Exploring Historical and Contemporary Causal Problem Framing: Towards a Framework for Research, Teaching, and Assessment

by

Alex Honold

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Educational Studies)
in the University of Michigan
2022

Doctoral Committee:

Associate Professor Bob Bain, Chair
Professor Barry Fishman
Professor Chauncey B. Monte-Sano
Associate Professor Christopher Quintana

Alex Honold

honold@umich.edu

ORCID iD: 0000-0002-0270-7793

Acknowledgements

I am thankful for the faculty at the University of Michigan who made this dissertation possible. I am incredibly grateful for my advisor, Bob Bain, who has critically shaped my thinking about history, teaching, and learning. Bob dedicated an enormous amount of time and attention to this dissertation. It would not be what it is without his guidance and commitment. Thank you also to my advisor Chris Quintana. My many conversations with Chris about learning theory and design inspired a great deal of this work. I am also grateful for the mentorship of my other committee members, Chauncey Monte-Sano and Barry Fishman. Many of the original ideas for this study emerged from my conversations with Chauncey in her independent study course and from my time in Barry's seminars on redesigning undergraduate learning.

I owe a huge thank you to Mr. Owens for opening up his classroom to me. A true teacher-scholar, Mr. Owens is one of the most innovative and prolific educators I have had the pleasure to work with. It was a privilege and learning experience to watch Mr. Owens teach and read Mr. Owens' scholarship. Thank you also to Mr. Owens' students. They warmly accepted me into their class and helped me remember just how clever and creative high schoolers are.

Thank you to my partner Edie Juno for your dedication, wisdom, patience, and many rounds of editing. Thank you to my mom, dad, pop, stepmom, siblings, and grandparents for your guidance and unwavering support. Finally, thank you to my friends and colleagues who kept up my spirits up through this process: Logan Eiland, Mar Estrada, Rod Franchi, Saba Gerami, Mauricio Gonzalez, Meghan Fagan, Mike Ion, and Bill Waychunas.

Table of Contents

List of Figures

List of Tables

List of Appendices

Abstract

One of the core dimensions of historical and social science inquiry is "[d]eveloping questions and planning inquiries" according to the National Council for the Social Studies' College, Career, and Civic Life (C3) Framework. Yet existing education research, instructional resources, and assessment have ignored how students frame problems in history and the social sciences or what it might look like to support students' problem framing. This dissertation takes up this work in several ways, focusing specifically on historical and contemporary causal problems. First, the literature review identifies most historical and contemporary causal problems as "wicked" or "ill-structured" and then highlights how historians and other ill-structured domain experts reason about and represent causation. Second, the dissertation presents analysis of three exploratory case studies. The first case study analyzed how an innovative and experienced AP US history teacher represented the characteristics of historical causation for his students. In the two subsequent studies, the dissertation reports how several students worked to frame an ill-structured historical problem and an ill-structured contemporary problem. Unlike traditional document-based inquiry tasks, the task design prompted students to construct an initial problem space rather than jump to evaluate evidence, write an account, or produce a solution. Drawing on the literature and analysis of these studies, the dissertation proposes a framework for researching, teaching and assessing causal problem framing. The framework comprises three key, interrelated dimensions of causal problem framing: *establishing the scale of the problem space, identifying agents and structures, and establishing the interaction of causes.* Finally, the dissertation explores the implications of this research and framework, including suggested design principles

for creating problem framing activities and interventions to support students in seeing the ill-structured nature of causal problems and the tradeoffs inherent in ill-structured problem spaces.

Chapter I

Introduction and Problem Statement

When I was a junior in high school, my younger brother Seth had just started Pre-K. Like many kids his age, he loved the question *why*? "Why do I have to wear sunscreen?" "Why does the school bus make so many stops?" "Why can't I eat grass?" For every answer I gave, he demanded to know more. "But *why* would eating grass make me sick?" And then, "but *why* is my stomach not designed to eat grass?" In asking these follow-up questions, Seth was doing something that experts in many fields do: reframe and refine their initial question.

In the 1980s, historian Richard Evans (1987) set out to answer the question: Why did an 1892 cholera epidemic devastate Hamburg while sparing the rest of Europe? He initially identified Hamburg's pre-modern water supply as the fatal culprit. Yet, to Evans, this only revealed something unsatisfying with his original question. *Why* did Hamburg's water lag critically behind its European counterparts? This raised further questions about poverty, political corruption, and social strife—questions not immediately relevant to his original problem space. Evans later wrote that "it became clear that explaining why a major epidemic happened in Hamburg that year and nowhere else in Western Europe would be even more revealing of the social and political assumptions and practices of nineteenth-century liberalism than the epidemic itself" (Evans, 1997, p. 124). By peeling back the surface layers of his initial question, he found a deeper, more interesting problem space to work in.

Framing and reframing the problem space is critical to inquiry in history (Collingwood, 1956, Fischer, 1970; Gaddis, 2002) and the social sciences (Voss et al., 1983). A historian,

political scientist, or economist might stop to ask, *What is this question really about? Who or what is involved here? Are there features of this problem I'm not seeing in the data? Is this the full story? Are there advantages to looking at the problem another way?* Posing questions like these help a historian or social scientist to see beyond surface layers of the problem, beyond how a newspaper or textbook typically represent problems. These questions also help them to move from passive recall (*What do I know about this problem?*) to active inquiry (*What might I need to know about this problem? Where would I find that information?*).

