

Operationalization and generalization in experimental psychology:

A plea for bold claims

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Abstract

The rise of scientific psychology has been tied closely to the adoption of experimental techniques in the study of human cognition and behavior. Experiments provide an elegant and rigorous tool to test mechanistic theories and they do so by distilling a theoretically relevant idea into an observable measure as part of a behavioral task – a process commonly dubbed as operationalization. I argue that modern experimental psychology is plagued by a continued trend towards overlooking the critical role of such operationalization. This neglect manifests in two seemingly opposing ways, either in research that jumps to inadequate conclusions by playing down the role of tasks in generating the research findings or, conversely, in research that is mainly focused on examining tasks (“paradigms”) for their own sake rather than testing theoretical ideas. This state of affairs can be rectified by re-embracing the power of explicit, theory-driven operationalization as I discuss in general terms as well as applied to the exemplary case of research on rule-violation behavior. Shifting focus back to how a theoretical idea is operationalized in a given research program will help to render experimental research in psychology methodologically sound while at the same time being able to provide generalizable findings.

Introduction

I read my first book on experimental psychology a little more than 15 years ago while eagerly waiting for my civil service to end. It probably was about time for me to dig into this subject as I read the book hoping to get a better grasp on what to expect from the degree programme in psychology that I had just enrolled in quite naively. Having expected psychology to be a rather wordy and potentially woolly subject, the concept of using controlled experiments to unravel the inner workings of the minds was enticing. The science of experimental psychology promised astonishing methodological rigour. It promised a clearly defined and tractable world of controlled experimental conditions to base its conclusions on objective, transparent and verifiable procedures. And it promised an exciting journey towards answering the big questions of human conduct.

This spirit does not quite align with how Davood Gozli's (2019) *Experimental Psychology and Human Agency* depicts the current state of the discipline. Unfortunately, his assessment appears to be careful, correct, and comprehensive. It highlights some of the major issues surrounding many contemporary investigations in experimental psychology. That is: While mainstream discourse has been preoccupied mainly with empirical and statistical discussions over the last years, Gozli claims that experimental investigations of the human mind have fallen prey to a much more profound issue in that they neglect a proper theoretical assessment, discussion, and integration of research findings. I believe that this far-reaching claim warrants a closer look.

Tasks as means, tasks as ends

The business of experimental psychology is to uncover how the mind does what it does, and its major tool to achieve this aim is to expose participants to tasks that they are

instructed to perform. Following this view, the task becomes a critical means to assess theoretical models of how the mind works (Gozli, 2017, 2019; Hackman, 1969). This role of tasks as scientific tools to construct, test, and specify theoretical ideas presupposes that experimental psychologists should not be interested in a given experimental task per se, for the task is only a means to an end. They should instead be interested in formulating a theoretical idea that eventually applies to situations that transcend the specific task setting in which it happens to be investigated in the first place. This interest in removing task characteristics from the picture takes a prominent spot in Gozli's critique (2019). In fact, he offers two supposedly widespread motives for keeping the task in the background (p. 12-13):

“It is important that we distinguish between the removal of task characteristics from psychological theories, as a scientific ambition, and the removal of task characteristics from description, as a rhetorical strategy. De-emphasizing the role of tasks in the production of research findings has rhetorical advantages. It allows us to make overly-general claims about human capacities. It leaves the social and normative dimension of the experiment out of consideration, treating participants, or models of the average participant, as isolated entities (Billig, 2013). By de-emphasizing the tasks, experimenters also de-emphasize the mutual understanding of the tasks, achieved through language, which then allows experimenters to maintain their focus to attributes of performance. By neglecting the social-normative dimension of the experiment, we ignore the fact that scientific activity is conducted within a social and cultural context.

Another rhetorical advantage of keeping the task in the background is that it facilitates a type of bait-and-switch trick performed on the audience of the research, including funding agencies and incoming members of the discipline. This trick involves borrowing a concept from its everyday domain to justify the research project. The concept may have rich and varied meanings in its original contexts of use, but after it is operationalized as an attribute of an experimental task, its meaning changes (Smedslund, 1997; Teo, 2018). This creates a gap between the everyday meaning of the concept and the meaning within the experiment. If we de-emphasize the task, we can de-emphasize this gap, talking about the findings as if they apply equally to the experiment and to everyday contexts.”

