A Theory of Causal Explanations in Organizations:
How the Structure of an Organization's Problem Can Generate
Divergent Problem Explanations Under Limited and Divided Attention

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The most up-to-date version of my job market paper can be found here:
https://mhsingell.github.io/files/Singell_JMP_current.pdf

"There is nothing so practical as a good theory." -Kurt Lewin

ABSTRACT

I develop a theory for how employees form causal mental models to explain organizational problems from the observation of factors in organizations. The theory-based view of strategy posits that people generally, and employees specifically, attend to what they are ready to attend to, which is shaped by the cognitive theories they hold about their context. But how do organizations influence the causal mental models that employees form about what is worth attending to? Considering a specific and limited environment of a single organizational problem, I suggest that the same characteristics that impact search outcomes across an organization's environment are also likely to generate divergence in mental models for employees within the organization. I assume that organizations do direct and limit the attention of their employees around factors related to their assigned work, but I show that the consequence of this direction of attention by the division of labor only sometimes results in the formation of different causal mental models of an organizational problem. Using a logical argument and a formal model, I show that the structure of the organization's problem and the strength of the interdependencies between factors determine when the limited and divided attention expected in organizations is likely to result in different theories of what is important amongst employees.

INTRODUCTION

Organizations base their strategic choices on their employees' cognitive representations, making employees' mental models a key determinant of strategic foresight and organizational performance (Gavetti & Levinthal, 2000; Csaszar & Laureiro-Martínez, 2018). These mental models held by employees are simplified representations of the organizational environment (Gary & Wood, 2011), and they are often used to represent problems facing the organization and to generate solutions to those problems (Simon, 1991). When considering how cognitive theories shape the observations and behaviors of employees, the theory-based view of strategy suggests that "whether you can observe a thing or not depends on the theory which you use" (Einstein, Polanyi, 1974, pg. 604). In this view, because the mental models that employees hold determine which sets of factors they observe and ultimately act on, the most important factor in determining the strategies and outcomes of organizations is the cognitive theory that employees hold about the context (Felin & Zenger, 2017).

But how do organizations influence the mental models that employees form about what is worth attending to? Work on attention suggests that organizations are full of structures that are likely to limit and structure the attention of their employees, and thus the observation of factors for their employees (Ocasio, 1997). Most notably, the division of work by organizations means that employees are unlikely to view the entire scope of the organization's problem environment at once and are likely to view different parts of the problem at different frequencies (Dearborn &

Simon, 1958; Joseph & Gaba, 2020; Levitt & March, 1988; Clement, 2023; Ocasio, 1997). If mental models are based on what employees attend to, and organizations differentially direct the attention of their employees, it is reasonable to conclude that organizations may consistently generate divergent mental models amongst their employees about what is important.

Yet, organizations often do come to convergent theories and strategies. Previous work considers many potential structures such as hierarchy that can aggregate divergent representations and that can search for the best solution given employees' divergent representations (Rivkin & Siggelkow, 2003; Siggelkow & Levinthal, 2003). However, it doesn't necessarily explain why organizations vary in the degree to which cognitions diverge inside them (Joseph & Gaba, 2020; Thornton, Ocasio, & Lounsbury, 2012).

In fact, a recent review of information processing in organizations highlighted that while organizational scholars have acknowledged variation in the degree to which cognitions are shared in organizations, the ability for organizational structure to differentially generate divergent mental models, and thus differentially generate conflict, has been chronically underexamined (Joseph & Gaba, 2020; Gaba & Joseph, 2023). I address this gap by developing a theory for how employees form causal mental models to explain organizational problems from the observation of factors in organizations, highlighting two important antecedents to the development of divergent mental models under organizational structure: the structure of the organization's problem environment and the degree of interdependence between factors in the environment.

I start by considering a significantly simplified environment, called the organization's problem environment, which I define as the ordered selection of factors made in the organization that generate a single performance outcome. I then consider the cognitive theories, or explanations, that employees are likely to form to represent this environment. I formalize both causal processes as simple causal models, known as directed acyclic graphs (DAGs), which are causal models with directed arrows that contain no cycles (i.e. see Pearl, 2009). For these DAGs, I consider two insights from previous work that I use to direct my argument. First, work on causal induction suggests that the structure of the underlying causal process generating outcomes is likely to greatly impact the inferences formed about it (see Pearl, 2009). Second, under the modification of observation due to the division of work, the strength of interdependencies between factors is likely to influence how easily employees confuse the causal direction between factors (Waldmann & Hagmayer, 2001).

Using a series of logical arguments, I generate a theory for how both the structure of the organization's problem environment and the strength of interdependencies between factors are likely to generate the conditions for divergent mental models of problems in organizations under the division of labor. I then formalize the set of assumptions and propositions from my logical argument to provide a closed form solution to when employees will form divergent mental models of problems as a function of both the problem environment's structure and strength under the division or labor. Ultimately, both my theoretical and formalized model provide evidence that if organizational problems are generated by a sufficiently interdependent causal chain of factors, leadership must be aware and seek to mitigate the impact of their organizational structure to potentially generate divergent theories of organizational problems amongst their employees.

A MOTIVATING EXAMPLE

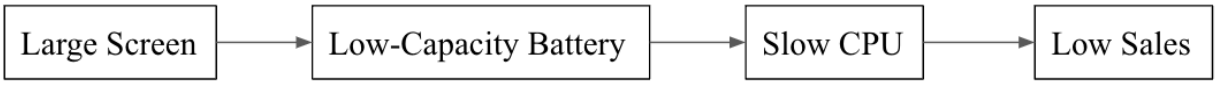
In order to illustrate the usefulness of considering both the organization's problem environment and employees' mental model of the problem as directed acyclic graphs (DAGs) for

the explanations formed of an organization's problem I present an example. I adapt the example of portable computers consisting of three important components screen size, battery and CPU that contribute to the fitness of the computer, used in Csaszar's explanation of the NK model (2018). Where a computer manufacturer is selecting three product attributes that are interdependent, the screen size (small or large), the battery (low capacity or high capacity), and the CPU (slow or fast), and where the combination of the selection of these capabilities results in a fitness value for the computer (Csaszar, 2018).

Consider that the computer manufacturer is seeing low sales of their most recent computer release after selecting a configuration of screen, battery and CPU, and is now experiencing ambiguity about the nature of the interdependencies between the computer factors and their performance. The organization needs an explanation for why they have experienced these low sales in order to find a solution to their low performance, and this explanation will not simply note that the three computer features are interdependent, but will explain why the organization's choices have generated poor performance given this interdependence.

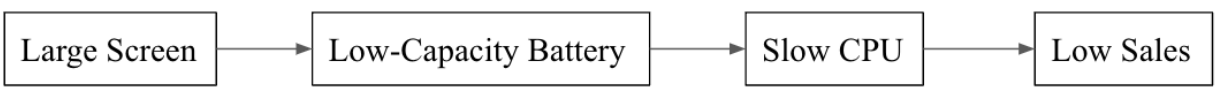
For example, consider that the product team has chosen large screens for the personal computers, a decision which limited the battery life and CPU capabilities of the computer, which in turn generated low sales. In explaining this low performance, the organization's sales can be thought of as a fourth factor in the graph of relationships between computer features. Note that when representing the computer sales problem, instead of a factor being screen (small or large), the factor is large screen where a 1 represents a large screen being chosen, and a 0 represents the screen selection not yet being made. I represent this true explanation of the organization's low sales as Figure 1 below.

Figure 1: True Explanation of Organization's Computer Sales Problem



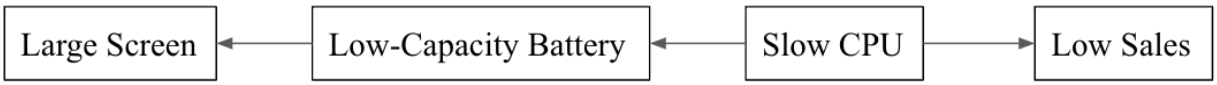
Because the organization cannot observe the process or hold a mental model of the problem itself, finding this true explanation for the organization's low sales involves soliciting the explanation of the problem from its employees. First, the management talks to the product manager, who is responsible for overseeing the choices of screen size, battery, and CPU for the computer, and thus focused on observing the factors associated with these product choices. The product manager emphasized screen size in the last product launch as the most important feature and has seen its impact on the battery and CPU spec choices made over time in the development of the product. While the product manager has not often directly observed the sales impact of the product choices, she can infer given the low sales that the chain of her product choices is likely to have driven the low sales, where the root cause of the low sales was actually the initial selection of the large screen. Thus, the product manager's explanation of her organization's low sales is likely to be as follows in Figure 2:

Figure 2: Product Manager's Explanation of Organization's Computer Sales Problem



However, the management in the organization is also likely to talk to the sales manager about why the computer isn't selling. The sales manager, who is responsible for overseeing computer sales, is uniquely focused on factors related to sales. Because of this, the sales manager has observed over the time of the last product launch that the most important feature that generated low sales has been the slow CPU of the computer, and thus the CPU choice of the product seems like the most important factor in the explanation of the organization's low sales. Since the sales manager is under-observing the other product choices the product manager has made, she concludes that the explanation for low sales is that the computer has a slow CPU, which is generating both poor sales, and other poor product choices, as represented below in Figure 4:

Figure 4:
Sales Manager's Explanation of Organization's Computer Sales Problem



If theories about what is important in the organization are essential to the formation of successful strategy, then there are two outcomes of this explanation process that should give this computer manufacturer pause. First, the sales manager's explanation of the organization's low sales focuses on a feature that is not the root cause of why the computer manufacturer ended up experiencing low sales. Thus, if the organization went with a solution based on the sales manager's explanation of the current low sales, the solution might be incorrectly focused on observing the wrong product feature. Second, the product manager and the sales manager disagree on the explanation of the problem. This is likely to direct attention differentially in future product launches to the CPU vs. screen features, and for an organization trying to select the correct solution and get buy-in from all stakeholders on their chosen solution, this divergence may ultimately be problematic.

So why are the observations of the product manager and sales manager leading them to form divergent explanations of their organization's problem, and why is the sales manager wrong? My theory considers two factors that are likely to generate these incorrect and divergent problem explanations for employees: the structure of the organization's problem environment and the interdependence between factors given the organization's division of labor. Here I will generate the intuition for these arguments with this example.

The organization divides the work of the product manager and the sales manager so that they do not observe the entire structure of their organization's problem environment. The product manager is likely to observe the parts of the causal graph that relate to the product, and the sales manager is likely to observe the parts of the causal graph that relate to sales, where product choices that directly result in low sales may be more likely to be observed by the sales manager. This differential observation of factors in the organization generates the potential for divergent explanations of an organization's problem, but when this occurs will be contingent on both the strength of interdependencies between factors and the causal connection between the factors that make up the organization's problem environment.

First, consider the role of the interdependencies between factors in relationship to the division of labor for the explanations formed by employees. If factors are not strongly

interdependent, then decisions between them need not be tightly coupled, and explanations formed about factor decisions will be less likely to be wrong, regardless of the division of work. For example, take an edge case where screen size, battery capacity and CPU are completely independent. If the CPU being slow were the factor generating low sales, both the sales manager and the product manager would be likely to observe this relationship occurring and correctly infer the explanation for the low sales, even under the division of work. However, when factors are interdependent, it both gets more difficult for the product manager to assess the relationship between product factors, and more difficult for the sales manager to assess the relationship between product factors and the low sales. Under this condition, whichever product decision was made closest to the point of failure is more likely to be observed by the sales manager and inferred as the explanation for why sales have failed in the organization. This is a particularly problematic finding given that the more strongly interdependent factors are, the more important it is for selecting the right strategy that they be considered jointly (Lawrence & Lorsch, 1967; Thompson, 1967).

Second, the structure of the organization's specific problem environment is likely to matter for when employees are able to form convergent explanations about why low performance is occurring given a sufficiently interdependent set of factors. If the division of labor still allows every employee to view the origin of the organization's problem (the initial factor choice that generated the outcome), even if factors are interdependent, employees will be able to form convergent explanations of the problem. For example, if the choice to have a slow CPU was the initial one that both triggered a set of interdependent product choices and generated poor performance, then both the product manager and the sales manager would agree. But for organizational problems that are based on a chain of decision factors where decisions that drive failure are made further away from the point of failure, the division of labor is likely to make it difficult for all employees to observe the choice of factors that generated an outcome, leading to divergent explanations. This generates the situation too often witnessed in organizations, where the sales manager tells the product team to 'just' build a faster CPU in the computer to increase sales, leaving the product manager stuck balancing impossible interdependencies that are unlikely to generate the desired performance outcome.

While this example is suggestive in nature, it builds off the previous literature's use of the interdependencies of computer feature choices (see Csaszar, 2018) to show why it might be helpful to consider the explanation of an organization's particular instance of poor performance as a directed acyclic graph. In the sections that follow, I develop a theoretical model to codify this intuition for how, under the limited and divided attention that is likely due to the division of labor, the strength and the structure of the organization's problem environment are likely to matter for when individuals in the organization converge on correct explanations of their organization's problem. The basis of the argument is that because some combinations of strength and structure of organizational problems under the division of labor allow employees to observe the root causes of the organizational problem, and others do not, these two factors are likely to determine when employees agree on explanations of their organization's problem. My work ultimately provides a set of theoretically grounded propositions and hypotheses for how the strength of interdependencies and structure of problems observed under the division of work are likely to matter for the formation of problem explanations and provides a theoretical framework for more rigorous research of causal mental models in organizations.

THEORY

A Roadmap for Where We Are Going Together

In this theory section I develop my theory for how employees form causal mental models to explain organizational problems from the observation of factors in organizations. My theory suggests that how the organization directs the limited and structural attention of employees through the division of labor interacts with the environment's structure and interdependency strength to determine whether employees' cognitive theories correctly converge. The argument is structured such that I develop the intuition for a series of assumptions I make, and then show that the results of my argument based on these assumptions are likely to generate divergent problem explanations as a function of the structure and strength of the organization's problem. The theory section progresses by answering a series of questions in order generate this argument, which I provide in a list below to give you (the reader) a sense for where we are going together.

