

Expert Decisions Without Decision-Making: The Situation Shaping Hypothesis

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ABSTRACT

The finding that how individuals frame a situation often shapes their actions more than deliberation over predefined options has been central to Naturalistic Decision-Making research from its inception. Yet the theory and language surrounding this insight have remained diffuse and sometimes disconnected. We refer to it here as the Situation Shaping Hypothesis and offer a constructivist, opportunities-and-constraints-based account that highlights its role in bridging the Recognition-Primed Decision model and the Data-Frame Theory of Sensemaking. We examine the hypothesis' inherent circularity and introduce a virtue-based framework grounded in abductive theorizing to clarify which features of a frame enable effective situation shaping.

KEYWORDS

Decision-making; sensemaking; frame; cognition; constructivism; relevance realization; epistemic virtues.

INTRODUCTION

Before the field of Naturalistic Decision Making (NDM) even had a name, three themes were identified at the inaugural conference (Lipshitz et al., 2001).

The first theme concerned the kinds of domains that the researchers studied: complex, real-world environments characterized by time pressure, uncertainty, ill-defined objectives, high personal stakes, and other contextual intricacies. The second theme highlighted the type of individuals that the researchers studied; those with demonstrable expertise, rather than novices.

However, the last theme was distinct in that, rather than identifying the field of study, it was an insight among the diverse researchers. Theme three noted that *the ways in which individuals made sense of situations often exerted greater influence on their actions than did deliberation over a set of predefined options*. We call this the *Situation Shaping Hypothesis*, indicating that people solve problems and make decisions by actively shaping, or constructing, their situational understanding, not by optimizing within a pre-existing frame.

The hypothesis is a foundational empirical finding of NDM, but it is not unique to the field. Similar hypotheses have been put forward in related fields of decision-making. Perhaps most famously by Herbert Simon (1996) who said that,

"All mathematical derivations can be viewed simply as change in representation, making evident what was previously true but obscure. This view can be extended to all problem solving—solving a problem simply means representing it so as to make the solution transparent."

More recently, there has been a "*cognitive turn*" in Behavioral Economics that is "*more focused on explaining and unifying anomalies than on accumulating new deviations*" (i.e., cognitive biases) and "*aims to replace reduced-form notions of biases or 'revealed non-standard preferences' with the underlying cognitive mechanisms*" (Enke, 2024). In a recent paper by Bordalo et al. (2024), the authors propose a model of decision-making remarkably similar to the Recognition-Primed Decision model (Klein, Calderwood, & Clinton-Cirocco, 2010), as well as similar to arguments by Dreyfus and Dreyfus (2005), arguing that:

"Before evaluating choice options, people use attention and memory to categorize a problem in a class of similar problems they solved in the past. This step produces a mental representation: the set of features deemed relevant for solving the problem."

In order to advance the theory and coordinate around a shared language, this paper examines three questions relating to the Situation Shaping Hypothesis: (1) how should the cognitive process underlying effective situation shaping be characterized, (2) how do experts overcome the circularity inherent in finding a frame which already implies the answer, and (3) how might researchers evaluate the constructed "shape" of the situation?

THE COGNITIVE SCIENCE OF SITUATION SHAPING

In Klein et al.'s (2010) original research into firefighters, it was noted that firefighters rarely generate multiple options and deliberate between them. Instead, they rapidly diagnose the situation by drawing on patterns from past experience. The subsequent situational understanding has an "if X, then Y" relationship with an action that can either be directly implemented or possibly evaluated first through mental simulation. This process was later systemized into the RPD model.

A related but distinct model of expertise is the Data-frame Theory of Sensemaking (DTS) (Klein et al., 2007) which seeks to explain how people make sense of situations by framing relevant data. In the theory, individuals identify data which helps to inform a frame, and the frame helps the search for further data in a reciprocal relationship. A frame is defined as “*an explanatory structure that defines entities by describing their relationship to other entities.*” Similar terms include schemas and mental models, and Klein explicitly notes that stories, maps, scripts, and plans are all frames. Anything which involves conceptualizing a situation, such as categories, affordances, and saliency can also be understood as aspects of the frame.