The remainder of this chapter is dedicated to reflecting on this excerpt. By doing so I do not intend to reduce Gozli’s (2019) critique to this particular view, especially because many points raised in his book offer striking insights into the current state of the discipline. In fact, I found myself agreeing with many themes of this critique so enthusiastically that the only room for discussion arises from how he assesses the role of task characteristics in the psychological literature. Because tasks take such a prominent spot in experimental psychology, however, I believe that a thorough reflection on this particular quote – or rather, an exegesis of it – may highlight potential avenues to improve theorizing in the field. By extension, these avenues may also be apt to improve *empiricizing* at the same time. With the term *empiricizing* I refer to bread and butter of the empirical scientist: the business of conducting empirical work for any reason, be it to test a theoretical idea, to teach students how to conduct and interpret experiments, or any other motivation one can think of.

The following sections will thus reflect on the validity of Gozli's (2019) conclusions on how task characteristics are downplayed in psychological research. Based on a somewhat divergent perception of the field, I will argue that task characteristics are in fact over- rather than underrepresented in some areas of experimental psychology. A way to resolve the limitations that come with neglecting and overly attending to task characteristics alike would be re-embrace the power of explicit operationalization. I will apply this reasoning to the specific case of research on rule-violation behavior (due to my own preoccupation with the subject matter) before outlining a more general rationale of how theory and empirical work should interact in experimental psychology and related fields.

While doing so, I agree that both rhetorical strategies of the above quote – omitting task characteristics in order to derive overly general claims and omitting task characteristics to downplay the gap between experimental setups and everyday contexts – are certainly conceivable and, anecdotally, I feel that I have made use of both of them myself (with varying levels of guilt for doing so). But how common are these strategies actually in the broader field of experimental psychology? First and foremost, they do not appear to be equally common across different researchers and different sub-disciplines. When browsing through recently published issues of relevant journals, it seems that some areas – e.g., experimental approaches in the social and developmental literature – do indeed tend to play down task characteristics quite routinely. The state of these fields thus seems to conform to the above quote.¹ I believe that matters appear quite different when turning to the field of cognitive psychology, however. Even though many of the studies discussed by Gozli (2019) fall into this domain, I feel that

¹ This claim might warrant additional evidence in the form of exemplary citations (quite a few of which readily come to mind) or a quantitative corpus analysis of a larger body of the published literature. I opted not to include any specific references because this chapter does not intend to point fingers at particular articles or journals. Instead, the assessment is meant to describe my subjective perception of the field.

contemporary cognitive psychology is plagued by the very opposite limitation. Rather than playing down task characteristics, certain tasks have actually become the target of most scientific efforts in this field. That is: Rather than seeing tasks as means to study some theoretically interesting idea, certain tasks have become an end of their own for many experimental psychologists sailing under the cognitive flag (see also Meiser, 2011).

The continued preoccupation with tasks is apparent in many colloquial presentations of research findings on conferences and workshops around the globe. These presentations would often start with icebreakers such as “Are you familiar with the negative priming paradigm?” or “I guess you have heard of task switching before!” Each of these paradigms might be used to study different theoretical twists, however (Frings, Schneider, & Fox, 2015; Kiesel et al., 2010), but these eventual theoretical implications tend to find themselves overshadowed by discussions over empirical and methodological fine print. More often than not do these fine-grained issues hide behind three-letter acronyms such as SOA (short for stimulus-onset asynchrony), ITI (inter-trial interval), or RSI (response-stimulus interval), and they often revolve around timing specifics and other variables that lend themselves to parametric manipulations (eccentricities, relative frequencies, sequential positions, and the like). Scrutinizing parametric manipulations of timing-related variables, even those with three-letter acronyms, may of course be viable and highly informative at times. This approach requires a thorough theory of mental processing to live up to expectations, though (for a positive example, see e.g., Pashler & Johnston, 1989). One could of course argue that colloquial presentations omit such theoretical explications for rhetorical reasons, and that these discussions help to distill theoretically meaningful ideas in the end, but the published literature is similarly plagued by reports that seem to study certain experimental paradigms for their own sake without making meaningful connections to the theoretical landscape. One way

to resolve this limitation of current practices is embracing the use of explicit operationalization much more strongly than currently done in the field.