For a budding scientist like my brother or an experienced historian like Richard Evans, formulating good questions is paramount to framing fruitful investigations or inquiries. Likewise, the authors of the College, Career, and Civic Life (C3) Framework recognized the role that questions play in helping students develop "skills that are needed for active and responsible citizenship" and the "21st century workplace" (NCSS, 2013, p. 19). They identified four dimensions of inquiry:

1. "Developing questions and planning inquiries
2. Applying disciplinary concepts and tools;
3. Evaluating sources and using evidence;
4. Communicating conclusions and taking informed action" (NCSS, 2013, p. 12).

The first dimension of the inquiry arc, "developing questions and planning inquiries," explicitly emphasizes the importance of problem framing in history and social studies. While essential, educational researchers, teachers, and social studies curriculum have mostly ignored the question and inquiry framing dimension to focus on the last three dimensions of the inquiry arc. Though researchers, teachers, and social studies curricula often begin with a driving question, they have paid comparatively little attention to how teachers teach or students engage in problem framing.

Related to the second dimension ("applying disciplinary concepts and tools"), researchers have studied students' thinking and instructional interventions on important metahistorical concepts, such as change and continuity (e.g. Blow, 2011), causation (e.g. Lee & Ashby, 2000; Lee & Shemilt, 2009), and historical empathy (e.g. Lee & Ashby, 2001). Related to the third and fourth dimensions, "evaluating sources and using evidence" and "communicating conclusions," researchers have focused on students' thinking and writing about historical sources (e.g., Monte-Sano, 2010, 2011; Reisman, 2012; Wineburg, 1991). In particular, Wineburg's (1991) research on the differences between historians' and students' evidence practices spawned a host of historical thinking and historical literacy interventions (e.g., Britt et al., 2000; Hicks et al., 2004), including a curriculum chartered by Wineburg called Reading Like a Historian (RLH) (SHEG, n.d.). RLH provides teachers class-period long inquiry activities, each furnished with a central question, curated source materials, and graphic organizers to facilitate student thinking and writing. As with similar inquiry resources, the onus of formulating questions and identifying useful sources falls on the curriculum designers rather than the students.

College Board's widely used Advanced Placement (AP) US History exam does not assess or expect students to problem frame or plan an investigation. For example, College Board offered the following sample prompt and documents in the 2020 course guide distributed to teachers (Figure 1).

Figure 1

AP US History Document Based Question Sample Prompt

Prompt: Evaluate the relative importance of different causes for the expanding role of the United States in the world in the period from 1865 to 1910.

- Document 1 Source: Treaty Concerning the Cession of Russian Possessions in North America, 1867.
- Document 2 Source: Josiah Strong, *Our Country: Its Possible Future and Its Present Crisis,* 1885.
- Document 3 Source: Captain Alfred Thayer Mahan, *The Interest of America in Sea Power, Present and Future*, 1897.
- Document 4 Source: Political Cartoon in *The Boston Globe*, 1898.
- Document 5 Source: John Hay, US Secretary of State, The Second Open Door Note, 1900.
- Document 6 Source: Political Cartoon in *Puck,* 1901.
- Document 7 Source: President Theodore Roosevelt, Annual Message to Congress, 1904.

(College Board, 2020, p. 255)

Given this prompt, a historian like Richard Evans might take a day or a week to consider, *What is this problem really about?* However, with limited time to plan and craft their response, students cannot afford to dwell on framing the problem. They must shift quickly from interpreting the question statement to evaluating the provided source evidence to writing their conclusions. Furthermore, like many of AP's history prompts, this prompt includes a specific time span (1865-1910), hindering students from pursuing questions about earlier or later time periods. Finally, College Board's expectation that students' writing incorporate most of the documents discourages students from considering different framings of the problem that are not explicitly implicated by the documents. For instance, none of the documents listed above mention the U.S.'s subjugation of tribal territories in North America. Should these territories not be framed as part of "the world" external to the Unites States? In this activity, and many like it, students are not given the opportunities or supports to frame the problem for themselves.

As Evans (1997) and other historians (e.g., Collingwood, 1956, Fischer, 1970; Gaddis, 2002) have demonstrated, problem framing and reframing is a vital, iterative, and ill-defined

process that gives shape to inquiry. Yet most history and social studies curricula and assessments provide students with well-defined problem spaces to focus students on the intellectual work of evaluating sources and crafting written responses. This dissertation, however, confirms a historiographic stance about the value and necessity of problem framing to ask *what if schools gave students more opportunities to develop problem spaces rich with questions to explore? What would students do?* History and social studies education research has rarely explored such questions or conceptualized students' approaches to problem framing.