- What is a causal mental model of a problem and why is it important for organizations?
- What is the nature of a problem environment and an employee's ability to form a representation of it?
- How do employees form causal mental models explaining problems from their observations?
- How do organizations impact the observation of the problem environment for their employees?
- How does the structure of the problem space interact with employees' divided observation of this environment in an organization to generate incorrect or divergent causal models of problems?

What is a causal mental model of a problem and why is it important for organizations?

A causal mental model of an organizational problem is a causal understanding of why the problem occurred. Causal understandings are individuals' cognitive representations of the true causal relationships that exist between factors or events (Carey, 1995). Thus, a causal mental model of an organizational problem is an explanation for how relevant factors are causally connected to generate a problematic outcome (Juarrero, 2011). In addition to being core to psychology and cognitive science's work on human reasoning (see Carey, 1995; Goodman et al., 2011; Chen & Bornstein, 2024), causal understandings are central to the function of organizations. This is because forming a successful organizational strategy requires a correct causal understanding of factors.

One way to view a strategy is as a proposed set of causal relationships between factors, where a strategy is really a theory of how the world works based on a causal mental model (Felin & Zenger, 2017; Lazzarini & Zenger, 2023; Carroll & Sorensen, 2021). For example, consider the management in our hypothetical computer manufacturer, who are concerned with the low sales of their personal computers. If the organization's strategy is to build a faster CPU in order to increase sales, then implicit to this strategy is the causal understanding that the CPU speed was, at least partially, responsible for the low sales. Thus, forming a strategy of what to do next relies on forming a causal mental model of what has happened previously.

If we accept that strategy formation is based on a causal mental model, then forming a successful strategy to address an organization's problem will be contingent on employees having a correct mental model of the problem. Particularly, because causal mental models are cognitive

representations of causal relationships, organizations do not form or hold mental models of their own problems, making the task of an organization forming a strategy based on a causal understanding one of considering the causal mental models that are held by employees. Continuing with our example, the computer manufacturer's strategy to increase the speed of the CPU capacity of their computer's will only be effective if the CPU speed was at least a partial contributor to the low sales. If the causal mental model of the relationship between factors held by employees is incorrect, the strategy formed is unlikely to be effective. This conceptualization of strategies as theories based on causal understandings is consistent with research that finds that managers that have a correct causal mental model of factors are more successful at resolving problems when they arise (Milgrom & Roberts, 1992; Ryall & Sorenson, 2021).

Finding the correct causal mental model in order to generate successful future strategy for an organization may sometimes be a straightforward task. For example, returning to the computer manufacture's low sales, if there were no interdependence between the computer features or if all the organization's employees agreed on a single feature that drove low sales, strategy formation would likely follow directly from simple mental models of the factors. However, if there are consistent elements that generate either incorrect or divergent causal mental models, and these causal understandings are core to the formation of successful strategies, then organizations ought to be uniquely concerned with uncovering these determinants.

Indeed, work in organizations has addressed several possible antecedents to incorrect and divergent causal mental models. For example, under causal ambiguity, where causal relationships are difficult to infer, trustworthiness is likely to matter for how much information and understandings are shared (Szulanski et al., 2004). Hidden factors may also make it difficult for managers to reach a correct mental model of the relationship between them (Ryall & Sorenson, 2021). And while not necessarily directly based in inferring causal relationships, a large body of work addresses how differences in mental representations may make the search for and formation of strategy less than ideal (Csaszar & Levinthal, 2016; Santos et al., 2021; Joseph & Gaba, 2020).

However, in considering the broad set of factors that might impact the ability for employees to converge on correct causal mental models, organizational scholars have often overemphasized the complexity of the environment, and underemphasized the importance of the employee's representations of problems (see Gavetti et al., 2005; Felin & Zenger, 2015). Previous work, in emphasizing the complexity of environments across which organizations search for solutions, has formalized these processes as complex system dynamic models (i.e. Gary & Wood, 2011) or as searches across rugged and interdependent landscapes (i.e. Csaszar & Levinthal, 2016; Gavetti et al., 2005). While this complexity is no doubt realistic to the nature of the environments organizations face, it may over-complicate the task that employees are often trying to complete when facing an organizational problem, which is to explain the problem in order to find a solution to it.

Explaining a problem involves identifying the relevant factors that contribute to the problem and specifying the relationships between these factors that led to the observed outcome. In other words, explaining a problem involves inferring the causal relationships between a set of relevant factors. When evaluating data to form these causal explanations, the human cognitive preference is to prefer simpler causal explanations over complex ones (Lombrozo, 2007). In organizations, this 'Occam's Razor' preference may be particularly helpful in considering which causal explanations employees are likely to form about organizational problems. While

employees may represent the relationships between factors that contribute to a problem in interdependent ways (i.e. Gavetti, 2005; Gary & Wood, 2011; Ackerman & Eden, 2005), their explanations of why an organizational problem occurs may be limited to the most foundational and relevant contributors that provide a sufficient answer (see Borg & Bex, 2021; Jenkins & Johnson, 2003). Thus, considering employees' mental models of organizational problems as simple causal models, called Directed Acyclic Graphs (DAGs), is consistent with work in human cognition.

While these simplified causal models explaining a problem may be consistent with cognition, some cognitively grounded work suggests that other mechanisms may be more important in determining the theories employees hold of their organization's problem. For example, the importance of attention and observation of events in the formation of causal mental models has been challenge by work citing that employees' interpretations and true patterns can never be disentangled, and that employees can even hold understandings that are in direct contrast to their experience (Weick et al., 2005; Levitt & March, 1988). While there are no doubt pathways of motivated reasoning and interpretation that generate causal mental models (i.e. see Tappin et al., 2020), work in causal induction suggests that one of the central reasons that causal models diverge when being inferred from observation is because of the underlying structure of the process generating outcomes (see d-separation, Pearl, 2009).

In the next section I turn to this work in causal induction, introducing the structure of an organization's problem environment and a series of assumptions about this environment, which I will build into a theoretical argument for why and how the structure of an organization's problem is likely to matter for the inference of causal mental models of it in organizations.

What is the nature of a problem environment and an employee's ability to form a representation of it?

An organization's problem environment is the ordered selection of factors made in the organization that generate a single performance outcome. Typical considerations of an environment in organizational research emphasize its complexity, with causality in organizations being likely to contain cycles and interdependencies that have thus far been best characterized as a 'rugged landscape' (Levinthal, 1997). This representation of an organization's environment is realistic, in that it codifies the directed interdependence of factors that is likely to occur in the organization (Csaszar, 2018). However, this representation of an organizational environment is unrealistic, in that it disregards the order of relationships between factors that is likely to exist when decisions are made in organizations, because even directed interdependence does not specify a causal order through which factors were decided.

Since, as I define it, an organization's problem environment is specifically about the ordered selection of factors that generate a performance outcome, the previous formalizations of a non-ordered, complex environment are not well-suited to representing the organization's problem environment. Instead, I conceptualize an organization's problem environment as a directed acyclic graph, which are causal models with directed arrows that contain no cycles (i.e. see Pearl, 2009). While directed acyclic graphs (DAGs) under-represent the interdependent nature of an environment of possible solutions for organizations, they correctly specify order in the relationships between relevant factors.

Because the explanations that employees form of organizational problems consist of causal linkages between factors that tend to have a beginning and an end, I argue that capturing the order in the relationships between factors is likely to be the more important source of

variation for the mental models formed by employees for the purpose of explanation of an organization's problem. Thus, I represent both employee mental models of organizational problems and the organizational problem environment as simple causal models.

If there is a true causal process generating organizational performance, then an employee's causal mental model of that problem can be defined as this individual's cognitive representation of the underlying true organizational problem environment. While some work within organizations has asserted that there is no true causal process generating outcomes in organizations (i.e. see Sköldberg, 1994; Rhodes & Brown, 2005), the argument in this research generally relies on the fact that humans can never observe the true causal process of problems independent from their interpretation or perception of the problem (see Weick et al., 2005). While I also assume that the true causal process generating organizational outcomes cannot be observed, it is analytically useful in my argument to distinguish between the existence of a true organizational problem environment and the ability to observe it. These two first assumptions of the existence, but unobservability, of the true causal process generating organizational problems are formalized below.

Assumption 1: There is a true causal process that generates an organization's performance outcomes (I call this true causal process the organization's problem environment).

Assumption 2: The true causal process that generates an organization's performance outcomes is unobservable to employees.

It follows from these two assumptions that employees can seek to find the true causal process that generates organizational performance but must infer the true causal relationship between factors based on their observation of the factors, and not the observation of the process directly. Thus, the act of an individual forming a causal mental model, or a cognitive representation of the organization's problem environment, is an act of inference from the observation of factors.

Proposition 1: When an employee forms a causal mental model of an organization's problem environment, she uses her observation of a set of factors to infer the causal relationship between them.

How do employees form causal mental models explaining problems from their observations?

If individuals must form causal mental models of organizational problems through inferring the true causal relationships between factors based on their observations of them, the natural next question is how individuals perform this inference. To start, I differentiate between factor occurrence and factor observation. A factor occurring means that a factor has been generated by the organization's problem environment. A factor observation means that an individual has observed the factor occur in the environment.

In considering the process through which employees observe factors in an organizational problem environment, while a single instance of the problem environment is occurring, employees observe the problem environment at its many different stages as the problem unfolds and as they attend to different portions of the problem environment. For example, any time the product manager engages with the large screen attribute of the product, she may observe this factor, and related factors that may or may not have been decided on, like whether to have a

slower CPU or a lower capacity battery. While I differentiate between factor occurrence and factor observation, crucial to my argument is that individuals who are observing factors do not differentiate between the occurrence of factors and their observation of them. This is a simplifying assumption, but it is consistent with work on theories of causal induction, where inference of causal relationships based on the observation of even small sets of data is a uniquely human endeavor (Griffiths & Tennenbaum, 2009).

Assumption 3: An employee forming a causal mental model assumes that factor occurrence is consistent with her observation of factors.

With assumption 3 in hand, that individuals assume that their observation of factors is consistent with actual factor occurrence, I now turn to how individuals go from observing factors to inferring relationships between them. General causal inference proceeds with basic principles about how causality should work. One such principle is that a cause can occur without its effect, but an effect cannot occur without its cause. While this is in some ways a strict assumption in our multi-modal complex world, it is also an assumption ingrained in the definition of the terms cause and effect. Simply put, a cause must occur before its effect, or else the labels of cause and effect are not analytically useful or correct (Gale, 1965). However, effects need not occur with their causes. For example, consider the relationship that a cloud causes rain. A cloud must be present in the sky for it to rain, but it need not be raining for a cloud to appear in the sky. I formalize this assumption below:

Assumption 4: A cause can occur without its effect, but an effect cannot occur without its cause (or causes).

The above assumption helps individuals who are seeking to form causal mental models to explain problems, but cannot observe the true causal relationships in the environment directly, make correct inferences about the causal relationships between factors. However, we are not just interested in individuals forming causal mental models generally, but in employees forming causal understandings in the structured context of organizations. In considering what causality is like in organizations, and what principles of inference might help employees converge on correct causal explanations of an organizational problem, I make one further assumption about the nature of causality. Specifically, while much work in causal induction thinks about deterministic causality, I suggest that causal relationships in organizations is most likely to be probabilistic.

Deterministic causality means that if A causes B, when A happens B happens. Probabilistic causality means that if A causes B, A occurring increases the likelihood that B occurs. In the context of organizations, factors are generally interdependent, but vary in how tightly coupled they are (Raveendran et al., 2020). For example, choosing a large screen size is likely to constrain the battery capacity and CPU speed of the computer, but not necessarily determine the exact specification of these two factors for the computer. Thus, when considering causality in the context of organizations, I assume that employees, consistent with the body of organizational research, will form causal explanations of outcomes that are probabilistic. I formalize this assumption below.

Assumption 5: If a cause occurs the likelihood of its effect occurring is S, where $S<1$.
(Note: S denotes the causal strength of the relationship between a cause and its effect)

The causal strength of relationships between factors (S) specifies how tightly coupled two factors are in organization's choices, which determines the base rate of factor occurrence in the organization's problem environment. In other words, the causal strength between factors represents the interdependence between them in the organization's problem environment. This is one of the central aspects of the problem environment that is likely to determine when employees diverge on causal mental models. To understand why, first consider the proposition about the formation of causal explanations by employees that follows from these assumptions. Since an effect cannot occur without its cause (assumption 4), an effect must occur at a rate lower than its cause (assumption 5), and employees assume that their observation of factors is consistent with the occurrence of factors (assumption 3), it follows that causes should be observed occurring more often than effects.

Proposition 2: For an employee forming a causal mental model consistent with causal inference principles, causes should be observed occurring more often than effects.

Consider how proposition 2 is more or less likely to be satisfied as a function of interdependence between factors (causal strength S). If factors are relatively independent, causes should be observed occurring much more than effects. However, if causes are relatively interdependent, the difference between the base rate of occurrence of causes and effects will be smaller, making proposition 2 less distinguishable. Thus, the interdependence between factors is likely to determine how difficult it is to infer causes from effects based on the causal inference principles above. In the below sections, I will formalize this into a hypothesis about when divergence is likely in an organizational context as a function of the interdependence between factor (causal strength, S).

How do organizations impact the observation of the problem environment for their employees?

With a series of assumptions and a proposition developed for how employees might infer a causal explanation of organizational performance based on their observation of factors, I now turn to how organizations might impact these employees' observation of the problem environment. Firms alter the attention of their employees in consistent ways (Ocasio, 1997). A key way in which organizations structure the attention of their employees is through the division of labor; in order to complete the complex and information intensive tasks of an organization, work must be divided between employees (March & Simon, 1958; Mintzberg, 1989). While the division of labor improves an organization's ability to complete its necessary tasks, work on modularity and organizational design frequently points to the potentially unintended consequence of this division: the division of attention in the organization (Clement, 2023; Dearborn & Simon, 1958; Joseph & Gaba, 2020; Ocasio, 1997).