Operationalization

In my judgement, it seems that the argument of playing down task characteristics does apply to certain sub-disciplines in experimental psychology, but it does not seem to map too closely onto the current state of cognitive psychology. Here researchers often seem to be preoccupied with studying task characteristics in the first place rather than systematically playing down such aspects of their work. Fortunately, the two strategies are not mutually exclusive when taking different reports of research findings into perspective, even reports published by the same researcher or group of researchers on different occasions. It seems perfectly possible to spend a major share of one's career empiricizing about highly specific and paradigm-centric methodological concerns, but to jump to conclusions by playing down task-characteristics on other occasions. I would thus argue that many experimental psychologists are indeed mindful of task characteristics and their role in producing empirical observations, and that these factors are discussed at length in the field. This discussion is largely disconnected from occasions on which authors try to highlight theoretical ideas, however.

Perhaps surprisingly, the two different views of how task characteristics are discussed in the experimental literature converge on the same outcome when assessed in more general terms. Irrespective of whether task details become marginalized when reporting research findings or whether they become the main target of experimental endeavours, researchers adopting either one of these strategies will fail to build informed theories of human conduct due to a missing connection between theorizing and empirical work. In a similar vein

Experimental Psychology and Human Agency further highlights that findings from experimental psychology are not sufficiently scrutinized by philosophical and sociological analyses (Gozli, 2019). Ideally, such critique would go beyond addressing specifics of a certain task at hand, by scrutinizing how the field is shaped by the very fact of involving tasks in the first place (see also Ting, this volume). I fully agree that this dimension is hardly ever discussed in the field at present and would deserve a more prominent spot, even though I will focus on task-driven research in the following.

One particular technique to connect theory and empirical work is to derive an experimental setup – or “paradigm” as commonly dubbed in experimental psychology – from a theoretical idea. This process of explicitly operationalizing a theoretical idea seems to have fallen out of favor at least in the cognitive literature (here matters seem to be less critical in fields such as social psychology, again based on my subjective perception of the literature). Mainstream research in cognitive psychology seems to have reached a tacit agreement that certain paradigms can be employed without much justification. This is particularly apparent in research on cognitive control where specific paradigms such as the Flanker task (Eriksen & Eriksen, 1974), the Simon task (Simon, 1990), and the Stroop task (1935) are routinely employed in a wide range of studies. Only rarely do researchers discuss other potential uses of these tasks – say: to study selective spatial attention rather than cognitive control in case of the Flanker task – and other potential facets of cognitive control that might be captured by distinct experimental setups (e.g., Dignath, Kiesel, & Eder, 2014; Miyake et al. 2000). In its extreme form, this development results in a collection of basic cognitive tasks that are commonly regarded as useful tools to carry out psychological research (e.g., Bermeitinger, 2012). The danger associated with such a development is that the tasks seem to become

meaningful entities of their own. Researchers might thus be tempted to target the specifics of particular tasks while failing to address the broader picture.

A potential defense against this criticism might be the argument that such considerations had been voiced when the field of cognitive control was still in its infancy (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Hommel, Proctor, & Vu, 2004). Maybe such theoretical groundwork may indeed help to set a specific experimental setup into context, but I believe that the somewhat antique exercise of operationalization will always help to provide the audience of a research finding with a good sense of its potential relevance. Going one step further, I would argue that explicitly communicating the logic behind the researcher's operationalization is an ideal way to justify general conclusions that aim to transcend the task at hand. I will try to give an example for this claim by turning to work on rule-violation behavior as discussed by Gozli (2017, 2019).