Research on "wicked" or "ill-structured" problem-solving in fields like urban planning or policy studies has taken up the issue of problem framing more explicitly (e.g., Fernandes & Simon, 1999; Rittel & Webber, 1973; Simon, 1973; Voss et al., 1983). Like many historical problems, wicked and ill-structured problems in these fields have certain intractable features, such as the existence of multiple stakeholders, high levels of uncertainty, and multiple possible problem framings and solutions (Fernandes & Simon, 1999; Rittel & Webber, 1973; Voss & Wiley, 2006). These are often the characteristics of questions in history and social studies courses *before* teachers and instructional resources, such as source packets or essay planning guides, provide structure. To manage wicked or ill-structured problems, policy experts, urban planners, and social scientists engage in a variety of core problem-solving practices, including defining the problem and establishing the bounds of the problem space (Newell & Simon, 1972; Voss et al., 1983).

This dissertation seeks to build on this scholarship by exploring how a history teacher and high school history students work with ill-structured historical and contemporary problems. In doing so, I sought to identify core problem framing practices and construct a framework teachers and researchers might use. Delineating the core practices of problem framing across the range of

history or social sciences problems is too broad a task for one project. Therefore, I narrow the scope of this dissertation by focusing specifically on ill-structured *causal* problems (e.g., *Why did cholera devastate Hamburg in 1892? Why does government spending cause inflation only some of the time? How might a rise in nationalism impact world peace?).* Causal problems are the heart of many inquiries in history and social studies. These problems also tend to be ill-structured. For example, there is no rule that dictates how far back in time or how far out in space one should trace the causes of any event (Gaddis, 2002). There is also not a rule that dictates to what extent one should focus on agents of change or social structures (Pomper, 1996), nor is there a rule that dictates how one should represent causal relationships (Gaddis, 2002; Hexter, 1971).

With the ultimate goal of devising a framework for studying and supporting students' approaches to framing ill-structured causal problems in history and social studies, I begin by reviewing existing literature on causal reasoning in history and history education in Chapter Two. In Chapter Three, I explore related research on expert approaches to framing ill-structured problems in a variety of fields outside of history. I found these two bodies of research on history and ill-structured problem-solving to be informative in several ways; however, neither explicitly addresses how teachers represent the ill-structured characteristics of causation for students nor how students develop problem spaces in response to ill-structured historical and contemporary problems.

To inform a framework for studying and supporting students' approaches to problem framing, I conducted three exploratory studies. Chapter Four explains the methods of the studies, including their context and the data collection and analysis. Chapter Five details findings from

the first study, a year-long observation of a veteran AP US history teacher named Mr. Owens[1]. The purpose of this study was to investigate how an experienced teacher represents the characteristics of historical causation for his students.

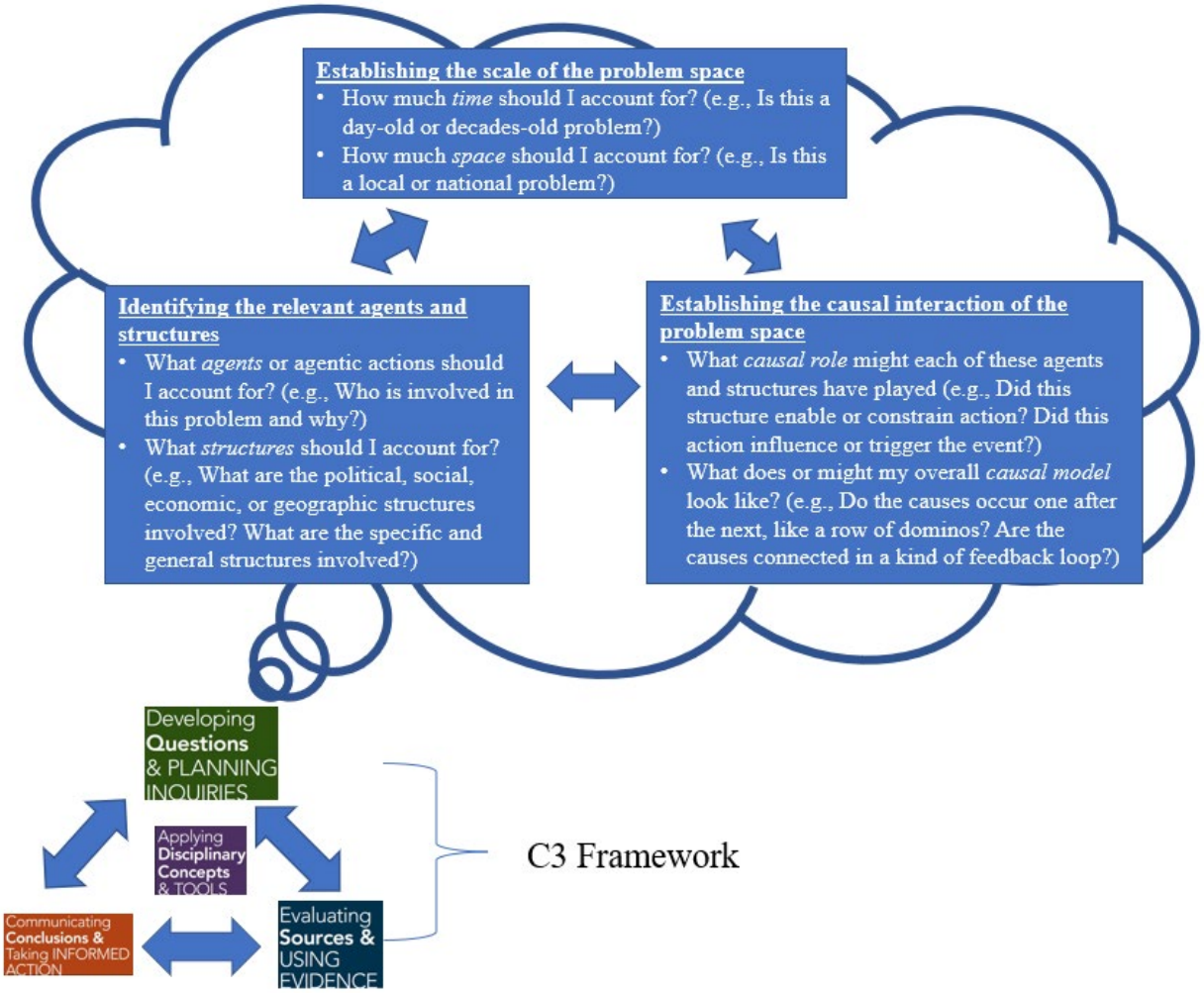
In the second study, which I describe and analyze in Chapter Six, I provided a subset of Mr. Owens' students with an ill-structured, historical causal problem framing task. Unlike traditional document-based inquiry tasks (e.g., RHL, AP), the task in this study prompted students to construct an initial problem space rather than evaluate evidence, write an account, or produce a solution. I report my analysis using three student case studies. In the third study, I provided students with an ill-structured, current event problem framing task. In Chapter Seven, I report my analysis of this study using the same three students. In both analyses, I found that the students framed distinct problem spaces and that there seemed to be patterns in how students framed the scale, agentic and structural content, causal roles, and the complexity of their problem spaces.