In considering how to specifically operationalize the way in which organizations divide factor attention for their employees, I consider two dimensions along which organizations are likely to vary the work, and thus the factor experience, of their employees: scope and frequency (which generally maps to the limited and structured attention of employees; see Ocasio, 1997). First, the division of work is likely to generate a factor observation for employees that is reduced in scope. When employees are given a set of related tasks that represent a subset of tasks the organization performs, they are also likely to have a reduced scope of visibility into factors corresponding to the tasks that these employees are not performing. Thus, organizations are

likely to direct the attention of employees to factors that are related to each other, but limited in that their attention of factors may not fully represent a complete set of factors occurring in the organization. As Simon says, "structural boundaries and the division of labor reflect how the organization represents its problems and affect how individuals filter information" (Dearborn & Simon, 1958; Joseph & Gaba, 2020).

The structure of the organization then, which limits the scope of work to a small set of related tasks, may also limit the scope of the factors that an employee is likely to pay attention to at any given time, which in turn serves to create this employee's causal explanation of factors in the organization as a whole. Thus, the core feature that I consider in operationalizing the way that organizations impact the observations of factors for their employees, is the way in which organizations limit employees from getting a bird's eye view of the organization, limiting observation of factors at any time. I formalize this assumption below:

Assumption 6: Organizations divide the scope of observation of the organization's problem environment for their employees, such that while many factors may occur in the organization, employees in the organization will only ever observe a subset of related factors occurring. 1

Footnote 1: To formalize this assumption for the model specifically, I constrain the observation of the scope of factors to pairs of related events only, which greatly simplifies the calculations needed. However, theoretically, the scope of the observation of factors need only be consecutive and one event fewer than all causes occurring in the organization, in order for this logical argument to hold.

This is the strongest assumption of my work, and it is also the most consequential. To consider why this assumption may be accurate for organizations, I return again to the motivating example. In our hypothetical computer manufacturer, both the product and sales mangers are forming causal mental models of their organization's low sales. The problem that both sets of employees face in trying to understand their organization's performance is that they cannot focus on the whole set of factors at once. Because the organization silos attention (whether by time, role, or department), neither the product manager nor the sales manager are likely to observe the choice of a large screen directly with low sales. This could in some ways help the product and sales managers form correct causal explanations, because they are unlikely to identify spurious relationships between those factors, where large screens directly causes low sales (a common problem in the divergence of causal models, see d-separation in Pearl, 2009). However, it also means that when observing factors in the organization, the product and sales managers both had the difficult task of connecting their observation of sets of factors into a larger model of the organization's problem to generate their own causal mental model of factors.

The second way in which the organization's division of labor is likely to impact the observation of factors for employees is by modifying the frequency of observation of factors. While the division of labor is both likely to result in limited and structured attention, in order to consider the independent contribution of limited attention, first I present a base case assumption where organizations do not structure the attention of their employees differently. In this limited attention only assumption, employees in the organization see all slices of factors equally, which could represent small organizations, organizations with generalist employees, or organizations with high transparency (i.e. Ferreira & Sah, 2013; Ball, 2014). This argument emphasizes the impact of limited attention in organizations on causal mental models formed (Ocasio, 1997).

Assumption 7a: Employees in an organization are equally likely to observe any set of related factors.2

Footnote 2: To formalize this assumption for the model specifically, the constraint of the observation of the scope of factors to related factors only means that employees are equally likely to observe any pair of related factors.

Under assumptions 6 and 7a, I can develop the intuition for why limited attention in organizations is likely to generate incorrect causal explanations. Because factors are observed in sets with their directly related factors, and factors in the middle of organizational problems are related to more other factors, occurrence of a factor in the middle an organization's problem is more likely to be observed by an employee than occurrence of a factor at the edge of the organization's problem environment. I call this being 'Caught in the Middle of Causality". Whether this generates incorrect explanations will depend on whether or not factors in the middle of the organization's problem space are causes or not, which I will explicitly theorize in the next section.

However, the other, potentially more likely, way that organizations may impact the frequency of observations of factors by their employees is through unequal focus on slices of the organization's problem space. Specifically, because organizations tend to have employees specialize on specific tasks and not others (Dearborn & Simon, 1958; Heath & Staudenmayer, 2000; Thompson, 1961), employees are likely to observe factors related to their assigned work at a higher frequency than those factors outside the scope of their work (structured attention, Ocasio, 1997). Returning to our motivating example, the product and sales managers are responsible for different tasks in the organization, which likely leads them to observe different sets of factors impacting organizational performance at different frequencies. The sales manager was responsible for sales, and thus was likely to observe the low sales and its direct antecedent of the slow CPU than the product manager who observed the factors associated with the product more. I formalize this below:

Assumption 7b: Organizations focus employees on factors related to their work, such that while employees may observe factors that are not associated with their work focus, employees in the organization will observe sets of factors in their work focus more frequently.3

Footnote 3: To formalize this assumption for the model specifically, the constraint of the observation of the scope of factors to related factors only, generates a pair of factors equation such that, employees in an organization will observe the pair of factors that they are responsible for at a rate higher than that of all other pair of related factors, where the focus pair of factors e_1 and e_2, for an employee i is observed at a rate $f_{i,focal}(e_1 \& e_2)$ and all other factors are observed at a rate $\frac{(1-f_{i,focal}(e_1 \& e_2))}{k_r - 1}$, such that focus on all pairs of factors sums to 1.

Under assumption 6 that the scope of factor attention is limited, the modification of the frequency of observation of factors by organizations in 7b could either exacerbate or attenuate the formation of incorrect causal mental models above, depending on both which pair of factors an employee is focused on and the structure of the organization's problem environment. I generate a set of hypotheses for when the combination of focus on factors and structure of the

organization's problem are likely to generate either incorrect or divergent causal explanations for employees below to specify these conditions.

How does the structure of the problem space interact with employees' divided observation of this environment in an organization to generate incorrect or divergent causal models of problems?

In this theory section, I've developed a series of assumptions about how employees will infer causal understandings from their observation of factors and how organizations will influence these employees' observation of factors. I now come to the predictions that this theoretical set-up allows me to make about the explanations employees will form of their organization's problem environment. Specifically, I show that the explanations that employees form of their organization's problems are likely to be "Caught in the Middle of Causality".

Defining an edge factor of an organization's problem environment as one where the factor is related to fewer other factors than its effect, I argue that because organizations limit the scope of employee attention to related factors, but the focus on related factors of employees overlap, factors in the middle (non-edge factors) of the organization's problem environment will be focused on at a higher frequency than factors at the edge of the environment. In this final section of theory, I connect the assumptions and propositions made about employees inferring causal understandings under the divided observation of factors in organizations to this "Caught in the Middle of Causality" problem in order to generate two hypotheses about when employees are likely to come to incorrect or divergent causal mental models in organizations.

When organizations divide work, they implicitly limit (assumption 6) and structure (assumption 7b) the attention of their employees (Ocasio, 1997). While it may seem likely that employees will hold incorrect explanations of an organization's environment under this limited and divided attention, actual incorrect inference of causal mental models is likely to depend on the structure of the organization's problem environment, the interdependence between factors, and the nature of the division of work (assumption 7a vs. 7b). This is because different structures of problem environments, interdependencies, and division of labor in organizations differentially satisfy assumption 3, that employee's observation of factors is consistent with the occurrence of them.

As long as an employee's observation of factors is consistent with actual occurrence of factors (assumption 3) such that causes are observed occurring more than effects (proposition 2, off of assumption 4 & 5), the fact that organizations limit the observation of factors for employees (assumption 6) should not interfere with coming to a correct causal understanding of factors.However, consider how under the limited, but unstructured attention of assumptions 6 and 7a, the structure of the organization's problem environment is likely to matter.

Organizations, under this limited scope of factor focus, force employees to observe subsets of related factors only, not the entire birds eye view of the organization's problem environment. Under a non-structured set of attention as in assumption 7a, employees' observation of a focal factor will be a function of how many other factors the focal factor is related to. Middle factors (factors that are related to more factors than their causes) are definitionally related to more other factors, and thus are likely to be observed more by employees. Because causes should be observed more than effects (proposition 2), the increased frequency of observation of middle factors will lead them to be inferred as causes by employees.

However, this inference of middle factors as causes need not generate incorrect explanations of an organization's problem space. Particularly, there are two factors that matter for whether an incorrect explanation will be formed from employee inference of an

organization's problem environment. First, consider the impact of the structure of the organization's problem environment. If middle factors are causes, particularly root causes (a cause not caused by other factors), in the problem space, the inference of middle factors as causes will lead to correct inferences by employees. Thus, whether the limited scope of attention organization's place on their employees will generate incorrect explanations of an organization's problem will depend on whether the organization's problem space has a root cause of the problem on the edge of problem space or not.

Second, consider the impact of the interdependence between factors (causal strength, S) for the inferences made by employees. Even if the problem environment contains an edge root cause, if factors in the environment are sufficiently independent, such that employees can still observe the root cause more than the middle cause, then employees will reach a correct explanation of events. Thus, I hypothesize that because limited, but unstructured attention to organizational problem spaces leads to middle factors being observed more, problem environments with edge root causes are likely to be incorrectly inferred, but only when factors are sufficiently interdependent. I formalize this as hypothesis 1 below:

Hypothesis 1: When organizations limit, but do not structure, the attention of their employees, problem environments that have an edge root cause and sufficiently interdependent factors will generate incorrect causal explanations.

To generate the intuition for which problem environment structures contain an edge root cause, I produce all possible directed acyclic graphs between three factors, and label whether or not the graph contains an edge root cause in Table 1.

Table 1: All Possible Directed Acyclic Graphs Between Factors A, B, and C And Whether the Graph Contains an Edge Root Cause

	Example Graph	**Edge Root Cause**
No Cause	A B C	No
One Cause	A->B C	No
Repeller	A<-B->C	No
Collider	A->B<-C	Yes
Linear	A->B->C	Yes

Now consider the second way in which organizations modify the attention of their employees, through the structured observation of different sets of factors in the problem space due to the division of work (Ocasio, 1997; Joseph & Gaba, 2020). Employees are still more likely to observe middle factors than edge factors through the same argument as above, making edge root cause problem environments problematic for forming correct problem explanations under limited and divided attention. However, how attention is divided is likely to differentially impact the causal mental models of employees. The motivating example above can help me explain why.

The product manager in the computer manufacturer formed the correct explanation of the organization's problem, even though the structure of the problem contained an edge root cause. The reason that it was possible for the product manager to do this is because she over-observed the slice of the organization's problem environment that contained the edge root cause. The

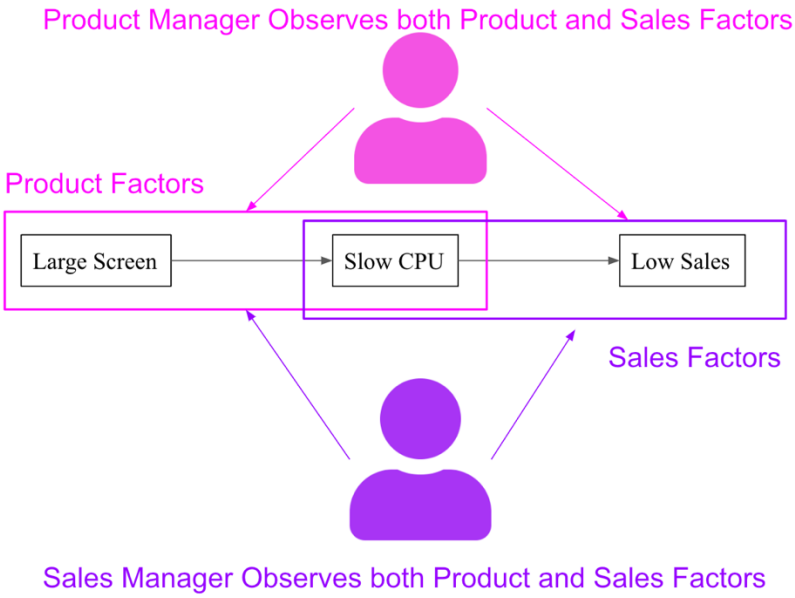
structured attention of the product manager on the product decisions, led her to observe factors in the problem space consistent with how those factors occurred, satisfying assumption 3 and generating the correct explanation.

However, the sales manager, whose division of work focused her on the portion of the organization's problem very far away from the edge root cause, was very unlikely to form a correct explanation of the organization's problem. The structured attention in organizations due to the division of labor is likely to generate this type of divergence in explanations of organizational problems when there is an edge root cause, as long as the base rate of occurrence of factors is high enough (high enough interdependence between factors). This is because some employees are likely to focus on slices of the organization's problem environment that contains the root cause, which is going to generate correct mental models of the problem, and others are going to focus on slices of the problem environment that do not contain this root cause, which will generate incorrect explanations of the problem. Thus, I hypothesize that:

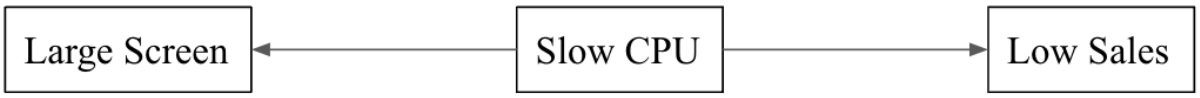
Hypothesis 2: When organizations limit and structure the attention of their employees, problem environment that have an edge root cause and sufficiently interdependent factors will generate divergent causal explanations.

To visualize hypotheses 1 and 2, I use our motivating example above. Because I want my model to present the most basic case, which is the easiest to understand and which also extends to more complicated cases, I remove the battery factor from the above explanation, but I note that the results would be the same. First, I consider the case where the product and sales manager have limited, but unstructured attention, such that it is difficult for either the product manager and the sales manager to see the factors associated the product and the factors associated with sales all at once, but both the product and the sales manager have visibility into the factors occurring in the other department. This is likely to generate an incorrect explanation for the highly interdependent factors by both the product and sales manager that the root of the organization's problem was their choice to have a slow CPU in the computer, when in reality, the decision to have a large screen is what generated the slow CPU choice, and ultimately the low sales. I visualize this hypothesis 1 explanation in Figure 3 below.