Bold claims: The case of rule-violation behavior

Tasks are comprised of a number of rules that define which type of situation requires which type of action from the participants, and such rules tend to take the form of stimulus-response mapping rules in the context of behavioral research. Not surprisingly, such task rules have been studied in considerable detail in the cognitive literature, e.g., by assessing how effectively a new, instructed task rule is established and by measuring interference from opposing rules (Kunde, Kiesel, & Hoffmann, 2003; Meiran, Pereg, Kessler, Cole, & Braver, 2014; Waszak, Pfister, & Kiesel, 2013; Wenke, Gaschler, Nattkemper, & Frensch, 2009). These findings suggest that rules become ingrained quite deeply into the human cognitive system and, once established, take considerable mental effort to be overcome (Dreisbach, 2012). Such observations resonate with classic findings from social psychology, which

showed a general preparedness of human participants to follow rules and norms (Asch, 1951; Cialdini & Goldstein, 2004). This latter strand of research is commonly subsumed under the labels of “conformity” and “obedience”, and corresponding studies have indicated that participants would even take extreme actions if repeatedly commanded to do so by an authority (Blass, 1999; Milgram, 1963, 1974).

Theorizing in cognitive and social psychology stands in stark contrast to theoretical ideas that have been developed in the economic literature on cheating and dishonesty (Fischbacher & Föllmi-Heusi, 2013; Gneezy, 2005; Hilbig & Thielmann, 2017). Here, participants were reported to show a strong tendency to break the rule of an experimental task whenever rule-violation behavior would promise to maximize their payoff (for a critique of these studies, see Ting, this volume). When asked to report the outcome of a hidden die roll, for instance, the mean reported outcome routinely exceeds chance level when participants can secure monetary rewards based on their reports (Fischbacher & Föllmi-Heusi, 2013). Economists therefore suggested that rule adherence requires time and mental effort to overwrite temptations from potential, motivationally relevant outcomes (Bereby-Meyer & Shalvi, 2015; Shalvi, Eldar, & Bereby-Meyer, 2012; but see Foerster, Pfister, Schmidts, Dignath, & Kunde, 2013).

These and other findings from behavioral economics may be taken to suggest that rules are merely relevant for informing about potential payoffs and punishment for certain behavioral options (Becker, 1968). A closer look at the data pattern emerging from recent studies on economic games suggests that participants do not blindly maximize their rewards, however, but that they rather tend to misreport their outcomes only slightly and not to the maximum possible extent (Hilbig & Hessler, 2013; Ting, 2020). Classic economic theories on cheating and dishonesty do not predict such a pattern of results, nor can they accommodate

such qualifying observations *ex post facto*, because they regard rules as relevant only for defining likelihood and severity of punishment for rule-breaking. A similar idea lies at the heart of prominent sociological theories such as the “General Theory of Crime” (Gottfredson & Hirschi, 1990; Pratt & Cullen, 2000). This theory suggests that human agents have a strong tendency to maximize their own rewards and will do whatever it takes to secure such “gratification” (to use the term employed by the theory). This framework thus regards rules as a mere tool to define punishments in order to deter agents from engaging in criminal actions if such actions were to promise interesting rewards.

Which of the two assertions is true? Do rules mainly feed into rational decision processes that balance expectancies and values (rewards) as suggested by economic theorizing? Or is the human cognitive system geared towards absorbing and internalizing rules and norms as suggested in the psychological literature?

This question can be answered by the dedicated study of actions that aim at breaking a given rule or norm as commonly done in the economic literature. Answering this question further requires an approach that is able to assess an empirical proxy of how cognitive processing unfolds in the course of a rule violation, however.² The common focus on decision outcomes in studies on cheating and dishonesty appears to be too coarse-grained to capture such processing, and we thus proposed an alternative setup in a series of studies (Pfister et al., 2016; Wirth et al., 2016). Our reasoning was as follows: Rule-breaking at the very least requires a situation in which an agent is aware of the rule and the behavior it prescribes, and he or she deliberately performs a different course of action. Such a minimal definition allows

² The vocabulary employed in this sentence as well as the methods described in the context of the following studies may suggest a theoretical relation to “action dynamics” accounts (McKinstry, Dale, Spivey, 2008). This resemblance is coincidental, however, and this work was not performed with such a theoretical perspective in mind.

for distilling an experimental paradigm that operationalizes precisely these two components, which appear both necessary and jointly sufficient to study rule-violation behavior.