How these two models interact or relate to each other is an interesting but unsettled question, with some researchers suggesting RPD is a central macrocognitive process through which all others can be understood (Hutton, 2019), while others have suggested that RPD is just one way of working through DTS. In practice, RPD gets emphasized in domains characterized by quick pattern matching, whereas DTS is emphasized in slower domains involving problem detection and diagnosis.

What the two models do seem to share is a similar function: situational discrimination. The core feature of RPD is recognizing different types of situations, and similarly the core function of DTS is generating situation specific frames. In both cases, the core function of the models is to help the individual discern the type of situation they are in. This shared feature is perhaps unsurprising as they are both models of expertise, and as argued by Dreyfus and Dreyfus (2005), “*the ability to make more subtle and refined discriminations is what distinguishes the expert from the proficient performer.*”

Such situational discrimination must be understood as a core element of the Situation Shaping Hypothesis. Since situations have an “If X, then Y” relationship to an action, the ability to distinguish between situation types is essential to knowing what to do. This ability to discern situations comes through increasingly concrete understanding of a domain which can facilitate pattern matching and other sensemaking abilities. This ability is why *the ways in which individuals made sense of situations often exerts greater influence on their actions than does deliberation over a set of predefined options.* It can also help to explain why experts tend to spend more time than novices on trying to understand the situation, and less time on generating possible solutions (Kobus et al., 2000).

However, identifying the situation (X) is only part of the story, as the Situation Shaping Hypothesis suggests that the situation must then suggest what to do (If X, then Y). But how does a certain situation get attached to a certain response?

Rather than retrieving pre-stored rules or chunked information from memory to recognize and respond to a situation (see Chase & Simon, 1973; Simon & Gilmarin, 1973; Gobet & Simon, 1996), we propose a constructivist view of cognition where frames clarify opportunities and constraints which work dynamically together to further discern situations. Each decision is assembled anew from the interaction between frames, opportunities, and constraints. Frames structure the context by highlighting what matters, filtering noise, and shaping how information is organized. They actively make problems tractable by carving out what is relevant and suppressing what is not (Klein et al., 2007). Constraints provide the underlying principles and limits that govern what can and cannot be done within that framed context, and opportunities guide attention in a similar way. When a frame highlights certain features of a situation, it simultaneously brings the relevant opportunities and constraints to the foreground and weights them, allowing an agent to generate an appropriate response. Together, they allow cognition to flexibly adapt to novelty, ensuring that even though every situation is new in some respect, the system can still respond efficiently and meaningfully. This constructivist perspective emphasizes that cognition is less about retrieving fixed structures and more about dynamically constructing them in context.

It is the fact that a frame is not abstract or a literal representation but is instead a constructed and functional understanding that makes the Situation Shaping Hypothesis possible. To solve a problem or make a decision, one needs to construct the right frame, as the frame implies the action to be done by constraining the possibilities and highlighting opportunities which together reveal possible pathways and affordances.

Consider how an expert law enforcement officer might navigate de-escalating a situation. As they are staring down an individual who may become violent at any moment, there is not enough time to construct many options to evaluate and then choose. Instead, their situational understanding which they dynamically shape throughout the encounter must instead surface the relevant constraints and opportunities so as to guide the conversation without the need for deliberation between options.

By acknowledging how situations are constructed in the moment through identifying constraints and opportunities which can then guide behavior, the Situational Shaping Hypothesis takes on a pragmatic as opposed to purely epistemic nature. This in turn collapses the difference between sensemaking, decision-making, problem solving, and problem formulation. Rather than treating problems and decisions as things to be found in the world, we must instead understand them as products of how a person makes sense of a situation.

Indeed, as others have argued, there are no natural kind processes called problem solving or decision-making (Cohen & Lipshitz, 2011; Kirsh, 2009), there is just how someone chooses to make sense of, formulate, and shape their understanding in a functional way so that they can navigate the world effectively. For this reason, the situational discrimination central to expertise is better understood as situational shaping, which emphasizes the active role the individual takes in shaping their understanding. As John Schmitt (2021) has said, “*problem formulation and problem solving are not merely linked cognitive processes. They are the same cognitive process.*”

However, there is a possible problem in this theory. How can it be possible to formulate (or shape) one's understanding of a situation in an adaptive way before one knows what would be adaptive?