FIGURE 3: HYPOTHESIS 1
Product and Sales Managers Causal Explanations
Under Limited, but Unstructured Attention

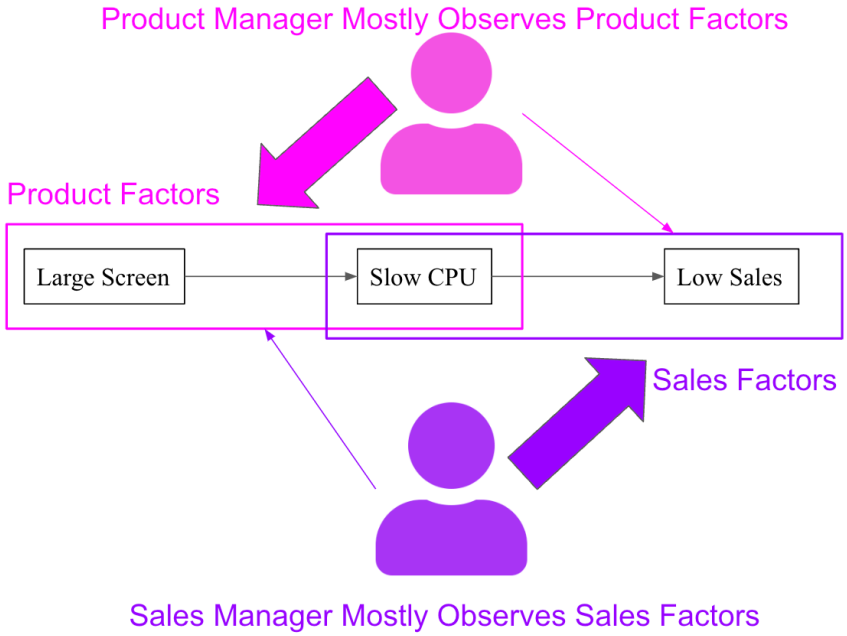


Causal Explanation of Both the Product and Sales Managers:



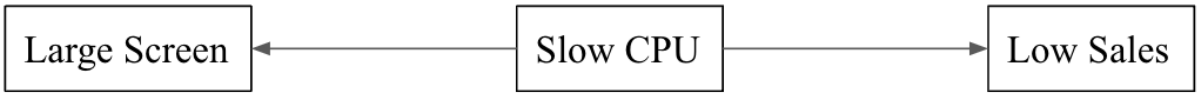
Second, I consider the case of hypothesis 2, where the division of labor has generated structured attention for the product and sales manager, such that the product manager tends to see factors associated to product, and the sales manager tends to see factors associated to sales. Since the factors in the organization highly interdependent, this is likely to generate divergent explanations by both the product and sales manager, where the product manager recognizes the choice to have a large screen generated the low sales, and the sales manager thinks that the choice to have the slow CPU in the computer was the root cause of the low sales. I visualize this hypothesis 2 explanation in Figure 4 below.

FIGURE 4: HYPOTHESIS 2
Product and Sales Managers Causal Explanations
Under Limited and Structured Attention



Causal Explanation of Product Manager:

Causal Explanation of Sales Manager:



To test the hypotheses above against my developed assumptions and propositions, and to provide a set of mathematically grounded predictions for the role of the structure of the organization's problem environment and the division of labor in generating incorrect and divergent causal understandings under limited attention in organizations, I develop a mathematical model using the set of assumptions I've outlined above.

MODEL

In this section I mathematically test whether edge root cause problem environments are likely to generate incorrect and divergent causal understandings when attention is limited and structured by the division of labor in an organization and factors are sufficiently interdependent. To do this, I operationalize my conception of limited and divided attention in organizations into a

causal model and test the likelihood of incorrect and divergent causal understandings across different problem environments. The above section outlined and defended several assumptions about the individual inference, organizational attention, and the organization's problem environment, which I present in Table 2 below. From these seven assumptions, two propositions about how causal explanations will be inferred by individuals followed, which are presented in Table 3.

My model developed below shows that because interdependent problem environments with edge root causes break assumption 3, that an employee's observation of factors is consistent with actual factor occurrence, proposition 2, that causes should occur more than effects, is not valid. This generates incorrect or divergent causal understandings for employees at high causal strengths, depending on whether the attention of employees is limited (assumption 7a) or limited and structured (assumption 7b) for employees. My causal modeling method provides a proof of concept that in considering organizational problem environments and employees' explanations as directed acyclic graphs the structure of the problem space and work predict when employees will form correct and convergent explanations, as detailed in hypotheses 1 and 2, presented in Table 4 below.

Table 2: Assumptions

Number	Assumption
1	There is a true causal process that generates an organization's performance outcomes (I call this true causal process the organization's problem environment).
2	The true causal process that generates an organization's performance outcomes is unobservable to employees.
3	An employee forming a causal mental model assumes that factor occurrence is consistent with her observation of factors.
4	A cause can occur without its effect, but an effect cannot occur without its cause (or causes).
5	If a cause occurs the likelihood of its effect occurring is S, where $S<1$. (Note: S denotes the causal strength of the relationship between a cause and its effect)
6	Organizations divide the scope of observation of the organization's problem environment for their employees, such that while many factors may occur in the organization, employees in the organization will only ever observe a subset of related factors occurring. (limited attention)
7a	Employees in an organization are equally likely to observe any set of related factors. (unstructured attention)
7b	Organizations focus employees on factors related to their work, such that while employees may observe factors that are not associated with their work focus, employees in the organization will observe sets of factors in their work focus more frequently. (structured attention)

Table 3: Propositions

Number	Proposition	Necessary Assumptions
1	When an employee forms a causal mental model of an organization's problem environment, she uses her observation of a set of factors to infer the causal relationship between them.	1, 2
2	For an employee forming a causal mental model consistent with causal inference principles, causes should be observed occurring more often than effects.	1, 2, 3, 4, 5

Table 4: Hypotheses

Number	Hypothesis
1	When organizations limit, but do not structure, the attention of their employees, problem environments that have an edge root cause and sufficiently interdependent factors will generate incorrect causal explanations.
2	When organizations limit and structure the attention of their employees, problem environment that have an edge root cause and sufficiently interdependent factors will generate divergent causal explanations.

Factor Occurrence vs. Factor Observation

The core distinction that allows me to uniquely apply a causal modeling approach to causal explanations in an organizational setting is the differentiation between factor occurrence and factor observation. A factor occurrence means that a factor has been selected in the organization's problem environment at a given time. A factor observation means that an employee has observed the factor occur at that time. While traditional work in causal modeling would tend to equate factor occurrence and factor observation, because I assume that organizations limit and structure the attention of employees, limiting the scope of the observation of factors, factors can occur in the organization without being observed by an employee. For example, the product manager can select a large screen size for the computer without the sales manager being aware of it. Thus, my general equation for the probability of a factor (e_n) for a given employee (i) in an organization is the likelihood of the occurrence of the factor $P(c_{e_n})$ times the likelihood that the factor is observed occurring $P_i(b_{e_n})$.

$$P_i(e_n) = P(c_{e_n}) * P_i(b_{e_n}) \quad (1)$$

In the below sections I break down how I calculate the likelihood of both factor occurrence and factor observation.

Factor Occurrence: The Likelihood of a Factor Given an Organization's Problem Environment and a Probabilistic Causal Strength

Factor occurrence in an organization is a function of the structure of the organization's problem environment. One way to understand factor occurrence is to conceptualize the possible

worlds that an organization's problem environment could create at any given time. For all directed acyclic graph data-generating processes with three factors (A,B,C) for example, there are eight possible worlds that could occur ranging from all three factors not yet occurring (A:0, B:0, C:0) to all three factors co-occurring (A:1, B:1, C:1). I outline all possible worlds for three factor problem environments in column 1 of table 5. However, for any specific organizational environment with three events, the likelihood of each possible world differs.

For example, consider the organization's problem environment being a linear graph, as in the motivating example, where Large Screen→Slow CPU → Low Sales (A→B→C). If I assume, as I have above, that effects cannot occur without their causes (assumption 4) then for a linear problem space, some possible worlds will not be possible, because B occurring without its cause A is not possible. In column 2 of Table 5, I identify which of the 8 possible worlds are possible for the linear graph.

Table 5: Likelihood of Factor Occurrence for 3 Factor Linear Graph (A→B→C) in the Possible Worlds Framework

Possible Worlds	Possible for Linear Graph	Likelihood of World for Linear Graph	Likelihood for Linear Graph at S = 0.9
A:0, B:0, C:0	Yes	(1-S)	0.1
A:1, B:0, C:0	Yes	S*(1-S)	0.09
A:0, B:1, C:0	No	0	0
A:0, B:0, C:1	No	0	0
A:1, B:1, C:0	Yes	S*S*(1-S)	0.081
A:0, B:1, C:1	No	0	0
A:1, B:0, C:1	No	0	0
A:1, B:1, C:1	Yes	S*S*S	0.729

After understanding which worlds of factor occurrence are possible, the next step of my model is to calculate how likely each world of factors is to occur. The assumption that the degree to which factor selections are coupled in organizations varies (assumption 5), is core to executing this calculation. I use the variable causal strength (S) to identify the amount that a cause increases the probability of its effect being selected by. For example, if the causal strength (S) of the relationship between large screen and slow CPU is 0.7, then selecting a large screen for the computer increases the likelihood that a slow CPU is chosen at any given time by 70%. Using this framework, the likelihood of a factor occurring given its cause has occurred is S, and the likelihood of a factor not occurring given its cause has occurred is 1-S. I assume that the likelihood of an independent cause occurring is also S, which can be interpreted as an unobserved cause of the independent cause occurring. I use this basic logic to generate the likelihood of each possible world for the linear graph in column 3 of Table 5.

Table 5 shows the general intuition that factor occurrence in an organization is a function of the structure of the organization's problem environment and the causal strength between related factors. While I show the intuition for these calculations for a linear graph with three events above, this framework can be generalized to any number of factors and problem environments, as I formalize in equation 2 below, where the probability of any possible world (w) is a function of the causal strength of the relationship between factors (S), the number of factors that occur in the possible world (j), the number of independent causes that do not occur in

the possible world (i.e. factors that do not have a cause in the world, k), and the number of effects of factors j that do not occur in the possible world (m).

$$P(w) = S^j * (1-S)^k * (1-S)^m \quad (2)$$

With equation 2 formalized to give the likelihood of a possible world given a causal strength (S) and data-generating process (which determines the values of j, k, and m), to find the likelihood of a factor occurring $P(c_e)$, I only need to sum all possible worlds where factor e_n occurs, which I formalize in equation 3, where d is the number of possible worlds.

$$P(c_{e_n}) = \sum_0^d w_d[e_n] * P(w_d) \quad (3)$$

I can also calculate the probability of any two factors (e_1, e_2) co-occurring together, $P(c_{e_1 \& e_2})$, by summing possible worlds where both factors occur, as formalized in equation 4.

$$P(c_{e_1 \& e_2}) = \sum_0^d w_d[e_1] * w_d[e_2] * P(w_d) \quad (4)$$

The above formalization of my model of possible worlds gives me a way to measure the likelihood of factor occurrence in an organization $P(c_e)$ given an event-generation process and strength of causal relationship (S). This portion of the model is similar to work developed in causal modeling (i.e. see Pearl, 2009), but adapted to an organizational setting. In equation 2, I also find a calculation supporting our intuition for why edge root cause problem environments may generate incorrect or divergent causal explanations. Edge root cause problem spaces are more likely to generate a smaller number of possible worlds, and when causal strength is high, these graphs are most likely to either generate complete co-occurrence or no occurrence of all factors. This uncertainty creates the opportunity for errors in causal mental models, which limited and structured experience is likely to produce.

However, my key assumption about organizations, that they limit and structure experience for their employees, is not incorporated into the occurrence of factors, but rather into the observation of factors that have occurred $P_i(b_{e_n})$, thus I turn to formalizing the observation of factors next.

Factor Observation: The Likelihood of an Employee Observing a Factor Occur Given the Divided Experience in the Organization

Factor observation in an organization is a function of the degree to which attention is directed in the context. For example, if the product manager is tasked with developing the product features of the organization's computer, the organization can be said to have limited and structured the attention of the engineer to focus on product-related factors. This means that the product manager is both more likely to see the selection of factors related to the computer specifications, but it also means that they are more likely to see these factors not occur. What the structuring of attention functionally means in an organization is that employees are focused on observing specific sections of the organization's problem environment more than others. One nice metaphor to consider this concept through is the tale of the inebriated man searching for his keys only where the lamp had lit up the street, because it was the only place that he could see. Organizations allow for selective observation of factors by 'turning on the streetlight' for certain

people on certain factors across time, creating variance in the observation of factors given a set of occurrences of factors.

To formalize this idea of the limited and structured attention in organizations, consistent with our assumption that organizations limit the scope of experience observable to subset of related factors only (formalized for the model as pairs of related events only, see assumption 6, and footnote 4 below), the likelihood that an individual observes a pair of factors (e_1, e_2) occurring in an organization is simply the likelihood that the employee's (i) attention in this organization focuses them on observing this pair ($f_{i,e_1\&e_2}$).

$$P_i\left(b_{e_1\&e_2}\right) = f_{i,e_1\&e_2} \tag{5}$$

Footnote 4: As noted in footnote 1, the model formalizes the set of factors an employee can observe as a pair of related factors only. Making the operationalization of assumption 6 for the model as follows: Organizations divide the scope of observation of their problem environment for their employees, such that while many factors may occur in the organization, employees in the organization will only ever observe pairs of related factors occurring. However, as long as the scope of factors remains smaller than the number of causes, the argument holds.