In our paradigm, we therefore presented participants with a simple stimulus-response classification task and asked them to perform a mouse movement from the bottom center of the screen to either the top-left or the top-right depending on an imperative stimulus that appeared on screen. We used a small set of only two stimuli, and the mapping rule prescribing the correct response to each of these stimuli was instructed explicitly to ensure that participants would be aware of the rule and the behavior it implied for each situation. Critically, participants either followed the rule or acted against the rule on different trials. This was achieved by either asking participants before each trial whether they wanted to abide by the rules or break the rules (Pfister et al., 2016, Exp. 1), or by instructing one type of behavior (Pfister et al., 2016, Exp. 2; Wirth et al., 2016, Exp. 1).³ We then sampled the trajectory of the mouse cursor while participants performed their action, and assessed whether the resulting trajectories would follow a straight path to their eventual target location or whether they would be attracted towards the target location on the opposite side of the screen. While rule-abiding responses followed a relatively straight path, rule-violation responses were deflected towards the opposite target location, i.e., the target location that would have represented the rule-abiding option. This observation suggests that rule-based responses were

³ Instructing participants to break a similarly instructed rule may seem somewhat unorthodox, because rule-breaking then becomes nested in a meta-rule of either following or violating an instructed stimulus-response mapping (Gozli, 2017). This is especially the case if both instructions emerge from the same source, e.g., from the same experimenter as in the case of our experiments. We still opted to do so because relying on free choices between rule-following and rule-breaking is plagued by a general reluctance to opt for rule violations so that it is difficult to find a control condition which comes with a similar experience for one or the other response. Crucially, even this artificial situation conforms to the minimal definition of rule-breaking as behavior that does not align with a rule. Whether participants do construe it the same way is a different question, of course (Gozli, 2019). This concern would be especially relevant if the results of the free choice condition had not replicated for instructed violations. Observing a similar pattern of results for instructed violations, however, seems to validate the experimental design.

indeed retrieved even against the agent's intention of enacting a different behavioral option. The experiments further included a control group in which the same procedure was introduced not as a choice between rule-following and rule-breaking but rather as a choice between a standard task ("Task 1") and an alternate task ("Task 2"). This procedure ensured that, from the outside, the participants performed the very same actions in response to the very same stimuli as for the rule-violation instructions, but their options were now labelled as equally rule-abiding. The trajectories of this control group showed only a small deflection when responding according to the alternate mapping as compared to the standard mapping, and this difference was substantially smaller than the difference observed under rule-violation instructions. This even held true when the alternate task was introduced not as a separate task ("Task 2") with its own mapping rule but rather as having the opposite mapping of the standard task so that participants would have to negate the task rule themselves (Wirth et al., 2016, Exp. 3).

We took these findings to suggest that "Merely defining a rule, however arbitrary and irrelevant it may be, thus seems to prompt a tendency toward following it" (Pfister et al., 2016, p. 97). This is a strong statement. In fact, it seems to be a perfect example for an attempt to make overly general statements by jumping from a rather abstract, experimental task to broad, theoretical claims about human conduct. This view is certainly correct in that our interpretation is likely too broad and too general to represent a full-fledged theoretical take on rule-violation behavior. I would still defend this claim for at least two reasons.

The first reason for defending our interpretation is that our conclusions are safeguarded by an explicit operationalization. That is: We took care to build an experimental design specifically to meet criteria that had emerged from a thorough analysis of the theoretical construct at hand (Rule breaking := "an agent is aware of the rule and the behavior

it prescribes, and deliberately performs a different course of action”), and we justified the reasons for doing so explicitly. This axiomatic procedure safeguards against criticisms in terms of the generality of the conclusions, because the task was build in a theoretically motivated attempt to capture the very essence of rule-violation behavior across a wide range of situations. This procedure does not safeguard against criticisms pertaining to how successful our operationalization was, of course, including potential reservations regarding an impact of the experimental situation itself that may reinforce tendencies to follow rather than break rules (Gozli, 2017). It also does not address criticisms of the general methodology of isolating specific cognitive processes (or aspects thereof) in controlled experimental designs (Gozli & Deng, 2018).