Through both a review of the literature and discussion of the exploratory studies, Chapters Two through Seven paint a complex picture of students' approaches to causal reasoning and ill-structured problem framing. In Chapter Eight, I bring together these insights to propose a three-part framework for developing questions and planning causal inquires in history and social studies, essentially unpacking what is embedded in C3's first dimension of the inquiry arc (Figure 2).

[1] All participant names are pseudonyms

Figure 2

A Framework for Causal Problem Framing



Central to the framework are the relationships and tradeoffs between the different dimensions of students' problem spaces. For example, establishing a large-scale problem space may help reveal important political or social structures surrounding the event, but may obscure individual agents (e.g., historical actors, stakeholders) and their complex relationships with institutional structures (e.g., laws, corporations). On the other hand, focusing mostly on individual agents may cause one to overlook important long-term causes and abstract structures (e.g., capitalism, culture). It is

critical then that researchers and teachers understand these tradeoffs when describing or assessing students' problem spaces. Additionally, teaching students to recognize these tradeoffs in their own approaches to problem framing may improve their ability to ask effective questions and develop inquiries.

Chapter II

Problem Framing and Causal Reasoning in History and History Education

This chapter reviews existing literature in history and history education 1) to explain key aspects of causal problem framing in history, 2) to better understand students' reasoning about historical causal problems, and 3) to explore interventions that might support students in framing causal problems in history.

Problem Framing in History

How do historians define or frame their problems? Gaddis (2002) was curious to know what other historians thought. So, he invited famed historian William H. McNeill to a conference and asked him. McNeill explained,

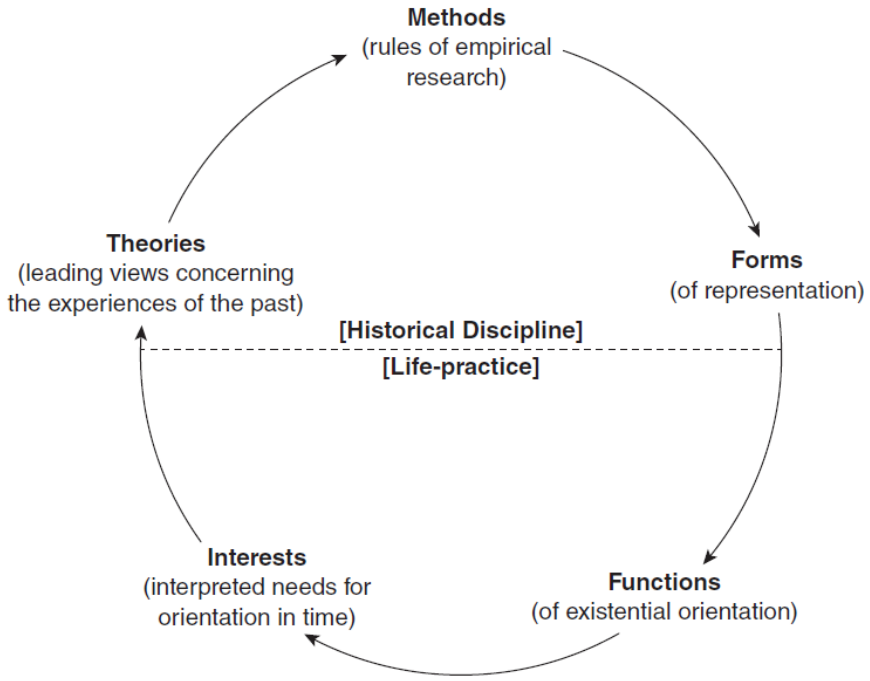
> I get curious about a problem and start reading up on it. What I read causes me to redefine the problem. Redefining the problem causes me to shift the direction of what I'm reading. That in turn further reshapes the problem, which further redirects the reading. I go back and forth like this until it feels right, then I write it up and ship it off to the publisher (Gaddis, 2002, p. 48)