In order to find the likelihood of observing any particular factor (e_n) given the siloed, pairwise focus of factors in organizations, I can simply sum all the pairwise focuses that include factor (e_n), giving equation 6 below.

$$P_i\left(b_{e_n}\right) = \sum_{y=0,y\neq n}^{N} f_{i,e_n\&e_y} \tag{6}$$

This factor observation portion of my model formalizes the assumption that organizations limit the factor experience of their employees to specific sets of related factors, providing a variable of factor focus ($f_{i,e_n\&e_y}$) that maps an organization's division of labor to an observation window for individuals to observe factors within the organization. Functionally the factor focus variable operationalizes how organizations limited their employees' attention to see only slices of factors at any given time, where its only possible for an employee to either observe product factors or sales factors at any single time point. When I assume that employees focus on pairs of factors equally as in assumption 7a, this assumption can be formalized by equation 6 being equal for all pairs of factors within a single employee (i). When I assume that employees focus on different pairs of factors differently as in assumption 7b, this assumption can be formalized by the value of equation 6 varying from equal across different employees (i).

In Table 6 I summarize the parameters of my model that I can vary to generate different likelihood of factors.

Table 6: Model Parameters

Parameter	Name	Description	Possible Values	Category of Variance
S	Causal Strength	Given that the cause is selected, the likelihood of also selecting the effect.	[0,1)	Interdependence of Factors
$f_{i,e_1\&e_2}$	Factor Focus	The proportion of employee i's focus that is directed by the organization onto factors e1 and e2.	[0,1]	Direction of Employee Attention
j	Factors, Occurring	Number of factors that occur in a possible world.	[0,N]	Problem Environment
k	Independent Factors, Non-Occurring	Number of factors that do not have causes that do not occur in a possible world.	[0,N]	Problem Environment
m	Effect of Factors j, Non-Occurring	Number of effects of factors j that do not occur in a possible world.	[0,N-1]	Problem Environment

Now that I have developed a model to calculate the likelihood that employees within an organization will observe factors, I can turn to how these employees will form causal understandings from these factors.

Forming a Causal Explanation of Factors from Factor Observation

In order to form a model about how an employee will form a causal mental model from factor observation over time, I reference several assumptions and propositions generated in the theory section above. Consider proposition 2, which states that for an employee forming a causal explanation consistent with causal inference principles, causes should be observed occurring more often than effects. The first part of proposition 2 specifies that an employee would need to be trying to form a causal explanation consistent with causal inference principles in order for the second piece of the proposition to be relevant. In the model, I formalize this contingency into an additional assumption, which is that employees are seeking to form the correct causal mental model of the organization's problem environment, which means that employees will choose the causal explanation that is the most likely to be correct based on the observed probabilities and causal inferences principles.

Assumption 8: Employees seek to find the correct explanation of the problem environment through the application of causal inference principles (assumption 3-5).

There is much work in organizational research that references motivated or situated interpretation when it comes to making sense of situations in organizations (see sense-making literature, i.e. Weick et al., 2005). However, if successful strategies are based on correct causal understandings, and employees are either motivated or incentivized to generate successful organizational outcomes, this assumption may represent a reasonable set of true scenarios in organizations.

Next, the assumptions 1-5 and their implications proposition 1 and 2, plus the newly minted assumption 8, gives the model a clear way to decide how employees will select their causal explanations. The second half of proposition 2 states that causes should be observed occurring more than effects, and assumption 8 says that employees will select the causal explanation that is most likely to be correct given their causal inference principles. Thus, if factor 1 is observed occurring more than factor 2, then an employee (i) will conclude that factor 1 causes factor 2. I formalize this logic into equation 7 below.

$$\begin{gathered} if\ P_i(e_1) > P_i(e_2)\ \ then\ e_1 \rightarrow e_2 \\ if\ P_i(e_1) < P_i(e_2)\quad then\ e_2 \rightarrow e_1 \\ if\ P_i(e_1) = P_i(e_2)\quad then\ e_1 \rightarrow e_2\ or\ e_2 \rightarrow e_1 \end{gathered} \tag{7}$$

By operationalizing my assumption about employees wanting to find the correct explanation and employing causal inference principles to do so, I can form equation 7, which provides a clear way that employees go from observing factor co-occurrence to forming causal mental models of these factors. In equations 8 and 9, I formalize how the probabilities in equation 7 can be derived from the factor probabilities I calculate in equations 1 through 6.

$$P_i(e_1) = P_i\left(b_{e_1}\right) * \sum_0^d w_d[e_1] *\ P(w_d) \tag{8}$$

$$P_i(e_2) = P_i\left(b_{e_2}\right) * \sum_0^d w_d[e_2] *\ P(w_d) \tag{9}$$

When Employees Form Incorrect and Divergent Causal Explanations: Problem Environments with an Edge Root Cause

The structure is now in place for the model to measure when the division of attention enacted by organizations ($f_{i,e_n\&e_y}$) will generate incorrect causal understandings (presented as $P_i(e_2) > P_i(e_1)$ when $e_1 \rightarrow e_2$). Since an incorrect explanations occurs when e_1 causes e_2, but e_2 is observed more than e_1, I formalize the likelihood of forming an incorrect mental model in equation 10a and 10b below, where equation 10a represents when an incorrect causal understanding would occur given that problem environment has the relationship $e_1 \rightarrow e_2$, and equation 10b represents when an incorrect causal understanding would occur given that the problem environment has the relationship $e_2 \rightarrow e_1$.

$$P_i\left(b_{e_2}\right) * \sum_0^d w_d[e_2] *\ P(w_d) >\ P_i\left(b_{e_1}\right) * \sum_0^d w_d[e_1] *\ P(w_d)\ \text{, when } e_1 \rightarrow e_2 \tag{10a}$$

$$P_i\left(b_{e_2}\right) * \sum_0^d w_d[e_2] *\ P(w_d) <\ P_i\left(b_{e_1}\right) * \sum_0^d w_d[e_1] *\ P(w_d)\ \text{, when } e_2 \rightarrow e_1 \tag{10b}$$

Both equations 10a and 10b can be rewritten to reflect the relative ratios of factor occurrence and factor observation for events 1 and 2, where the relative factor observation of the

two events (represented by $P_i(b_{e_1})$and $P_i(b_{e_2})$)is not consistent with the actual relative factor occurrence of the two factors over time (represented by $\sum_0^d w_d[e_1] * P(w_d)$ and $\sum_0^d w_d[e_2] * P(w_d)$), incorrect explanations are likely to be formed. I rewrite equation 10a and 10b as equations 10a2 and 10b2 in this form below.

$$\frac{P_i(b_{e_2})}{P_i(b_{e_1})} > \frac{\sum_0^d w_d[e_1] * P(w_d)}{\sum_0^d w_d[e_2] * P(w_d)} \text{ , when } e_1 \rightarrow e_2 \quad (10a2)$$

$$\frac{P_i(b_{e_2})}{P_i(b_{e_1})} < \frac{\sum_0^d w_d[e_1] * P(w_d)}{\sum_0^d w_d[e_2] * P(w_d)} \text{ , when } e_2 \rightarrow e_1 \quad (10b2)$$

Note that this specification of incorrect causal explanations is a direction contradiction to one of the assumptions that the employee is making in her attempt to form a causal mental model, which is that the employee's observation of factors is consistent with factor occurrence (assumption 3). Functionally what equations 10a2 and 10b2 formalize is that when an employee assumes that her factor observation is consistent with factor occurrence, but when factor occurrence is not consistent with the employee's factor observation, then an incorrect causal explanation is likely.

I can now calculate when the pattern of observation of factors, whether equal or unequal as specified in assumption 7a and 7b respectively, will be likely to generate incorrect or divergent causal explanations. First, consider the case that assumes limited but unstructured attention, where employees are equally as likely to see all slices of the organization's problem environment. This formally means that for any pair of factors that are related, the likelihood of observing this pair is one over the total number of relationships in the problem environment (p_r), which is shown in equation 11.

$$f_{i,e_n\&e_y} = \frac{1}{p_r} \quad (11)$$

Now consider what the implication of this is for the observation of a single factor by an employee (i). Since each pair of factors has an equal likelihood of being observed by employee (i) in assumption 7a, the likelihood of observing any single factor (e_n) is just the number of pairs of factors that factor (e_n) is in. I formalize this into equation 12 below, where l_{e_n} is the number of relationships that event e_n is in.

$$P_i(b_{e_n}) = \sum_{y=0, y\neq n}^{N} f_{i,e_n\&e_y} = l_{e_n} * \frac{1}{p_r} \quad (12)$$

I now plug in equation 12 into equation 10a2, which specifies when the true relationship $e_1 \rightarrow e_2$ or $e_2 \rightarrow e_1$will be mistaken, and the employee will come to an incorrect causal explanation, labeling this equation 13.

$$\frac{l_{e_2}}{l_{e_1}} > \frac{\sum_0^d w_d[e_1] * P(w_d)}{\sum_0^d w_d[e_2] * P(w_d)} \text{ , when } e_1 \rightarrow e_2 \quad (13a)$$

$$\frac{l_{e_2}}{l_{e_1}} < \frac{\sum_0^d w_d[e_1] * P(w_d)}{\sum_0^d w_d[e_2] * P(w_d)} \text{ , when } e_2 \rightarrow e_1 \quad (13b)$$

What equation 13a shows is that when $e_1 \rightarrow e_2$, but factor 2 (e_2) is in more relationships than factor 1 (e_1), such that $l_{e_2} > l_{e_1}$, even though the organization's problem environment will have factor occurrence such that the cause (e_1) occurs more than its effect (e_2), employee observation in the organization will generate inconsistent observation with factor occurrence, generating incorrect causal explanations. This is true as long as the interdependence between factors (causal strength, S) is high enough such that the difference between the ratio of the number of relationships $\frac{l_{e_2}}{l_{e_1}}$ and the ratio of base rate of occurrence of factors $\frac{\sum_0^d w_d[e_1]* P(w_d)}{\sum_0^d w_d[e_2]* P(w_d)}$, is greater than 1, where the higher S is, the smaller the ratio of occurrence between factors.

In considering which problem environment structures will satisfy factor 2 (e_2) being in more relationships than factor 1 (e_1), such that $l_{e_2} > l_{e_1}$, edge root cause problem environments will necessarily satisfy it. I now formally define what an edge root problem environment is. First, edge root cause environments are environments where the root cause is contained in the factor set, such that if $l_{e_{rootcause}} = z_{e_{rootcause}} + t_{e_{rootcause}}$, where $z_{e_{rootcause}}$ is the number of causes of the root cause and $t_{e_{rootcause}}$ is the number of effects of the root cause, $z_{e_{rootcause}} = 0$. Second, edge root cause environments have an effect that has more relationships with other factors than the root cause, such that $l_{e_{effect}} > l_{e_{rootcause}}$. Thus, realities where $l_{e_{effect}} > l_{e_{rootcause}}$ and the effect and root cause co-occur will necessarily satisfy equation 13 and generate incorrect causal mental models at high enough causal strengths. I formalize my definition of edge root cause environments in equation 14 below.

Formal Definition of Edge Root Cause Environments: Equation 14

$$l_{e_{rootcause}} = z_{e_{rootcause}} + t_{e_{rootcause}} \quad (14)$$
$$z_{e_{rootcause}} = 0$$
$$l_{e_{effect}} > l_{e_{rootcause}}$$

Where $z_{e_{rootcause}}$ is the number of causes of the root cause and $t_{e_{rootcause}}$ is the number of effects of the root cause.

What my model then shows is a mathematical proof that under limited, but unstructured attention of factors in an organization, employees are likely to generate incorrect causal explanations for edge root cause environments when interdependence between factors is high, confirming the intuition of hypothesis 1.

Now, consider the second case of organization's dividing factor observation, such that employees observe different pairs of factors at different frequencies (assumption 7b), representing both a limited and structured attention for employees due to the division of labor. This formally means that for any pair of factors that are related, the likelihood of observing pairs of factors is a specified in assumption 7b, reformalized as equation 15 & 16 below:

$f_{i,focal}(e_1 \& e_2)$, where events e_1 and e_2 are the factors that employee (i) are focused on (15)

$f_i(e_n \& e_y) = \frac{(1-f_{i,focal}(e_1 \& e_2))}{k_r - 1}$, where factors n and y are any events but the focal pair (16)

In considering what the implication of this focus is for the probability of observing a single factor n for employee i ($P_i(b_{e_n})$), I plug our formalizations in equation 15 and 16 into equation 6 to get the following equation 17:

Where if factor e_n is in the focal pair with factor e_x then:

$$P_i(b_{e_n}) = f_{i,focal}(e_n\&e_x) + \sum_{y=0,y\neq n,x}^{N} f_{i,e_n\&e_y}$$

$$= f_{i,focal}(e_n\&e_x) + (l_{e_n} - 1) * \frac{(1-f_{i,focal}(e_n\&e_x))}{k_r-1} \quad (17a)$$

And if factor e_n is not in the focal pair, but another factor e_y is, then:

$$P_i(b_{e_n}) = l_{e_n} * \frac{(1-f_{i,focal}(e_y\&e_x))}{k_r-1} \quad (17b)$$

I now plug in equation 17 into equation 10a2, which specifies when the true relationship $e_1 \rightarrow e_2$ will be mistaken, and the employee will come to an incorrect causal explanation, labeling this equation 18. However, the equation will differ depending on whether factor 1 or factor 2 are a part of the focus pair of factors, thus I formalize equation 18a, where factor 1 (e_1) and factor 2 (e_2) are both in the focus pair of factors and 18b where factor 1 (e_1) is not a part of the focus pair of factors, but factor 2 (e_2) is.

$$\frac{f_{i,focal}(e_1\&e_2) + (l_{e_2}-1)*\frac{(1-f_{i,focal}(e_1\&e_2))}{k_r-1}}{f_{i,focal}(e_1\&e_2) + (l_{e_1}-1)*\frac{(1-f_{i,focal}(e_1\&e_2))}{k_r-1}} > \frac{\sum_0^d w_d[e_1]*P(w_d)}{\sum_0^d w_d[e_2]*P(w_d)}, \text{ when } e_1 \rightarrow e_2 \quad (18a)$$

$$\frac{f_{i,focal}(e_2\&e_y) + (l_{e_2}-1)*\frac{(1-f_{i,focal}(e_2\&e_y))}{k_r-1}}{(l_{e_1})*\frac{(1-f_{i,focal}(e_2\&e_y))}{k_r-1}} > \frac{\sum_0^d w_d[e_1]*P(w_d)}{\sum_0^d w_d[e_2]*P(w_d)}, \text{ when } e_1 \rightarrow e_2 \quad (18b)$$

What equation 18a and 18b show is that when $e_1 \rightarrow e_2$, but an employee focuses sufficiently on a factor pair that contains factor 2 (e_2) and not factor 1 (e_1) as in equation 18b, if $l_{e_2} > l_{e_1}$ this employee is likely to form an incorrect understanding when interdependence between factors is high enough. However, what 18a shows is that even in a world where $l_{e_2} > l_{e_1}$, if an employee focuses sufficiently on factor pairs that contain factor (e_1) and factor (e_2), this employee is likely to form correct causal understandings. Thus, in an edge root cause problem environment as outlined in equation 14 (such that $l_{e_1} = 0$ and $l_{e_2} > l_{e_1}$), equation 18a and 18b show that employees are likely to form divergent causal explanations.