The second reason for defending our interpretation is that interpretations of scientific findings are necessarily provisional in nature. They should always be read as a statement of the authors’ current beliefs based on the available evidence. Here, the results of our experiments do not suggest any indication for exceptions to the hypothesized retrieval of rule-based actions, and this also holds true when carefully assessing what is available in the published literature. The only hints for an exception in this direction seem to be repeated violations of the same rule in close temporal succession (Wirth, Foerster, Herbort, Kunde, & Pfister, 2018) and situations that suggest the rule to be negated at times (Imhof & Rüsseler, 2019). The latter finding emerged from a setting in which participants were asked to break the rules on some trials whereas they were asked to respond according to a negated rule on other occasions. One way to view these findings is that the simultaneous operation of both instructions (“break the rule” vs. “negate the rule”) caused the participants to fuse both meanings either by re-framing rule-breaking into following the negated rule or vice versa. Such a re-framing appears likely given that breaking rules and following a negated rule

implied the same behavioral response. This view is further in line with ideas that task instructions will affect the salience of certain aspects of the experimental task, the employed stimuli or the potential response options (Gozli, 2019). The state of the evidence therefore does not allow for a strong case based on either of the two findings at present, neither is there a compelling theoretical alternative to explain the present database (note that accounts in terms of instruction-induced salience cannot easily explain the observed difference between “violation” instructions and instructions to select a separate “Task 2” without assuming a special role of the concept of rules). With additional evidence incoming our interpretation will likely be toppled sooner or later, but until such evidence is available I believe it is useful – actually: desirable! – to aim at maximally general claims. After all, experimental work can only be conducted, interpreted and discussed when assuming generalization of research findings. If one portrayed experimental observations to be specific to the precise circumstances from which they emerged – to name a few that apply to the studies discussed above: experiments conducted in the Röntgenring 11 buildings of Würzburg University in the time from November 2012 to January 2013, testing a WEIRD sample (Henrich, Heine, Norenzayan, 2010) on an experiment that was displayed on an old-fashioned cathode-ray monitor and operated by a non-ergonomic Logitech™ optical corded USB mouse – then there is no point conducting experimental work in the first place. Any empirical efforts will always come with an infinite number of specificities, and it will thus not be possible to assemble an exhaustive list of potential confounding variables. If one wanted to see meaning in experimental work – and this is to be expected from an experimental psychologist – then the possibility of generalization has to be the default mindset when interpreting research findings. Generalization at least in time and space, but ideally also regarding any other variable on which the sample at hand comes with a specific value.

Now, if we were to accept the (preliminary) conclusion that rules become ingrained into the human cognitive system, does this conclusion speak against a direct and tempting influence of motivationally salient rewards as it is highlighted in economic theorizing? No, it does not. It seems eminently plausible that temptations may at times compete with tendencies to follow a rule or norm, and such temptations may readily bias participants to opt for violating a rule as has been shown in several experiments (e.g., Hilbig & Thielmann, 2017). Whether or not the presence of a strong motivational temptation will ever be sufficient to remove rather than counteract the hypothesized automatic retrieval of rule-based tendencies in their entirety is a different and currently open question, though. Tackling this question with suitable experimental designs will certainly inform our understanding of how rules are represented and how directly and immediately a rule is retrieved when encountering rule-related stimuli in the environment (see Pfister et al., 2019, for a first attempt in this direction).

Other potential moderators of retrieving rule-based response tendencies are also likely to exist and have been highlighted by research on conformity and by research on human factors alike. They include situational variables such as social support, e.g., by observing disobedient acts of a third party, interpersonal variables such as the individual propensity for risk-taking, as well as cultural variables, e.g., those that vary along the individualistic-collectivistic continuum (Chen et al., 2006; Elms & Milgram, 1966; Reason, 1990). Rule-violation behavior will further be shaped by prior acts of rule-violation of one and the same agent (Jusyte et al., 2017; Ting, 2020; Wirth et al., 2018), and the cognitive burdens of enacting a rule violation are also likely to differ between different types of rule violations. Such types comprise hidden rule-breaking as in the case of cheating, open acts of rule-breaking as in the case of rebellious behavior, as well as norm-breaking acts of creativity and innovation (Gozli, 2019). As for the case of temptations, these potential moderators might

