Whither Inhibition?

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Inhibition is considered an essential process to goal pursuit and as a result has become a central construct in many disciplines in psychology and adjacent fields. Despite a century's worth of debate, however, there is little consensus about what inhibition actually is. We suggest it is time to abandon the concept of inhibition as it currently stands, given that its definition has been problematic. Instead, we propose an alternative framework that suggests inhibition has been improperly operationalized as a process to obtain a goal, when in fact inhibition is the target outcome. To better understand how people can achieve an inhibition goal, we leverage existing process models to further elucidate how people can actively regulate impulses and desires. Although the field has been led astray by classifying inhibition as a process, our current framework seeks to provide greater practical utility to the study of goal pursuit moving forward.

inhibition | goal pursuit | strategies | process model | cognitive control | executive function | willpower

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Introduction

Inhibiting mental processes is considered essential for successful goal pursuit, whether the goals relate to basic motor movements, thoughts and emotions, or higher-order objectives (e.g., health, relationships, finances). Inhibition's roots are deep, tracing back to ancient philosophers as well as to the father of modern psychology, William James, who stated that inhibition is “an essential and unremitting element of our cerebral life” [1]. Although inhibition seemingly plays a key role in many areas of psychology (e.g., cognitive, social-personality, developmental, clinical) and adjacent fields (e.g., neuroscience, economics), there is little consensus about what inhibition actually is. For over a century, researchers have debated the nature of inhibition [2, 3, 4], with no resolution in sight.

In this article, we suggest it is time to abandon the concept of inhibition as it currently stands. To advance research on inhibition, we first provide an overview of what is problematic about the concept of inhibition. To address these concerns, we then present an alternative framework that re-classifies inhibition as an outcome rather than a process, thereby providing greater conceptual and practical utility of inhibition as a construct. Finally, we close by outlining promising directions for future research.

Fundamental Issues with Inhibition

Over the years, scholars have raised numerous concerns about inhibition. Here, we consider three interrelated issues: (1) different subfields disagree on how to define inhibition,

which has led to a proliferation of different operationalizations; (2) many areas have seemingly lowered the threshold for what counts as inhibition, diluting its meaning as a construct; and (3) the term inhibition has been overextended to concepts that can be more parsimoniously explained by other constructs. To help contextualize these points, it is important to note that we make few exceptions, most notably regarding neural inhibition: It is widely accepted that, from a biological standpoint, neurons can inhibit each other [4]. Here, we focus solely on when the term inhibition is used to describe the downregulation of mental and behavioural processes, where the process at the neural level tends to be biologically excitatory.

Proliferation of Definitions. One pressing concern is that researchers rarely explicitly define inhibition [5], and when definitions are provided, they are often broad and/or differentially operationalized across disciplines. For example, inhibition has been broadly defined as “any mechanism that reduces or dampens neuronal, mental, or behavioural activity” [6], but also as a cautious temperament within development [7]. Some researchers draw more nuanced distinctions by focusing on specific types of inhibition, spurring a longstanding debate on whether inhibition is a single general construct applied across contexts or if inhibition is a series of unique processes that operate in different contexts (e.g., differentiating between behavioural inhibition, cognitive inhibition, neural inhibition) [3]. To date, it seems that the only thing we know for sure about inhibition is that there is no consistent definition for inhibition. While having a far interdisciplinary reach should promote cumulative science [8], it appears the interdisciplinary nature of inhibition has led to a fragmented field, thus stagnating its theoretical, practical, and methodological advancement.

Dilution of the Construct. As with many concepts in psychology, inhibition has undergone many semantic and conceptual shifts over time. As a result of this concept creep (the conceptual expansion of constructs) [9], inhibition encompasses a much broader range of phenomena than ever before. Some expansion is beneficial, such as when a concept is broadened outward to new contexts - for example, the concept of bullying has since been rightfully expanded to other contexts, such as online behaviour (“cyberbullying”) and certain types of social exclusion where the focus is on harmful omission rather than direct hurtful actions toward the victim [9]. However, other types of expansion are more problematic, such as when the threshold for what counts as a construct becomes less stringent. For example, writing a one-off angry

social media post about your classmate after a bad day may in certain situations be perceived as cyberbullying. With inhibition, it has indeed been overextended to the “point of meaninglessness” [10]. This is likely because what counts as inhibition is largely subjective, therefore allowing researchers to easily classify any behaviour as inhibition. For example, a person who chooses pizza over salad is often assumed to have failed to inhibit their desire for pizza, yet it is equally plausible that no conflict requiring inhibition existed in the first place (e.g., they budgeted the treat into their daily calories). While concept creep is inevitable among popular constructs like inhibition, it is imperative that researchers work together to monitor how the concept evolves and decide whether a particular trend should be encouraged, ignored, or resisted [9]).