To McNeill and many other historians (e.g., Collingwood, 1956; Evans, 1997; Gaddis, 2002), historical inquiry is an iterative process. Historians come to their questions and conclusions neither solely through induction or deduction, but through abduction—constantly weighing facts and inferences (Collingwood, 1956; Gaddis, 2002). Gaddis (2002) argues that this is often true of the social and natural sciences as well.

What makes historical question framing somewhat distinctive is the institutional norms and informal logic imposed by the discipline (Fisher, 1970). Fischer (1970) argues for several key attributes of "a proper historical question" (p. 38). For instance, a historical question should not be metaphysical, but "resolvable in empirical terms" (p. 38). He also argues that a historical question "should be open-ended, but not wide-open. It should dictate the kinds of facts which will serve to solve a problem, without dictating the solution itself" (p. 38). Historical questions, as McNeill suggests, are also not static, but responsive to the historian's understanding of their facts and sources. This too is influenced by the logic and norms of the discipline. Yet, framing historical questions is not entirely disciplinary or logical. Personal and societal interests also drive historical inquiry. McNeill, for instance, claims that his initial questions are driven by curiosity, highlighting the importance of what Evans (1997) refers to as historians' "aesthetic and interpretative choices" (p. 123). Rüsen's (1990) disciplinary matrix (Figure 3) conceptualizes the relationship between the "historical discipline" (i.e., logic and institutional norms) and the "life-practice" of history (i.e., personal and societal interests).

Figure 3

Rüsen's Disciplinary Matrix



(Megill, 1994, p. 49)

In the matrix, the "historical discipline" comprises shared standards of practice, such as the "rules" governing interpretation of historical evidence and the creation of historical accounts. For instance, Fischer's (1970) ideas about the logic of question framing falls in this realm. In contrast, the "life-practice" realm represents how present-day interests shape historians' inquiries, such as how current events drive historical research agendas.

History education research has taken up different elements of the disciplinary matrix. Several researchers, for instance, studied how students make connections between history and their life in the present (e.g., Boix-Mansilla, 2000; Duquette, 2015; van Boxtel, Grever, & Klein, 2015). Researchers have also focused on students' understanding of the logic of historical

research, such as their use of evidence in historical writing and reasoning (e.g., Reisman, 2012; Wineburg, 1991). However, little attention has been paid to how students frame historical problems. How, for instance, do students draw from personal experiences or interests when framing historical inquiries? How do they use their understanding of historical theories or methodology when formulating questions?

Causal Problems and Causal Reasoning in History

Historians ask a broad variety of questions: *Did X represent a major change? How does event X compare to event Y? How significant was X?* To limit the scope of this dissertation, I focus specifically on causal problems in history. Framing a causal problem or engaging in causal inquiry is far from straightforward. A historian might consider:

- How far back in time or how far out in space should I trace the causes of this event? What might long-term causes tell me? What might short-term causes tell me? Am I going to find the root causes of this event at the local or national level?
- What historical actors and structures best explain why this event occurred?
- How exactly did these causes lead to the event?
- If causes X, Y, and Z were not present, would the event have occurred differently?
- Are there similar events in history that can help explain the causes of *this* event?

These questions reflect historians' reasoning about a number of metahistorical concepts central to framing causal questions: *time, space, agency, structure, causal roles,* and *causal accounts.* In the following sections, I review scholarship in history, historiography, and history education to explain how historians and students reason with and about these concepts. Additionally, I discuss existing interventions designed to help students develop more expert-like causal reasoning skills.

Historians' Reasoning about Time and Space in Framing Causal Problems

In framing a causal problem or constructing a causal account, historians tend to consider causes that vary in temporal and spatial proximity to the outcome they are explaining (e.g., *long-* and *short-term* causes, *proximate* and *distant* causes; Brien, 2013; Gaddis, 2002; Gottschalk, 1950/1963). For example, a historian might identify the assassination of Archduke Franz Ferdinand as a "short-term" cause of WWI and identify European nationalism as a "long-term" cause. Brien (2013) explains that what constitutes a short-term or long-term cause depends on the time-scale of the event itself.

Even if the scale of the actual event is well-defined, historians may establish different size problem spaces to explain the causes of the event. For instance, in *Origins of the Urban Crisis,* Segrue (1996) traces the causes of the 1967 Detroit uprising to racialized, economic inequality in the 1940s, whereas previous historians focused on causes in the 1960s (e.g., Orfield, 1988). One reason for these differing accounts, as Gaddis (2002) points out, "[t]here's no precise rule that tells historians where to stop in tracing the causes of any historical event" (p. 96). Instead, he argues that historians bound their problem space with regards to the "*principle of diminishing relevance*" (Gaddis, 2002, p. 96, emphasis in original: see also Evans, 1997). However, determining what is relevant or irrelevant is itself an ill-structured problem.