either affect the strength with which a rule is retrieved upon encountering rule-related stimuli or they might even prevent the rule of being retrieved entirely. Determining which of these two possibilities is the case for different potential moderators again requires empirical efforts. These empirical efforts of course call for more refined, more complex, and potentially also for more externally valid experimental designs. They also call for different variants of operationalizing rule-violation behavior as only convergent operationalization allows drawing meaningful conclusions (Garner, Hake, & Eriksen, 1956; Grace, 2001). One potential avenue is to compare different kinds of rules such as specific stimulus-response pairings of the type “Upon encountering stimulus X, perform action Y” for a fixed set of potential stimuli versus classification rules of the type “Upon encountering a stimulus with the feature X, perform action Y” that may applied to an indefinite number of different stimuli or situations. Another potential avenue for arriving at convergent operationalization is to broaden the applied measures, with promising candidates being gaze behavior to study attentional allocation during rule violation as well as physiological responses such as skin conductance responses to evaluate potential affective implications. Undertaking such efforts will allow to judge the simple model of automatic rule retrieval and corresponding results will likely call for modifications and theoretical refinements. Eventually, they will also allow to assess whether the topic at hand did indeed allow for an approach that tries to isolate “building blocks”, and whether our initial operationalization did indeed capture what we had intended it to do (Gozli & Deng, 2018).

The use of different ways to operationalize the construct under investigation is especially relevant in the search of exceptions to our claim of immediate and necessary rule-retrieval during rule-violation behavior, because such work ultimately aims at providing evidence for the absence of an effect rather than documenting the absence of evidence. As

mentioned above, a consistent bias towards choosing rule-violation for certain individuals in certain situations cannot be seen as sufficient evidence as it omits the process of how an eventual decision came about. Suppose a child in the swimming pool, boasting in front of its peers that it has no issue whatsoever jumping from the highest diving platform. Observing this child to consistently muster the courage to jump from the platform on several occasions will only tell part of the story. If its peers wanted to assess whether the child's boasting was fully justified, they might be inclined to take a closer look at signs of hesitation when standing on top of the diving platform. Observing the child to step back from the platform several times before anxiously leaping over the edge will paint a different picture than observing the child standing on the platform relaxed and calm. Similarly, research on rule-violation behavior will at the very least have to ascertain that measures of action planning (e.g., response times), measures of action execution (e.g., movement trajectories) and additional proxies of cognitive and affective processing (eye-movements, physiological arousal) jointly suggest an absence of rule retrieval upon encountering a rule-related stimulus to substantiate a case against the simple model advocated above.

While engaging in such research will offer many new insights in the representation of rules and its impact on human behavior, I believe that such efforts will have to be carried out in the spirit of narrowing down an ambitious and overly general theoretical idea, either by arriving at a more elaborate re-formulation of the theory or by pinpointing the situations to which the general theory applies sufficiently closely.

Generalization

“Science may be described as the art of systematic over-simplification”

(Popper, 1988, p. 44)

Philosophy of science has brought a variety of accounts that aim at characterizing, justifying, and norming the dialogue between theoretical ideas and empirical findings. The view that I promoted with reference to research on rule representations might be seen as a clumsy import of structuralist ideas into Popper's logic of exposing a theory to attempts at falsifying its predictions (Balzer, Moulines, & Sneed, 1987; Popper, 1935/2005, 1988; Westermann, 1987, 2017). Even though other modes of theoretical development are equally possible from a philosophical point of view, I believe that the agenda of embarking from bold theoretical claims in order to narrow down a theory or model is not only desirable in experimental psychology, but I believe that it is also without practical alternatives in this field as I will outline below (readily dismissing the Popperian insight that there is always a practical alternative when actually understanding a theory or problem; Popper, 1972). My commitment to such an approach in the context of experimental psychology does not intend to deny that more synthetic approaches for constructing theories will likely be viable on other occasions. Such synthetic approaches will further be able to inform experimental approaches (Valsiner, 2017). Still, I believe that experimentation will always require a sufficiently general theoretical idea as its bedrock. This even applies to experimental work that may be carried out with a number of other proximal goals in mind. A researcher might be inclined to address methodological shortcomings of previous work without necessarily subscribing to its theoretical tenets, or a lecturer might replicate an existing experiment with their students in order to demonstrate the intricacies of experimentation. However, such work will arise only if theory-driven work had been conducted in the first place.