Overextension to Other Constructs. Because of its ever-expanding nature, inhibition has become an overextended construct, limiting its conceptual and practical utility. However, this overextension is not merely a product of a lowered threshold – there are notable instances where some phenomena are incorrectly labeled as inhibition. For example, the colour-naming Stroop task, one of the most popular measures of inhibition, was not actually designed to test inhibition. It is actually a measure of interference (i.e., decreased performance caused by irrelevant information) [11] and someone can be successful without needing to “inhibit” word-reading [12, 13]. Thus, the outcomes of this task can be more aptly explained by other processes, such as selecting some stimuli for engagement over others or automatic memory retrieval [13, 4]. Similar ambiguities exist in memory research, where inhibition was originally proposed to be a process underlying retrieval-induced forgetting [14]. However, more contemporary views now cast doubt on inhibition’s role, suggesting that retrieval-induced forgetting is best explained by memory retrieval [4]. As a final example, the popular measure of the behavioural inhibition system – explored within the personality subfield as an individual’s tendency to inhibit behaviour leading to aversive outcomes [15] – overlaps highly with neuroticism and social anxiety, suggesting that it likely reflects emotional instability rather than one’s ability to inhibit unwanted responses.

Taken together, these issues of proliferation, dilution, and overextension have undermined research on inhibition. Despite the longstanding debate, there has been no resolution on how to define inhibition, let alone operationalize it. This begs the question: why are researchers still holding onto the idea that inhibition is a process? We suggest that operationalizing inhibition as a process has been hard to let go because there has yet to be a viable alternative framework to study the actual processes through which people control their impulses and desires.

A Framework for Examining Inhibition in the Context of Goal Pursuit

To move towards a productive next generation of research, we suggest it is time to abandon the concept of inhibition as it currently stands, given that its definition so far has been

problematic. Instead, research can refocus on the process of goal pursuit in order to better understand how people can achieve their goals. Research examining people’s use of inhibition tells us little about these processes people use to regulate impulses and desires, so articulating a framework to understand these processes is critical for helping people pursue their goals.

Inhibition is the Outcome, Not the Process. We propose that conceptual clarity has been elusive because inhibition has been inaccurately operationalized as a process to obtain a goal (i.e., a mechanism that creates the outcome), when in fact inhibition is the goal itself. Stated differently, a person does not use inhibition to suppress a target response; rather, the goal is to inhibit the target response, and to do this successfully, people must rely on other processes to achieve this goal. In this sense, we define inhibition as the goal of stopping a mental, behavioural, or emotional response (e.g., to not eat a cupcake, to not express one’s anger, to stop oneself from pressing a designated key).

An example might be illustrative. The Stop Signal Task is a cognitive reaction time task where a person is asked to respond quickly to a target stimulus (e.g., a square), but inhibit one’s response when presented with a designated stop signal (e.g., an auditory sound) that appears after a short delay period. Here, the goal is to stop one’s response on trials that randomly include the delayed sound. In this context, inhibition is not a process to be “used” to down-regulate a motor response; rather, inhibition is the goal of stopping a motor response, and this goal can be achieved in a number of ways (e.g., proactive strategies; [16]). For example, increased preparation in the Stop Signal Task results in more efficient inhibition, a finding which replicates using behavioural (e.g., reaction time) and neuroimaging (e.g., recruitment from frontoparietal regions) measures [17]. Another example is the goal to inhibit one’s desire for tempting unhealthy foods. Research shows that when people are asked to use inhibition, they actually engage in other processes that they misattribute to inhibition (e.g., distracting themselves, thinking about unappealing qualities of the food) [18]. Together, these findings highlight that people do not use inhibition to achieve a desired outcome; rather, inhibiting a target response is the desired outcome and people use a variety of processes to successfully regulate this goal.