A note for the example below, that if factors e_1 and e_2 are in the focal pair, but $e_2 \rightarrow e_1$, then equation 18c below represents when an incorrect understanding would be formed.

$$\frac{f_{i,focal}(e_1\&e_2) + (l_{e_2}-1)*\frac{(1-f_{i,focal}(e_1\&e_2))}{k_r-1}}{f_{i,focal}(e_1\&e_2) + (l_{e_1}-1)*\frac{(1-f_{i,focal}(e_1\&e_2))}{k_r-1}} < \frac{\sum_0^d w_d[e_1]*P(w_d)}{\sum_0^d w_d[e_2]*P(w_d)}, \text{ when } e_2 \rightarrow e_1 \quad (18c)$$

And then equation 18d where factor 2 (e_2) is not a part of the focus pair of factors, but factor 1 (e_1) is, and $e_2 \rightarrow e_1$.

$$\frac{f_{i,focal}(e_2 \& e_y) + (l_{e_1} - 1) * \frac{(1 - f_{i,focal}(e_2 \& e_y))}{k_r - 1}}{(l_{e_2}) * \frac{(1 - f_{i,focal}(e_2 \& e_y))}{k_r - 1}} < \frac{\sum_0^d w_d[e_1] * P(w_d)}{\sum_0^d w_d[e_2] * P(w_d)} \text{ , when } e_2 \rightarrow e_1 \quad (18d)$$

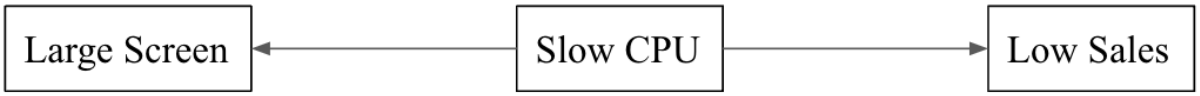
This calculation supports the intuition of hypothesis 2, which is that when the problem environment with sufficiently interdependent factors contains an edge root cause and employee see attention is structured such that they unequally observe the problem environment, divergence in causal explanations is likely. Thus, the mathematical model, built on the same assumptions as our theory section, supports both hypothesis 1 and hypothesis 2.

A Three Factor Example: Causal Explanations as a Function of Limited and Divided Attention, the Structure of the Problem Environment, and Interdependence between Factors

In my motivating example, the product and sales managers come to the following divergent explanations (with battery capacity removed for simplicity) about their organization's low sales.

Figure 5:
Causal Explanation of Product Manager:

Causal Explanation of Sales Manager:



My theoretical development suggests that if the problem environment generating the low sales outcome contains an edge root cause, then because middle factors are observed occurring more than edge factors due to the division of labor limiting and structuring employee attention, the divergence of causal explanations in Figure 5 is likely. My mathematical equations can be solved to show this is the case, which I generated above.

But how does this development matter for how causal explanations are formed in organizations? Calculating the values for the equations above, I show what levels of factor interdependence (causal strength, S) and how much structuring of attention (7b assumption) will generate incorrect or divergent causal explanations between the product and sales manager given a problem environment. In the results, only problem environments with an edge root cause generate divergent or incorrect understandings. In Table 7 I show all possible directed acyclic

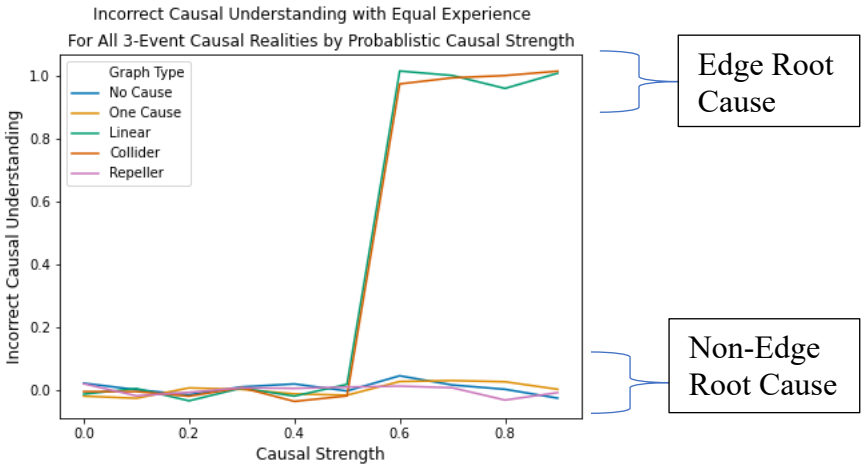
graph event-generating processes between the three factors: large screen (A), slow CPU (B) and low sales (C), identifying which graphs contain edge root causes.

Table 7: All Possible Directed Acyclic Graph Problem Environments for Three Events

	Example Graph	Number of Graphs in Type	Number of Arrows in Graph	Edge Root Cause	Equations Used
No Cause	A B C	1	0	No	NA
One Cause	A->B C	6	1	No	13a, 18a, 18b
Repeller	A<-B->C	3	2	No	13b, 18c, 18d
Collider	A->B<-C	3	2	Yes	13a, 18a, 18b
Linear	A->B->C	6	2	Yes	13a, 18a, 18b

Then, for each possible problem environment listed in Table 7, I first calculate equation 13 for each environment under the limited, but unstructured observation of slices of reality (assumption 7a), which tells us when employees will generate incorrect causal understandings. I visualize this in Figure 7, where on the x-axis is the causal strength of relationships between events (S), which is how tightly coupled the selection of factors was. On the y-axis, if the value is 0, employees converge to the correct causal explanation of the problem environment, if the value is 1, employees converge to the incorrect causal understanding of the problem environment. To calculate the 0 and 1 values of the y-axis for each problem space, I use either equation 13a or 13b (specified in column 6 of Table 7) depending on whether the true relationship is either A→B or B→A. If equation 13 is satisfied, employees reach an incorrect causal understanding for the true problem space at that causal strength, meaning a value of 1 on the y-axis.

FIGURE 6

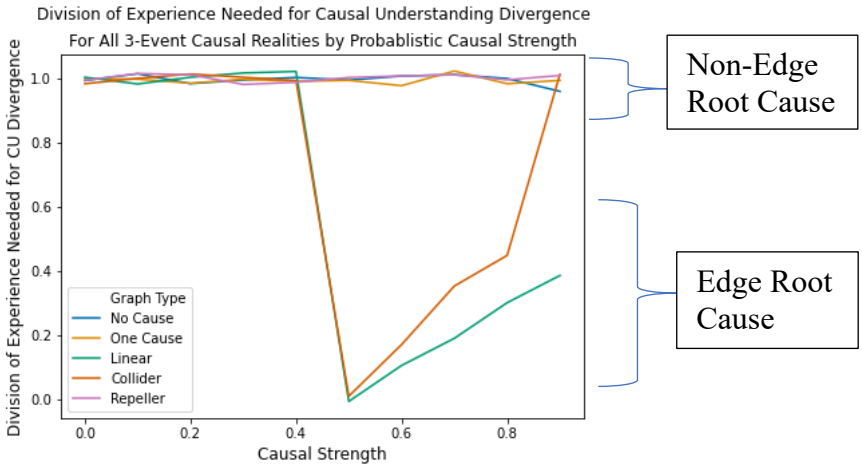


What Figure 6 above shows is that when the interdependence between factors is above 0.5 (S>0.5 on the x-axis), the structure of the organization's problem environment containing an edge root cause generates an incorrect causal mental model for employees with limited attention. This provides evidence to support hypothesis 1, that when organizations limit, but do not

structure, the attention of their employees, problem environments that have an edge root cause and sufficiently interdependent factors will generate incorrect causal explanations.

Next, I consider the results of equation 18 for each possible problem environment listed in Table 7, which tells us under the limited and structured attention leading to unequal observation of slices of the problem environment (assumption 7b), when employees will generate incorrect causal explanation. However, recall from hypothesis 2 and my mathematical development above that what is most likely expected for employees who differ in focus of factors it that these employees will diverge in causal explanations. Thus, in Figure 7, I visualize employee divergence in causal understandings as a function of causal strength (S) and structure of the problem environment. On the x-axis is the causal strength of relationships between factors, which measures how independent the factors are (S). On the y-axis is the difference between focus on a pair of factors that includes the root cause $f_{i,focal}(e_{rootcause}\&e_x)$ vs. focus on a pair of factors that does not include the root cause $f_i(e_y\&e_x)$ necessary to generate a divergence in causal understandings for employees, i.e. to satisfy either equation 18a or 18b (or for repeller, 18c or 18d) (see Table 7, column 6).

FIGURE 7



These results show that when an organization's problem environment contains sufficiently interdependent factors (high S) with an edge root cause, only a small amount of structuring in the attention of employees is likely to generate divergent explanations of problems. This result provides evidence supporting hypothesis 2, that when organizations limit and structure the attention of their employees, problem environment that have an edge root cause and sufficiently interdependent factors will generate divergent causal explanations.

To show the mechanism for why the results in Figure 6 occur (with a similar mechanism in Figure 7), for each of the problem environments I generate the observation of factors A and B for employees vs. the actual occurrence of factors A and B over time for employees across causal strengths (S) and report them in Figure 8a-e. When the observation and occurrence line remain on the same side of zero to each other, this means that employee observation in the organization is consistent with factor occurrence. However, for the edge root cause problem environments 'Linear' and 'Collider', above interdependence of factors of 0.5, employee observation and occurrence are no longer consistent, breaking assumption 3, and generating incorrect causal explanations.

FIGURE 8

FIGURE 8A: No Cause Environment

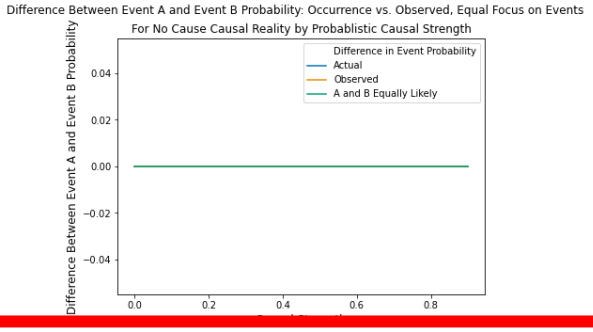


FIGURE 8B: One Cause Environment

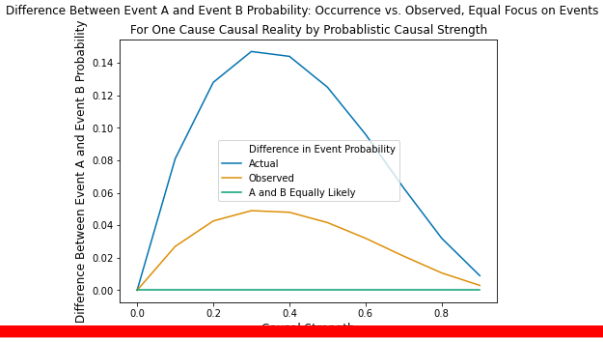


FIGURE 8C: Linear Environment

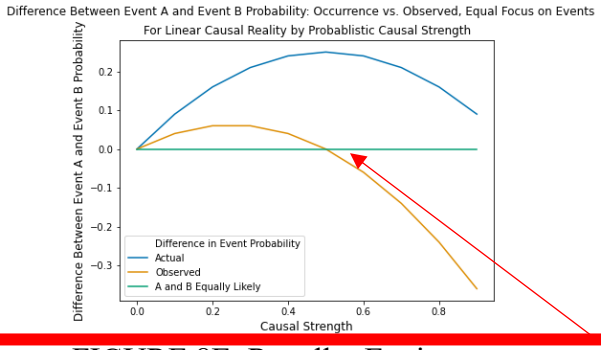


FIGURE 8D: Collider Environment

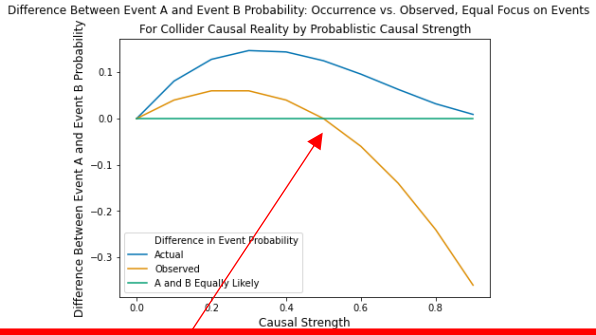
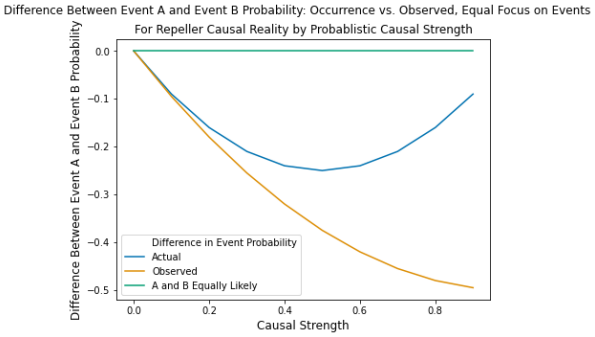


FIGURE 8E: Repeller Environment



Problem environments containing an edge root cause generate factor observation that is inconsistent with factor occurrence when factors are sufficiently interdependent (S > 0.5).