In framing the scale of their inquiries, historians have also been influenced by evolving disciplinary and institutional norms. Guldi and Armitage (2014) write that "historians once told arching stories of scale but, nearly forty years ago, many if not most of them stopped doing so" (p. 7). These historians responded to an increasing pressure to have total "command of archives…and an imperative to reconstruct and analyse in ever-finer detail" (p. 8). However, some historians, like David Christian (2005), have bucked this trend by advocating for temporal

and spatial scales that predate the formation of the earth and expand outwards into the galaxy. Such broadly scaled histories can offer different insights into the past.

Scale in Studies of Student Thinking and Instruction in History. Several studies on student thinking take up the issue of scale (e.g., Nersäter, 2018; Voss et al., 1994). This research found that students tend to identify or privilege short-term and proximate causes over long-term and distant causes. In the first part of a two-part study, Voss et al. (1994) asked college student participants to write an essay explaining the causes of the collapse of the Soviet Union. Most participants ignored long-term contexts or conditions, such as the 1917 Soviet Revolution. In the second part of the study, Voss et al. (1994) asked the college student participants to rank a list of given causes of the Soviet collapse in order of significance. In this task, participants gave higher rankings to "the more immediate potential causes with respect to time and place" than they did for "causes that were more remote" (p. 420). In another study, this time of secondary students' explanations of the "Scramble for Africa," Nersäter (2018) found that "few students addressed any such long-term causes for the scramble; they instead focused on the situation surrounding the actual event" (p. 85). Other studies found that students often privilege personal and intentional causes of historical actors—typically short-term and proximate—over structural causes, which are typically more distant in time and space (e.g., Carretero et al., 1994; Carretero et al., 1997; Jaccott et al., 1998). In short, these findings support the idea that students' reasoning about causation tend to work in or construct temporally and spatially narrow problem spaces.

Scholars have suggested and studied several interventions to improve students' thinking about the temporal and spatial nature of causation in ways that might enhance their causal explanations (e.g., Chapman, 2003; Stoel et al., 2017). Grounded in his own teaching, Chapman (2003) has suggested that teachers use graphic organizers that differentiate short-term and long-

term causes. He also designed an allegorical story-based lesson to explicitly teach students fundamental causal concepts. In this lesson, students investigated whether it was a straw or some underlying causes that broke the back of a camel named "Alphonse." The causes in the allegory range from a trigger event ("the straw," p. 48) to longer-term causes, such as the camel's mistreatment and malnutrition. According to Chapman, the interventions helped students think in more complex ways about causation in time. In an intervention study, Stoel et al. (2017), found that the use of a causal allegory, graphic organizers, epistemological prompts, and explicit causal instruction (e.g., instruction about "long term" and "short term" causes) helped students develop more sophisticated causal reasoning strategies. However, the way they reported their data makes it impossible to parse out the effects of these interventions on students' understanding of or approaches to scale. In subsequent chapters, I provide findings about students' framing of scale in more open-ended problem spaces.

Historians' Reasoning about Agency, Structure, and Abstraction in Framing Causal Problems

When framing causal problems, historians' reasoning extends beyond time and space. They also weigh the role of agentic causes against structural conditions (Pomper, 1996), the role of specific causes and more general causes (Gaddis, 2002), and causes from different "structural classifications" (Pomper, 1996, p. 282), such as political causes, economic causes, and social causes.

Historians' Reasoning about Agentic and Structural Causes. Marx (1852/1926) asserted that "Men make their own history, but not just as they please. They… have to work upon circumstances as they find them…" (p. 23). This quote highlights the central challenge of agency in the study of history: reconciling the fact that people (as individuals or groups) had the autonomy to make certain choices while recognizing that structures shaped those choices and

their consequences (Lloyd, 1993). Structures—natural, physical, and social entities that enable and constrain choice—play a critical role in historical accounts. In his book *Power Lines,* Andrew Needham (2014) traced how the development of energy infrastructure in the American Southwest (*a physical structure*) displaced many Navajo from their land. In his seminal work, *The Protestant Ethic,* Weber (1905/2012) posited that Protestant cultural values (*a social structure*) shaped the development of capitalism in Northern Europe.

Compared to work in urban planning or foreign policy (e.g., Carlsnaes, 1992; Healey & Barrett, 1990), historians often interweave historical actors and historical context in ways that imply agent-structure interactions without clearly defining agents and structures (Pomper, 1996). Nevertheless, as Pomper (1996) writes, it is still critical for historians "to determine both the relative causal weight and mutual impact of individual agency and structure" (pp. 281-282).

As with scale, there is no well-articulated rule for reasoning about the significance of or relationship between historical agents and structures—making causal analysis in history an ill-structured task. The difficulty lies in the idea that, as Giddens (1979) argues, "structure is both medium and outcome of the reproduction of practice" (p. 5). In short, agents' choices shape structures, and those structures shape agents' choices (Carlsnaes, 1992; Giddens, 1979). Even identifying an agent or structure can be difficult. For instance, when does a collective agentic action grow large enough to become a social structure? Or, when is it appropriate to ascribe agentic motives to large, heterogeneous entities like "the working class" or the "United States"? Further, historians' language can blur distinctions between agents and structures. As Pomper (1996) notes, historians sometimes "depersonalize" historical actors, "presenting them as personifications of groups or typical products of structural forces" (p. 286). Though this is a critical part of historians' problem framing, it adds to the ill-structured nature of their work.