THE INHERENT CIRCULARITY

There is a circularity involved in identifying a good frame with relevant constraints and opportunities. As Klein (2007) points out, *"The data identify the relevant frame, and the frame determines which data are noticed. Neither of these comes first. The data elicit and help to construct the frame; the frame defines, connects, and filters the data."* Elsewhere, Klein has said that while in hindsight sensemaking can look like just connecting the dots, the truth is we don't know what a dot even is until we have made sense of the situation (2009, p.128).

Even earlier, Klein et al. (2005) point out the circularity when they state that the difficulty with problem detection is "appreciating the significance of data elements in the first place." They state that;

"This circularity raises the question of what comes first, the indications that trigger problem detection, or the detection of the problem, which conditions the interpretation of the indicators? This dilemma is precisely the problem of meaning recognition, otherwise known as the Höffding Problem (Höffding 1889). How can you recognize something before you know what it is that you are recognizing? The act of recognition presupposes an act of recognition."

Is this circularity problematic? In personal conversations with members of the NDM community, some show a lack of interest in the problematic nature of this curricular reasoning, instead noting that the circularity is actually a strength of these models since so few other models do recognize it. Furthermore, there is a concern that any kind of explanation might be too microcognitive to be appropriate for NDM research.

Elsewhere the problem is given more central import. Vervaeke and colleagues (2012) argue that this circularity, which they call Relevance Realization, is a more general version of the Frame Problem in AI research. They further argue that the ability to solve the circularity and realize relevance is the "criterion of the cognitive"; that is to say, it is what makes cognitive agents distinct from AI and other seemingly intelligent but non-cognitive systems. Elsewhere, it is argued that relevance realization is what underlies intelligence (Vervaeke et al., 2013) and rationality (Riedl & Vervaeke, pre-print).

Given the proposed centrality of Relevance Realization to cognition, intelligence, and rationality, it is not a stretch to propose it has central importance to expertise, as well. All of the skills that experts have—pattern matching, 'seeing the invisible, recognizing a situation, mental simulation—seem to be difficult precisely because they require overcoming the inherent circularity.

Indeed, perhaps the circularity of relevance realization can help to explain the difficulty of developing expertise. A novice may struggle because they cannot shape their understanding of the situation in a way that implies the solution (no "if X, then Y" relationship). The novice cannot understand the situation due to not recognizing the relevant data, and they cannot recognize the relevant data because they do not have an appropriate frame of the situation. Later, even if the novice does begin to understand the situation, they might try to mentally simulate the correct action to take as the RPD model suggests. But there is a circularity there as well; they are testing their own understanding not against the world, but against their own understanding. So how can they be sure they considered all relevant variables in their mental simulation?

It would seem that the circularity of Relevance Realization is both a strength and a weakness of the macrocognitive models of expertise. It is a strength in that the circularity is indeed essential to explaining how experts are able to perform at such high levels, and the circularity may additionally help to explain why expertise is difficult to develop, as it is not straightforward (quite literally) how to overcome the circular reasoning.

However, it may also be a weakness in that it is unclear how such circular reasoning could be possible, which may make it difficult to fully understand expert decision-making. It may even make expertise seem mystical or magical, similar to how critiques of intuition and tacit knowledge are sometimes dismissed due to a similar difficulty in representation. Perhaps the two problems are even related, and tacit knowledge is not easily represented precisely because it is a type of cognitive reasoning which overcomes circular reasoning.

HOW DO FRAMES AFFORD DECIDING?

A good frame doesn't just help us understand a problem but is instead the very thing which makes a problem tractable. This is because there are no inherently simple choices, but rather, simplicity arises from frames which effectively manage real world complexity by omitting irrelevant information and making explicit relevant information. Without effective frames, decision-making falters because the inputs to the process can be poorly defined, misaligned, or too complex, resulting in the decision maker being unable to discern between noise and critical information, or to recall how anything relates to anything else.

The problem of selecting, or rather constructing, a good frame is not unique to the applied domains but is directly related to the epistemological problem of abduction, also called inference to the best explanation (Douven, 2011). Abduction is the process of finding which hypothesis best fits the evidence. A hypothesis can be understood as a certain narrow type of frame focused on causality as opposed to the broader construct of a frame which may include factors beyond causality such as goals, affordances, categories, etc.