Leveraging Process Models to Facilitate Goal Pursuit.

To better understand goal pursuit, researchers need to shift their focus away from inhibition as a process and instead toward the actual processes that help people reach their goals of inhibiting impulses and desires. To do this, we can leverage existing process models to more precisely identify the processes that are effective, ultimately providing greater practical utility to the study of inhibition. To help guide future research and theorizing on inhibition, we highlight a recent process model that describes goal pursuit as a dynamic, multi-stage process, beginning with identifying which goals to pursue, selecting strategies, implementing those strategies, and subsequently monitoring each of these processes over time

Fig. 1. Process model with inhibition as the goal (adapted from Gross, 2015; Werner Ford, 2021). First, a person identifies the target goal, in this case to inhibit an unwanted thought, emotion, or behaviour. Second, a person selects which strategies to use based on what strategies they have in their repertoire (i.e., their regulatory “toolbox”, or the strategies they have at their disposal). These strategies include: changing the situation (i.e., changing or modifying some aspect of the environment), redirecting attention (i.e., changing the focus of one’s attention), changing thoughts (i.e., changing how one is thinking about the situation), and changing the response (i.e., changing one’s experiential, behavioural, or physical response). Third, a person implements tactics by transforming the chosen strategies into specific actions. Fourth, and finally, a person actively monitors all processes in order to decide whether to maintain, switch, or stop a given approach (i.e., the goal, strategy, or tactic) based on whether or not they achieved their inhibition goal. For example, if a particular strategy or tactic was not initially successful (e.g., the desire for the cupcake still persists), the person may opt to change strategies or tactics in order to successfully inhibit the target response.

[19, 20, 18].

The process model of emotion regulation [20] is arguably one of the most influential models within psychology, and has since been adapted to relevant contexts including self-control [19, 18] and behaviour change [21]. The most recent adaptation, the extended process model of self-control [18], can be readily applied to inhibition (see Figure 1): A person identifies the goal to inhibit a target response – this could be inhibiting a negative emotional response when angry (e.g., do not yell at my kids), inhibiting one’s desire for an unhealthy, yet tasty treat (e.g., do not eat the cupcake), or inhibiting a target response during a computerized cognitive task (e.g., do not press the button on trials with a sound).

Once the goal is set, the person selects what strategies can be used to reach the desired outcome. Strategies can be used at different points in the response cycle: people face situations, which they can pay attention to, and appraise as relevant to them, and then ultimately respond. To reach their inhibition goal, they can act on any of these points by changing the situation, changing what they’re paying attention to, changing how they think about the situation, or changing their behavioral and/or physiological response. Importantly, people can flexibly use these strategies in ways that best match the situational demands [22, 18].

Once a strategy (or strategies) is chosen, it is then implemented using specific tactics that are most effective for them

in the moment – this could be leaving the room to be alone and cool down for a bit (i.e., situation modification), thinking about the negative consequences of eating the cupcake (i.e., cognitive reappraisal), or intensely focusing one’s attention on the computer screen while waiting for the auditory response on the Stop Signal Task (i.e., attentional deployment). If successful, the person would resist eating the cupcake, would not yell at their kids, and would withhold the button press at the appropriate time – they would have successfully achieved their inhibition goal. Finally, the progress at each stage is actively monitored so that a person can maintain, stop, or switch from a particular process when necessary.

Why Does This Distinction Matter? Shifting inhibition from process to outcome has many important implications for the study of goal pursuit. By rightfully operationalizing inhibition as a goal, the field can better focus on the actual processes people use to pursue their goals. As a result, researchers are not only able to determine which strategies are actually most effective, they can also instead focus on important questions including how personal factors can influence the processes people use (who uses what processes and when?), the extent to which contextual factors influence the effectiveness of different processes (when are particular processes most effective in the short-run?), and whether certain

processes are more adaptive (what are the most adaptive patterns of processes people can use to promote long-term success?) [23, 18].