It is a particular feature of experimental psychology – in fact: of any field that employs experimental methodology – that researchers carefully create the conditions they intend to investigate in order to elicit precisely the type of behavior they intend to study. This type of

work can only be stimulated by a sufficiently general theory on the subject under investigation. Constructing a corresponding theory, however, requires a vision. It requires a vision of what to explain and how to explain it. It requires a vision of how to transcend empirical facts that have already been established. And it requires a vision to explain cognition and behavior along a sufficiently large range of situations.

A vision itself will only provide a broad theoretical outline, of course, ideally supplemented by an informed intuition on how to implement a first experimental take on the subject matter. Once this outline is in place, however, it allows for critical modifications based on new evidence. This process of modifying a general theory based on accumulating evidence can be compared to the process of sculpting as portrayed in Figure 1 (Schenk, personal communication): The raw workpiece will typically define the scope of the final product regarding its outline – say: the shape of the rock that the sculptor starts to work on – and its makeup – say: the type of rock that is used.⁴ Only continued labor will carve out a sufficiently pleasing result eventually. In the context of experimental psychology, the workpiece is a relatively general theory on any aspect of human conduct, while carving out takes place via continued empirical efforts that aim at critically testing the original theoretical idea. As in sculpting, different states of a theoretical idea call for different empirical tools. While coarse theoretical ideas will yield simple experiments, increasing theoretical refinements call for increasingly sophisticated and complex experimentation that further adapts to challenges along the way (Ting & Fitzgerald, 2019). The final product, be it a

⁴ I borrow this metaphor from an inspiring presentation by Thomas Schenk (personal communication) on the two visual streams model. Like many other influential theories and models in psychology, this field of research started with an overly general claim on the neurophysiological and functional separation of two pathways for processing visual information (Milner & Goodale, 2006). Follow-up work then continued to show exceptions from this simple model, thus carving an elaborate understanding of visual processing in the context of conscious perception and action control alike (Schenk, Franz, & Bruno, 2011).

sculpture or a well-developed theoretical account, requires both types of work: Work that defines the broad outline with sufficiently coarse tools and work that carves out details to arrive at a desirable result. With regard to theorizing, this latter work takes place in the form of arguments that challenge, evaluate and refine certain ideas.



Fig. 1. The sculpting metaphor of theorizing in experimental psychology. Initial theories that are formulated when approaching a new subject may be overly general and miss many of the nuances that would be required for a satisfying description. Still, the original workpiece sets the scope of what the final product will eventually be like (left panel). Follow-up work that aims at replicating original findings with convergent operationalizations, work that aims at identifying limits and moderators and work that aims at challenging the basic tenets of a theory will carve out a more precise and well-rounded theoretical approach (center). Focusing only on isolated components or specific details, however, will torpedo the whole enterprise (right).

The iterative process of narrowing down a general theoretical idea (or: workpiece) also seems to come with several direct connections to scientific critique as advocated by Gozli (2019). Critique can curate theoretical approaches and corresponding findings to evaluate whether empirical (especially: experimental) researchers managed to find the right scope both with regard to theoretical progression as well as with regard to experimental manipulations. Critique can uncover connections to fields that might share goals or methodology, and it can

also uncover methodological pitfalls such as experimental specificities that might affect the generalizability of research findings. Finally, critique can pressure experimental researcher not to lose touch with the real world (or at least aim to regain touch if running danger to miss the bigger picture). Crucially, however, these valuable contributions of scientific critique will shine most when researchers aim to formulate maximally general theories on a cognitive process of interest and clearly communicate how they derive an operationalization from their theoretical beliefs. The exercise of conducting empirical research is conditional on the belief that findings might generalise at least to some degree, and only with this mindset can we build an informative and useful model of the inner workings of the human mind.

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