Now that I've outlined what the model results are, I turn to how these results speak to my hypotheses, and more generally suggest when organizations are likely to experience a trade-off between correct and convergent causal understandings and the division of work. I used the intuition of causal modeling to develop the hypotheses that edge root cause problem environments are likely to generate incorrect or divergent causal explanations under the divided attention of organizations when factors are sufficiently interdependent. My model shows that this is the case. In considering what this finding means for organizations, I return to the motivating example.

The product and sales managers at the computer manufacturer are trying to understand their low sales in order to form a successful strategy to resolve it. In order to generate this solution, employees in the organization need to understand the space in a way that allows them to come to a correct and convergent strategy of what to do next. But the computer manufacturer has also divided the work, and thus attention, of their employees, such that the product manager

and sales manager are likely to have experienced the organization's low sales in different ways. Given this structure of work and attention, when are the product manager and the sales manager likely to be able to form a correct and convergent causal understanding of what happened? If the problem environment is not highly interdependent or does not contain an edge root cause, the employees are likely to agree on the correct causal explanation even under their differences in attention. However, if the problem space is interdependent and does contain an edge root cause, either the product and sales manager will agree of the incorrect causal explanation or disagree on explanations, generating difficulty forming a successful strategy to address the organization's low sales.

Overall, my model suggests the importance of the structure of the organization's problem environment and the interdependence between factors for when organizations are likely to face difficulty forming correct and convergent explanations under the division of labor.

DISCUSSION & CONCLUSION

Below I summarize the findings of my theoretical and mathematical model, suggest a wide set of contexts that this type of model can apply to, and suggest directions for future research on causal explanations in organizations.

What do we gain from considering organizational environments and employees' causal explanations as simple causal models?

Organizational environments are undoubtedly complex and interdependent, and have been studied and formalized as such in organizational research (Csaszar & Levinthal, 2016; Gavetti & Levinthal, 2000). However, this emphasis on a complex environment in prior research has often led to an overcomplication of the task that employees complete when faced with a single instance of organizational failure. When facing poor performance, employees form an explanation of why the problem has occurred in order to find a solution, and explanations have an order to them and tend to be simple (Lombrozo, 2007). I consider how representing a single instance of an organization's problem environment and an employee's explanation of this problem as directed acyclic graphs might help capture variation in the order in which employee's choose to explain an organization's problem.

By developing a theoretical and mathematical model, I show that the structure and interdependencies of the organization's problem environment is likely to interact with the way in which employees' attention is limited and structured by the organization, impacting the explanations that employees form of organizational problems. My work suggests that the order in which decisions are made in an organization, the interdependence between decisions, and the way in which the decisions are attended to by employees, are essential forms of variation for understanding how employees form theories of an organization's poor performance, and thus likely important sources of variation for the solutions these organizations select.

Organizational research has previously underemphasized how organizational structure is likely to differentially generate conflicting cognitions (Joseph & Gaba, 2020). From research on causal induction and organizational search, I pull two important factors that are likely to impact the formation of these causal mental models for employees in organizational context: the causal structure of the organization's problem environment and the interdependencies between factors (Pearl, 2009; Levinthal, 1997). My model suggests that examining the interaction between an organization's division of work and problem environment provides a powerful way to predict when employees within an organization will reach incorrect or divergent explanations of

problems. Specifically, when the problem environment is sufficiently interdependent and contains an edge root cause, employees will either converge on incorrect explanation or reach divergent explanations of the organization's problem, depending on the division of attention in the organization.

The application of this model to real world organizations, however, may be stymied by a particularly troublesome and necessary assumption of it, which is assumption 2, that individuals cannot observe the organization's problem environment directly. My model provides a proof of concept for how the problem environment is important, but in order to identify situations where explanations are likely to be incorrect or divergent, knowing the structure of the problem environment is essential. So how can a model showing that the structure the problem environment matters be useful when it assumes that the structure of the problem environment is unobservable?

Practically, my model is likely to be most useful for organizations in three ways. First, in ex post analysis of organizational failures and success, my model suggests that considering the structure of the problem facing organizations might help distinguish why the computer manufacturer failed to select a successful strategy, but why the same configuration choices made in a different way, may have led to the organization succeeding. My model would provide the hypothesis that the problem that the computer manufacturer faced was not only uncertain, but also structured in such a way that converging on the correct assumptions in order to form the right strategy may have been a difficult task due to the chain of causal decisions that generated the poor outcome.

Consider how the computer manufacturer would have fared if the CPU decision was an earlier choice made in the specification set on the computer, and also the choice that most closely drove low sales. The sales manager would have observed the slow CPU impacting sales and concluded it was the reason that the product failed, and the product manager would have observed that the CPU was the root of the other product specifications, and concluded that it also was likely driving the low sales. However, when decisions on factors that are far away from the factors that directly impact the outcome are made first, explanations of the organization's problem may be incorrect. This is because these explanations are likely to consider factors that are closer to the problem as more important, even if the real reason the organization failed was because of a factor decision made early on that came with a string of interdependent choices.

While work based on the NK-model would address these interdependencies together in a search for a solution (i.e. see Csaszar & Levinthal, 2016), I argue that the strategy selected by an organization is likely to be contingent on which factors an organization sees as most contributing to the low performance, which explanations are likely to consistently get wrong if those decisions were made further away from the point of failure. Thus, my model highlights how order of decisions made might matter for organizations. My model would specifically suggest that given the problem environment faced by the computer manufacturer, the strong interdependencies between product factors, and the structure of division of work in organizations, only employees like the product manager who oversampled on the root cause of the problem space were likely to generate correct causal explanations.

Second, my model may be particularly useful to organizations when they are attempting to select the most successful strategy from a set of divergent causal explanations. While motivated reasoning and other factors may be at play in divergent explanations, another consistent reason employees in an organization reach divergent understandings of factors is because of the division of work, and thus attention in organizations (Dearborn & Simon, 1958;

Joseph & Gaba, 2020). However, only certain problem environments are likely to generate divergent understandings from division of labor, interdependent environments containing an edge root cause. In the case where the organizational environment is generating divergent understandings in organizations, my model provides a clear prediction for whose causal understanding will be correct, the employee who observes the root cause and its associated factors more.

Because the problem environment cannot be directly observed, it may be difficult to identify the root cause. However, my model suggests that having a theory for who is most likely to observe the root cause, may help organizations make more principled decisions in choosing a strategy from divergent causal understandings. In the debate between whether a top-down or theory-driven approach for information processing is better (see Walsh, 1995; Galambos et al., 1986; Nisbett and Ross, 1980), my work suggests that for the context of causal explanations specifically, a theory-driven approach that considers where the root cause is likely to be located in the problem environment will perform better. For example, some work suggests that managers may be closer to the root cause of problems, making manager's causal explanations of organizational problems more likely to be correct, but potentially generating myopia to the trickle-down effects of higher-order decisions (Hannan et al., 2003). While in other instances, employees on the ground who are doing the work and are closer to the action, may observe the root causes of issues in the organization more saliently, and thus soliciting input, especially divergent input, from employees, may generate more successful strategy (Tegarden et al., 2005).

Finally, my model suggests a rather counterintuitive, but hopeful implication for the division of work and divergent causal explanations in organizations. Traditional accounts of modularity in organizations point to how the division of work drives divergence and disagreement, harming coordination and performance (i.e. Campagnolo & Camuffo, 2010; Clement, 2023; Santos et al., 2021; Heath & Staudenmayer, 2000). A natural suggestion for improving the divergence generated by the division of work might be to increase the visibility and attention that employees have in the organization. However, my work suggests that when the the problem an organization faces contains interdependent factors with an edge root cause, the structure of attention that the division of work generates is uniformly positive as long as attention in the organization is limited.

This is because in edge root cause environments, if employees were not differentially focused on different parts of this environment, but their observation were still limited, employees would converge on causal explanations, but they would agree on an incorrect theory, and thus be likely to improperly attend to the correct factors in the future (Felin & Zenger, 2017). In this light, divergence in causal understandings due to division of work can be seen as a positive outcome of organizational processes, and one that would not be improved by removing the structure in employee attention. When employees see different slices of an environment, then even for edge root cause environments in which it is extremely difficult to infer correct understandings, there is a chance that organizations can reach the correct causal explanations, because some employees do hold this understanding.

Ultimately, while the organization's problem environment is unobservable, my work suggests that having a theory about the structure of the problem environment may help organizations consider how to better select which causal explanation to form strategy on when explanations diverge. In addition, in ex post analysis of organizational failure and success based on causal explanations, perhaps considering the organization's problem environment can provide

a more tangible input to the uncertainty and causal ambiguity that can generate differences in outcomes for organizations (Raynor, 2007; King, 2007).

Where else do the results of the interaction of division of experience and problem environments apply?

While the work above uniformly focuses on the organizational context, my theory on problem environments applies to any context that consistently divides individual scope and frequency of experience. Societal structures, such as the sociodemographic features of race, gender, and income, may also be likely to systematically structure individuals' attention and experience (Healey & Stepnik, 2009). Expanding my model to this wider set of social structures, my theory provides a potential explanation for why, for example, low-income and high-income parents may disagree on causal explanations of why certain parenting methods lead to success or failure (Lareau, 2018). Or even why democrats and republicans, whose attention is often stratified by many social features, may observe the same set of political factors and come to different understandings on them (Cutler, 2003; Basta, 2017). Thus, while I believe that organizations are particularly likely to exhibit the division of attention outlined in my model above, future work might well consider how other societal groups whose experience of factors is also structured, may also reach divergent explanations as a function of the limited and structured attention and the interdependent structure of the problem environment.

Where do we go from here?

The goal of the theory developed in the paper is to help future work in organizations and social science research better identify why incorrect and divergent causal explanations occur. I suggest an additional and often overlooked source of this variance in causal understandings, which is the order in which decisions are made, as specified by a simple causal problem environment. While the structure of the organization's problem environment is not readily observable to researchers and practitioners alike, my work suggests that having a theory of what the structure of the environment is may help us better understand the antecedents of divergence and make principled selections of explanations when divergence exists. Several pathways for future work follow.

First, while the propositions above are developed by following the set of assumptions, the first test of my theory is, in a controlled experimental setting, to see whether under this assumption set, individuals form incorrect and divergent explanations. Work on causal narratives in economics has run models and sets of experiments that generally support the idea that the observation of co-occurrence of events generates the types of causal inference errors I identify in my theory above (i.e. Spiegler, 2016; Eliaz & Speigler, 2020). However, this work does not test the set of assumptions about how organizations divide work and limit experience, thus future work should explore how the formation of causal explanations under the specific set of divided work we expect to see in organizations is likely to generate the theoretical insights developed here.

Second, a major contribution of this work in organizational contexts is that it may help organizations make principled decisions about which causal understandings may generate successful strategy when there is divergence of causal explanations in the organizations. Future work should explore this theoretical insight by specifically examining organizational contexts where division in causal understandings arise, testing whether forming a model of the structure of the problem environment and identifying which set of stakeholders are most likely to observe

the root cause of factors, may help organization select better strategies and ultimately perform better.

Finally, organizations' division of experience represents similar division of experience that occurs in many different parts of our society. For any social science scholar who studies populations that diverge on causal explanations, from work on polarization to work on class differences in parenting, considering the structure of the problem environment and division of attention of individuals may help explain the divergence of individuals who may ostensibly observe the same reality.

WORKS CITED

Ackermann, F., et al. *The Practice of Making Strategy a Step by Step Guide*. 2005.

Allen, Peter, et al. *The SAGE Handbook of Complexity and Management*. 2011, pp. 1–672.

Ball, Carolyn. "What Is Transparency?" *Public Integrity*, vol. 11, no. 4, Sept. 2009, pp. 293–308. *Taylor and Francis+NEJM*, https://doi.org/10.2753/PIN1099-9922110400.

Basta, Karlo. "The Social Construction of Transformative Political Events." *Comparative Political Studies*, vol. 51, no. 10, Sept. 2018, pp. 1243–78. *SAGE Journals*, https://doi.org/10.1177/0010414017740601.

Borg, AnneMarie, and Floris Bex. "Necessary and Sufficient Explanations for Argumentation-Based Conclusions." *Symbolic and Quantitative Approaches to Reasoning with Uncertainty*, edited by Jiřina Vejnarová and Nic Wilson, Springer International Publishing, 2021, pp. 45–58. *Springer Link*, https://doi.org/10.1007/978-3-030-86772-0_4.

Campagnolo, Diego, and Arnaldo Camuffo. "The Concept of Modularity in Management Studies: A Literature Review." *International Journal of Management Reviews*, vol. 12, no. 3, 2010, pp. 259–83. *Wiley Online Library*, https://doi.org/10.1111/j.1468-2370.2009.00260.x.

Carey, Susan. "On the Origin of Causal Understanding." *Causal Cognition: A Multidisciplinary Debate*, Clarendon Press/Oxford University Press, 1995, pp. 268–308.

Carroll, Glenn R., and Jesper B. Sørensen. *Making Great Strategy: Arguing for Organizational Advantage*. Columbia Business School Publishing, 2021.

Chen, Janice, and Aaron M. Bornstein. "The Causal Structure and Computational Value of Narratives." *Trends in Cognitive Sciences*, May 2024. *ScienceDirect*, https://doi.org/10.1016/j.tics.2024.04.003.

