more or less accurate. There is no simple answer to the question whether smokers' belief in the stress-reducing powers of smoking is accurate (e.g., Cook, Baker, Beckham, & McFall, 2017). There is evidence that smokers do overestimate the intensity of withdrawal symptoms, and this may encourage them to give in sooner rather than later. "If the end point will be the same, why suffer first?" (Baumeister, 2017, p. 81).

Note that the *theoretical* rationality of biases and false beliefs does not need to match their *practical* rationality: Some in/accurate beliefs may promote/hinder goal satisfaction. For instance, optimistic illusions have been associated with increased well-being (although as always, the picture is mixed, e.g., Bortolotti & Antrobus, 2015).

Finally, one may wonder whether it makes sense to talk about the objective value of a goal/outcome. At first sight, values are always values for a person, and so it seems that values can only be subjective. On second thought, however, the value of any lower-order goal depends on the expectancy that it will satisfy a valued higher-order goal, and this expectancy could be more or less accurate. A person may have the goal to become rich as a strategy to achieve happiness, but this strategy may turn out to be ineffective (Ryan & Deci, 2001). Applied to the case of smoking against better judgment, a person may smoke to satisfy the

goal for hedonic pleasure, but this goal (or prioritizing hedonic pleasure over health) may turn out the be an ineffective strategy to achieve happiness.

In sum, some cases of weak-willed behavior more properly may be categorized as strong-willed because they were driven by more valuable or more easily achievable goals that were not always obvious to the agent and therefore appeared weak-willed. Other cases of weak-willed behavior are best understood as stemming from errors in the evaluations of values or expectancies, but here too, the term weak-willed does not cut any ice.

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