Historians' Reasoning about Specific and General Causes. Historians' framing of a cause or causal problem may also range from very specific to very general (Gaddis, 2002). A historian, for instance, might explain a phenomenon using a "substantive concept" (p. 15; e.g., fascism, class) that they apply to a wide range of instances across time and space (Lee, 2004). A historian might also identify causes as specific events or conditions (e.g., the torpedoing of the USS Arizona; the price of grain in 1929).

What exactly distinguishes a "general" cause from a "specific" cause has not been well defined in the existing literature. Reappropriating Gaddis' (2002, p. 96, emphasis in original) heuristic of "*diminishing relevance*," I define a general cause as one whose constituent parts someone doing history deems significant to their causal account. For example, if a historian were to include "German aggression" as a cause of World War II, a reader would likely benefit from the inclusion of specific constituent events like the German invasion of Poland. In contrast, a specific cause is one whose constituent parts someone doing history deems as having little, if any, significance to a causal account. For instance, a historian may not see minute details about specific battles in Poland as relevant to their initial inquiry about why World War II began. Ultimately, what a historian considers a "general" or "specific" cause will likely depend on what questions they are trying to answer and the scale of their inquiry.

As with agentic and structural causes, historians also consider general and specific causes when crafting a historical account (Gaddis, 2002). On the one hand, "without generalization, historians would have nothing whatever to say" (Gaddis, 2002, p. 62). Specific causes alone rarely offer a satisfying explanation for a historical development. On the other hand, Gaddis (2002) explains that historians often try to avoid extracting generalizable theories from historical events or developments. Instead, they tend to use general causes to try to make sense of the

function and significance of specific actions or events (Gaddis, 2002). This is why historians, compared to social scientists, rarely use concepts like *class* or *race* outside of the contexts of a specific time or place (Gaddis, 2002). Understanding this balance between general and specific causes can be helpful for reflecting on or evaluating a historical problem space.

Historians' Reasoning about Structural Classifications. Lastly, historians tend to organize their causes along what Pomper (1996) refers to as "structural classifications," such as "economic, political, social, and cultural" (p. 282). Like agency and structure, or specific and general, historians can use these categories to define an individual cause (e.g., an executive order is a *political* cause) or the nature of their problem space (e.g., a *social* history, a *political* history). For instance, a social historian might look at a causal factor like "wealth inequality" in terms of power and social organization, whereas an economic historian might look at "wealth inequality" in terms of standards of living and available resources. As with agency and generalization, historians do not often explicitly name these classifications or frameworks in their accounts. Nevertheless, understanding these classifications is likely critical to framing or interpreting historical problem spaces.

Agentic and Structural Causes in Studies of Student Thinking and Instruction in History. Compared to issues of scale, there is a sizable body of research on how students consider or represent agentic and structural causes. Studies have shown, for instance, that students frequently neglect or misinterpret structural conditions (e.g., Halldén, 1997, 1998; Jacott et al., 1998; Lee & Shemilt, 2009; Reisman, 2009; Voss et al., 1994). As Halldén (1997) explains, historians tend to approach causation "with one foot in the humanities and the other in the social sciences," while students "seem to have both feet in the humanities… leaving out the impersonal structures altogether" (p. 205). For example, a student might fixate on King George

III's decision to tax the colonists as the cause of the American Revolution without considering longer-term social or political developments in the colonies. When students consider historical structures and processes, they often struggle to relate those structures to historical actions (den Heyer, 2012). They might also distill social structures into events (Barton & Levstik, 2004) or imbue social structures with human emotions and agentic intentions (Halldén, 1997, 1998; Jacott et al., 1998; Voss et al., 1994). Furthermore, scholars have found that dominant national narratives and students' ethnic or racial identity may shape how they attribute agency in history. For example, Penuel and Wertsch (1998) found that White university students tended to credit White historical actors for the end of slavery with little mention of Black historical figures. Epstein (1998) found that when discussing the *causes* of slavery, White students often made no mention of causal agency.

Students' struggles with historical agency and structure may affect their civic reasoning and participation. Seixas (2017) argues that, on the one hand,

> [i]nterpreting history as an iron cage sucks the energy from any attempt at action for social change or democratic participation in the present. On the other hand, overestimation of the malleability of the structures we have inherited can lead to doomed utopianisms (p. 601).

Although intuitive, I could find no empirical evidence to show whether or not this is the case for students in practice.