Various criteria have been proposed for evaluating hypotheses when doing abduction. These are sometimes called abductive virtues, or explanatory virtues. The most famous of these virtues is "simplicity", which is often referred

to as Occam’s Razor or Parsimony (Duignan, 1998). But many other virtues such as explanatory power, coherence, falsifiability, and conservativeness have also been proposed (Zukerman, 2024). The argument is that when deciding between which hypothesis to believe among a set, the one which most exemplifies the various virtues is the one we should accept.

Could a similar virtue-based approach help us to understand how one frame better supports decision-making than another? Since frames are a broader construct than a hypothesis, the virtues will likely be different, and the concerns more likely to be functional as opposed to epistemological. Indeed, truthfulness may not even always be a virtue when it comes to decision-making. As Hutton (2019) argues, sensemaking is pragmatic rather than rational, and the key criteria therefore is not consistency or coherence, but effectiveness. Similar arguments have been made by Donald Hoffman (2016). However, we must be cautious of taking this argument too far, as in dynamic and rapidly changing domains, a more accurate understanding of the situation is almost always necessary (Charan et al., 2021).

Here we propose various tentative virtues that could be used to describe what makes one frame more effective for decision-making than another, as well as related pitfalls which can help to explain errors in decision-making.

Table 1. Virtues and pitfalls of effective frames in situation shaping

Virtue	Definition	Pitfall
Functional	The frame implies a next action and constraints; it collapses “What should we do?” into an obvious step.	Premature closure. Locking onto an action too early and missing viable alternatives.
Relevance guiding	The frame directs attention toward likely cues and anomalies while filtering noise.	Tunnel vision. Filtering out signals that matter because they don’t fit the expected pattern.
Cognitive immediate	The frame makes the decision path obvious and supports fast, confident inference.	Impulsiveness. Moving too quickly when deliberate reasoning is required.
Value aligned	The frame brings the right values and trade-offs to the surface at the right time.	Moral myopia. Narrowing values to one dimension and neglecting other critical concerns.
Versatile	The frame retains integrity across roles, perspectives, and problems.	Vagueness. Becoming so broad or abstract that it loses the power to guide action.

Similar virtues such as simplicity, communicability, explanatory power, coherence, narrativity and others may be just as essential as what is named in Table 1. However, our goal here is not to generate a full list of virtues, but to propose a possible framework for making sense of the Situation Shaping Hypothesis, and to make salient how impressive it is that experts are able to so quickly form functional frames which satisfy so many criteria.

Is framing the Situation Shaping Hypothesis in terms of virtues helpful? We do not suggest there is only one way of talking about the functionality and adaptiveness of how experts make sense of the world. Other framings may be more useful for researchers or for the experts themselves, as we doubt experts will care about such a framework. We do not propose this virtue-based approach to be the last word, but as a starting point for conversations about how experts shape problems, and what makes their framings more effective than that of novices.

CONCLUSION

This paper has introduced the Situation Shaping Hypothesis as a starting point, not a settled account. By taking a constructivist, opportunities-and-constraints-based perspective, it highlights the potential to unify long-standing insights from the RPD and DTS models. Our aim is to spark inquiry into the deeper foundations of situation shaping, including its cognitive science, its links to RPD and DTS, and the factors that make some frames more effective than others. Clarifying the circular dynamics of framing and theorizing about the virtues that enable effective situation shaping open new avenues for advancing macrocognitive models of expertise.

At the same time, this work raises several pressing questions for the NDM communities:

- Is the inherent circularity within the data-frame model of sensemaking, where frames shape data, and data shapes frames, a feature to be embraced in our models, or a problem to be solved?
- If sensemaking and decision-making are inherently linked, should we continue to treat them as distinct constructs in our research and models, or would it be more productive to view deciding as an emergent property of sensemaking?
- Is the difficulty of representing tacit knowledge a reflection of the same circular dynamics that underlie situation shaping, and if so, how can we model this without reducing expertise to “mystical” explanations?

The questions are not exhaustive, but they point to both challenges and opportunities ahead. We hope they serve as an invitation to continue the conversation on how people shape situations, and how situations in turn shape people.

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