This shift to inhibition being a goal also has important methodological implications. Most pressingly, researchers typically use “inhibition” as the gold standard comparison condition when trying to understand the effectiveness of different processes (e.g., cognitive change). However, comparing processes to inhibition is methodologically problematic: because inhibition is not a process, telling people to “use inhibition” actually assigns them the goal to inhibit the target response. People then rely on whatever processes they have at their disposal, creating noisy variability (e.g., when “using inhibition”, some use distraction, others cognitive change [24]), making it difficult (if not impossible) to determine the true effectiveness of the comparator processes. Thus, future research would greatly benefit from examining the specific processes through which people can attain their goals.

Directions for Future Research

Adopting a process-oriented framework has important implications for multiple subfields within psychology and adjacent fields. Here, we highlight three examples, outlining promising directions for future research.

Social/Personality Psychology. In social/personality psychology, inhibition has been commonly known as willpower [25]. Traditionally, research has long promoted the benefits of willpower, although recent research has questioned its validity as a strategy [24], likening telling people to “use willpower” to telling them “to build a house with a pile of wood” [26, 27]. Common operationalizations of willpower include assigning participants the goal to inhibit a target response or assessing individual differences in a person’s ability to make progress on an inhibition goal; however, neither operationalization reveals the underlying processes that help people achieve their goals. Moving beyond willpower, researchers can instead examine the strategies people use to inhibit unwanted desires, including how people choose what strategies they use (including the use of a single vs. multiple strategies), the flexibility with which they use strategies in different contexts, as well as when and for whom each strategy is most adaptive [22, 18].

Cognitive Psychology. In cognitive psychology, inhibition is associated with research on cognitive control (also called executive function), which refers to the flexible allocation of attention in the service of goal-directed behaviour in the face of more habitual or immediately compelling behaviours [12]. Although inhibition is considered one of the core processes that powers cognitive control [28], there is little direct evidence that inhibition is actually needed to implement cognitive control [12]. Recall, that both Stroop and Stop-Signal performance can be improved by selectively attending to task instructions (e.g., name colours) and mentally preparing (e.g., proactively attending to stop-signal); it does not necessarily require reactively stopping a competing mental

process. Thus, while such tasks load onto the same factor [28], the name of this factor needn’t be “inhibition”. Indeed, other analyses suggest that the so-called inhibition factor is indistinguishable from a factor that taps the general speed of processing [29] or even a factor that is common to all executive function tasks [30]. In other words, with the possible exception of stopping motor commands (Aron, 2007), inhibition might be unimportant in the control of attention. Instead, what was previously bundled under the “inhibition” label might simply reflect the ability to efficiently select some processes for engagement over others, a key feature of both cognitive control and intelligence [29]. Expanding these findings, future research can now begin to focus more on comparing the effectiveness of specific processes that people use to inhibit their responses [17].

Clinical Psychology. Within clinical psychology, various forms of psychopathology are characterized by the inability to inhibit responses appropriately. Indeed, not being able to inhibit responses is associated with a range of negative mental health outcomes, including depression, ADHD, bipolar disorder, and substance abuse [31]. One solution has been to use inhibition training (i.e., teaching people to repeatedly stop their response to a particular cue) to reduce problematic behaviours (e.g., alcohol consumption, gambling, overeating); however, research suggests that such training does not offer any appreciable effects [32], possibly because (at least in part) training people to “use inhibition” is so vague that it cannot transfer to real world behaviour. Given the futility in training people to “use inhibition,” researchers can instead focus on unpacking the underlying processes that explain why a person can not adaptively inhibit target outcomes [33]. For example, one hallmark of people suffering with negative mental health is their rigid and limited use of strategies to cope with a situation. To help manage these experiences, researchers can develop interventions that provide people with a “toolbox” of strategies that they can then flexibly choose from in different situations [34].

Conclusion

For centuries, the concept of inhibition has played a prevalent role in understanding human functioning. In outlining the many conceptual issues surrounding inhibition, we propose that it is time to abandon inhibition as it currently stands – rather than treating inhibition as a process, we suggest treating it as an outcome and instead turning attention to studying the actual processes through which people achieve their goals. Our hope is that reframing inhibition this way will push the field towards greater conceptual and empirical clarity. Finally, inhibition is merely one construct of many in psychology (and adjacent fields) that have fallen victim to over-expansion and are now conceptually ambiguous. While our aim here was to help clarify the concept of inhibition specifically, we hope that this work inspires other researchers to tackle these issues within their respective disciplines.

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