Clement, Julien. "Missing the Forest for the Trees: Modular Search and Systemic Inertia as a Response to Environmental Change." *Administrative Science Quarterly*, vol. 68, no. 1, Mar. 2023, pp. 186–227. *SAGE Journals*, https://doi.org/10.1177/00018392221136267.

Csaszar, Felipe A. "A Note on How NK Landscapes Work." *Journal of Organization Design*, vol. 7, no. 1, Dec. 2018, p. 15. *Springer Link*, https://doi.org/10.1186/s41469-018-0039-0.

Csaszar, Felipe A., and Daniella Laureiro-Martínez. "Individual and Organizational Antecedents of Strategic Foresight: A Representational Approach." *Strategy Science*, vol. 3, no. 3, Sept. 2018, pp. 513–32. *pubsonline.informs.org (Atypon)*, https://doi.org/10.1287/stsc.2018.0063.

Csaszar, Felipe A., and Daniel A. Levinthal. "Mental Representation and the Discovery of New Strategies." *Strategic Management Journal*, vol. 37, no. 10, 2016, pp. 2031–49. *Wiley Online Library*, https://doi.org/10.1002/smj.2440.

Cutler, Fred. "The Simplest Shortcut of All: Sociodemographic Characteristics and Electoral Choice." *Journal of Politics*, vol. 64, no. 2, 2002, pp. 466–90. *Wiley Online Library*, https://doi.org/10.1111/1468-2508.00135.

Dearborn, Dewitt C., and Herbert A. Simon. "Selective Perception: A Note on the Departmental Identifications of Executives." *Sociometry*, vol. 21, 1958, pp. 140–44. *APA PsycNet*, https://doi.org/10.2307/2785898.

Eliaz, Kfir, and Ran Spiegler. "A Model of Competing Narratives." *American Economic Review*, vol. 110, no. 12, Dec. 2020, pp. 3786–816. *www.aeaweb.org*, https://doi.org/10.1257/aer.20191099.

Felin, Teppo, and Todd R. Zenger. "CROSSROADS—Strategy, Problems, and a Theory for the Firm." *Organization Science*, vol. 27, no. 1, Jan. 2016, pp. 222–31. *pubsonline.informs.org (Atypon)*, https://doi.org/10.1287/orsc.2015.1022.

---. “The Theory-Based View: Economic Actors as Theorists.” *Strategy Science*, vol. 2, no. 4, Dec. 2017, pp. 258–71. *pubsonline.informs.org (Atypon)*, https://doi.org/10.1287/stsc.2017.0048.
Ferreira, Daniel, and Raaj K. Sah. “Who Gets to the Top? Generalists versus Specialists in Managerial Organizations.” *The RAND Journal of Economics*, vol. 43, no. 4, 2012, pp. 577–601. *Wiley Online Library*, https://doi.org/10.1111/1756-2171.12000.
Gaba, Vibha, and John Joseph. “Content and Process: Organizational Conflict and Decision Making.” *Frontiers in Psychology*, vol. 14, Nov. 2023. *Frontiers*, https://doi.org/10.3389/fpsyg.2023.1227966.
Gale, Richard M. “Why a Cause Cannot Be Later Than Its Effect.” *Review of Metaphysics*, vol. 19, no. 2, 1965, pp. 209–34.
Galambos, James A., John B. Black and Robert P. Abe. *Knowledge Structures*. Taylor & Francis, New York, NY, 1986.
Gary, Michael Shayne, and Robert E. Wood. “Mental Models, Decision Rules, and Performance Heterogeneity.” *Strategic Management Journal*, vol. 32, no. 6, 2011, pp. 569–94. *Wiley Online Library*, https://doi.org/10.1002/smj.899.
Gavetti, Giovanni. “Cognition and Hierarchy: Rethinking the Microfoundations of Capabilities’ Development.” *Organization Science*, vol. 16, no. 6, Dec. 2005, pp. 599–617. *pubsonline.informs.org (Atypon)*, https://doi.org/10.1287/orsc.1050.0140.
---. “Strategy Making in Novel and Complex Worlds: The Power of Analogy.” *Strategic Management Journal*, vol. 26, no. 8, 2005, pp. 691–712. *Wiley Online Library*, https://doi.org/10.1002/smj.475.
Gavetti, Giovanni, and Daniel Levinthal. “Looking Forward and Looking Backward: Cognitive and Experiential Search.” *Administrative Science Quarterly*, vol. 45, no. 1, Mar. 2000, pp. 113–37. *SAGE Journals*, https://doi.org/10.2307/2666981.
---. “Looking Forward and Looking Backward: Cognitive and Experiential Search.” *Administrative Science Quarterly*, vol. 45, no. 1, Mar. 2000, pp. 113–37. *SAGE Journals*, https://doi.org/10.2307/2666981.
Goodman, Noah D., et al. “Learning a Theory of Causality.” *Psychological Review*, vol. 118, no. 1, 2011, pp. 110–19. *APA PsycNet*, https://doi.org/10.1037/a0021336.
Griffiths, Thomas L., and Joshua B. Tenenbaum. “Theory-Based Causal Induction.” *Psychological Review*, vol. 116, no. 4, 2009, pp. 661–716. *APA PsycNet*, https://doi.org/10.1037/a0017201.
Hannan, Michael T., et al. “Cascading Organizational Change.” *Organization Science*, vol. 14, no. 5, 2003, pp. 463–82.
Healey, Joseph F., and Andi Stepnick. *Diversity and Society: Race, Ethnicity, and Gender*. SAGE Publications, 2019.
Heath, Chip, and Nancy Staudenmayer. “Coordination Neglect: How Lay Theories of Organizing Complicate Coordination in Organizations.” *Research in Organizational Behavior*, vol. 22, Jan. 2000, pp. 153–91. *ScienceDirect*, https://doi.org/10.1016/S0191-3085(00)22005-4.
Jenkins, Mark, and Gerry Johnson. “Entrepreneurial Intentions and Outcomes: A Comparative Causal Mapping Study.” *Journal of Management Studies*, vol. 34, no. 6, 1997, pp. 895–920. *Wiley Online Library*, https://doi.org/10.1111/1467-6486.00077.
Joseph, John, and Vibha Gaba. “Organizational Structure, Information Processing, and Decision-Making: A Retrospective and Road Map for Research.” *Academy of Management Annals*, vol. 14, no. 1, Jan. 2020, pp. 267–302. *journals.aom.org (Atypon)*, https://doi.org/10.5465/annals.2017.0103.

Juarrero, Alicia. “Causality and Explanation.” *The SAGE Handbook of Complexity and Management*. 2011, pp. 1–672.
King, Adelaide Wilcox. “Disentangling Interfirm and Intrafirm Causal Ambiguity: A Conceptual Model of Causal Ambiguity and Sustainable Competitive Advantage.” *The Academy of Management Review*, vol. 32, no. 1, 2007, pp. 156–78.
Lareau, Annette. “Unequal Childhoods: Class, Race, and Family Life.” *Inequality in the 21st Century*, Routledge, 2018.
Lawrence, Paul R., and Jay W. Lorsch. “Differentiation and Integration in Complex Organizations.” *Administrative Science Quarterly*, vol. 12, no. 1, 1967, pp. 1–47. *JSTOR*, https://doi.org/10.2307/2391211.
Lazzarini, Sergio Giovanetti, and Todd Zenger. “Strategy as (a Causal) Theory of Change.” *Academy of Management Proceedings*, vol. 2023, no. 1, Aug. 2023, p. 11924. *journals.aom.org (Atypon)*, https://doi.org/10.5465/AMPROC.2023.11924abstract.
Levinthal, Daniel A. “Adaptation on Rugged Landscapes.” *Management Science*, vol. 43, no. 7, July 1997, pp. 934–50. *pubsonline.informs.org (Atypon)*, https://doi.org/10.1287/mnsc.43.7.934.
Levitt, Barbara, and James G. March. “Organizational Learning.” *Annual Review of Sociology*, vol. 14, no. Volume 14, 1988, Aug. 1988, pp. 319–38. *www.annualreviews.org*, https://doi.org/10.1146/annurev.so.14.080188.001535.
Lombrozo, Tania. “Simplicity and Probability in Causal Explanation.” *Cognitive Psychology*, vol. 55, no. 3, Nov. 2007, pp. 232–57. *ScienceDirect*, https://doi.org/10.1016/j.cogpsych.2006.09.006.
March, J. G., and H. A. Simon. *Organizations*. Wiley, 1958.
Milgrom, Paul, and John Roberts. *Economics, Organization and Management*. 1st edition, Pearson, 1992.
Mintzberg, Henry. *Mintzberg on Management: Inside Our Strange World of Organizations*. Simon and Schuster, 1989.
Nisbett, Richard E. and Lee Ross. *Human Inference: Strategies and Shortcomings of Social Judgement.* Englewood Cliffs, NJ: Prentice Hall, 1980.
Ocasio, William. “Towards an Attention-Based View of the Firm.” *Strategic Management Journal*, vol. 18, 1997, pp. 187–206.
Pearl, Judea. *Causality: Models, Reasoning and Inference*. 2nd edition, Cambridge University Press, 2009.
Polanyi, Michael. “Scientific Thought and Social Reality: Essays by Michael Polanyi.” *Psychological Issues*, vol. 8, no. 4, Mono 32, 1974, pp. 157–157.
Raveendran, Marlo, et al. “The Role of Interdependence in the Micro-Foundations of Organization Design: Task, Goal, and Knowledge Interdependence.” *Academy of Management Annals*, vol. 14, no. 2, July 2020, pp. 828–68. *journals.aom.org (Atypon)*, https://doi.org/10.5465/annals.2018.0015.
Raynor, Michael E. *The Strategy Paradox: Why Committing to Success Leads to Failure*. 1st edition, Crown Business, 2007.
Rhodes, Carl, and Andrew D. Brown. “Narrative, Organizations and Research.” *International Journal of Management Reviews*, vol. 7, no. 3, 2005, pp. 167–88. *Wiley Online Library*, https://doi.org/10.1111/j.1468-2370.2005.00112.x.
Rivkin, Jan W., and Nicolaj Siggelkow. “Balancing Search and Stability: Interdependencies among Elements Organizational Design.” *Management Science*, vol. 49, no. 3, 2003, pp. 290–311.
Ryall, Michael, and Olav Sorenson. *Causal Inference as an Organizational Problem*. OSF, 16 May 2022. *OSF Preprints*, https://doi.org/10.31235/osf.io/3ypt4.

Santos, Catarina M., et al. "The Effect of a Concept Mapping Intervention on Shared Cognition and Adaptive Team Performance Over Time." *Group & Organization Management*, vol. 46, no. 6, Dec. 2021, pp. 984–1026. *SAGE Journals*, https://doi.org/10.1177/1059601120981623.
Siggelkow, Nicolaj, and Daniel A. Levinthal. "Temporarily Divide to Conquer: Centralized, Decentralized, and Reintegrated Organizational Approaches to Exploration and Adaptation." *Organization Science*, vol. 14, no. 6, 2003, pp. 650–69.
Simon, Herbert A. "Bounded Rationality and Organizational Learning." *Organization Science*, vol. 2, no. 1, 1991, pp. 125–34.
Sköldberg, Kaj. "Tales of Change: Public Administration Reform and Narrative Mode." *Organization Science*, vol. 5, no. 2, 1994, pp. 219–38.
Spiegler, Ran. "Bayesian Networks and Boundedly Rational Expectations." *The Quarterly Journal of Economics*, vol. 131, no. 3, 2016, pp. 1243–90.
Szulanski, Gabriel, et al. "When and How Trustworthiness Matters: Knowledge Transfer and the Moderating Effect of Causal Ambiguity." *Organization Science*, vol. 15, no. 5, Oct. 2004, pp. 600–13. *pubsonline.informs.org (Atypon)*, https://doi.org/10.1287/orsc.1040.0096.
Tappin, Ben M., et al. "Thinking Clearly about Causal Inferences of Politically Motivated Reasoning: Why Paradigmatic Study Designs Often Undermine Causal Inference." *Current Opinion in Behavioral Sciences*, vol. 34, Aug. 2020, pp. 81–87. *ScienceDirect*, https://doi.org/10.1016/j.cobeha.2020.01.003.
Tegarden, Linda, et al. "The Engagement of Employees In The Strategy Process and Firm Performance: The Role of Strategic Goals and Environment." *Journal of Business Strategies*, vol. 22, no. 2, 2, 2005, pp. 75–100. *jbs-ojs-shsu.tdl.org*, https://doi.org/10.54155/jbs.22.2.75-100.
Thompson, Victor A. "Hierarchy, Specialization, and Organizational Conflict." *Administrative Science Quarterly*, vol. 5, no. 4, 1961, pp. 485–521. *JSTOR*, https://doi.org/10.2307/2390618.
Thompson, James D. *Organizations in Action : Social Science Bases of Administrative Theory*. Routledge, 2017. *www.taylorfrancis.com*, https://doi.org/10.4324/9781315125930.
Thornton, Patricia H., et al. "Introduction to the Institutional Logics Perspective." *The Institutional Logics Perspective: A New Approach to Culture, Structure and Process*, edited by Patricia H. Thornton et al., Oxford University Press, 2012, p. 0. *Silverchair*, https://doi.org/10.1093/acprof:oso/9780199601936.003.0001.
Waldmann, Michael R., and York Hagmayer. "Estimating Causal Strength: The Role of Structural Knowledge and Processing Effort." *Cognition*, vol. 82, no. 1, Nov. 2001, pp. 27–58. *ScienceDirect*, https://doi.org/10.1016/S0010-0277(01)00141-X.
Walsh, James P. "Managerial and Organizational Cognition: Notes from a Trip down Memory Lane." *Organization Science*, vol. 6, no. 3, 1995, pp. 280–321. *APA PsycNet*, https://doi.org/10.1287/orsc.6.3.280.
Weick, Karl E., et al. "Organizing and the Process of Sensemaking." *Organization Science*, vol. 16, no. 4, Aug. 2005, pp. 409–21. *pubsonline.informs.org (Atypon)*, https://doi.org/10.1287/orsc.1050.0133.