Despite the sizable amount of research on student thinking in this area, I was also unable to find substantive empirical research on relevant instructional interventions to improve students' thinking about agency and structure. A few studies suggest that students may benefit from historical prompts that establish an explicit connection or tension between an agent and the

contexts that surround them (e.g., Henríquez & Ruiz, 2014; Wendell, 2020). Similarly, Reisman's (2009) study suggests providing students with primary source documents "that speak to possible contextual causes" (p. 50) may encourage students to consider more than agentic causes. Additionally, Fertig (2008) promotes teaching about agency through the use of biographies that include critical historical contexts. Barton and Levstik (2004) advocate for activities where students "imagine themselves in the place of people in history" (p. 154). Lastly, Wendell (2020) and Chapman (2003) suggest that using counterfactuals in instruction might help students weigh the significance of agentic actions against social or physical structures. However, few have assessed the proposed interventions empirically.

Specific and General Causes in Studies of Student Thinking and Instruction in History. Much of the same expert-novice research showing students tend to surface and attribute greater significance to agentic and short-term causes has also found that students do the same for specific causes (e.g., Carretero et al., 1994; Jacott et al. 1998; Halldén 1986; Halldén, 1993; Voss et al., 1994). This is unsurprising as short-term, agentic causes tend to also be specific causes. However, by neglecting general causes in history, students may struggle to construct meaningful connections between specific events and structures (Gaddis, 2002).

A few studies address interventions for reasoning about abstract concepts and generalizations in history that could be informative for helping students frame general causes. In an experimental study, Kemp and Sadoski (1991) found that explicit instruction on forming and identifying generalizations led students to use more and higher quality generalizations when writing historical causal accounts. Similarly, Twyman et al. (2006) found that students were better able to apply abstract concepts when those concepts were "explicitly taught" and were "situated within a problem space" (p. 346). Shreiner (2017) found that explicitly teaching

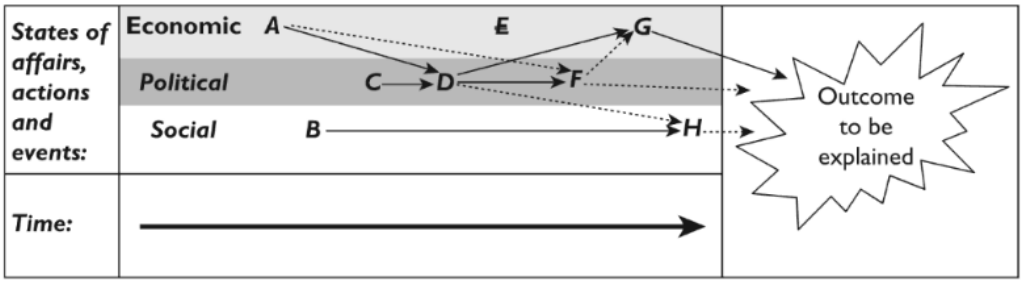
students the concept of "genocide" through a concept formation lesson (Parker, 1988) may have helped students in "weaving causal explanations of historical and contemporary cases of genocide" (p. 372). Finally, Coffin (2006) argues that having students write in the genre of historical argument (instead of a genre like biography) help students write more abstract causal accounts.

Structural Classifications in Studies of Student Thinking and Instruction in History. A few studies categorize students' causes by structural classification. In their study on college students' thinking about the collapse of the Soviet Union, Voss et al. (1994) found that participants most commonly referred to "psychological" and "political" causes, generally ignoring "cultural" causes (pp. 416-417). In a study of students' ideas about how the Nazis rose to power in Germany, Wendell (2018) found that students relied heavily on generalized economic concepts while neglecting other important political or social factors. More studies like these are needed to discuss generalizable patterns in students' thinking.

A few scholars have suggested interventions related to students' uses of structural classifications in causal explanation. Chapman (2017), for instance, advises teachers to support students in using structural classifications (or what he calls "content categories," p. 137) to analyze causal narratives (Figure 4).

Figure 4

A Theoretical Narrative Divided into Three Structural Classifications



(Chapman, 2017, p. 137)

He argues that distinguishing between causes of different structural classifications may help students to see the multi-dimensional nature of causal accounts (Chapman, 2017). However, more research is needed to understand what interventions might improve students' thinking with or about these categories.

Historians' Reasoning about Causal Roles and Accounts in Framing Causal Problems

Whether implicitly or explicitly, historians attribute *causal roles* to causal factors. For example, a historian might describe a cause as *hastening*, *forestalling*, or *enabling* a development. Having considered a number of causes and causal roles, a historian must then decide how to represent these in a *causal account*, often in the form of a book or journal article.

Historians' Reasoning about Causal Roles. Historical epistemologists tend to discuss causes as fulfilling either necessary conditions (i.e., conditions that make an event possible or highly probable) or sufficient conditions (i.e., conditions that are enough to make an event occur) (e.g., Evans, 1997; Tapp, 1952). Coffin (2004, 2006) explains that historians often operationalize these ideas about necessity and sufficiency through conjunctions and verbs like *aid, inspire, allow, accelerate,* and *prevent*. Coffin (2004, 2006) proposed two categories for these linguistic causal relationships: *enabling* and *determining*. She writes that "[e]nabling relations are

expressed through manner conjunctions (e.g., *by, through*) and express the means or manner by which an event or situation came about" whereas "a determining relationship…is expressed through conjunctions of consequence (e.g., *as a result of, because, thus*), purpose (e.g., *in order that, so as to*), and condition (e.g., *as long as, if*)" (p. 271).

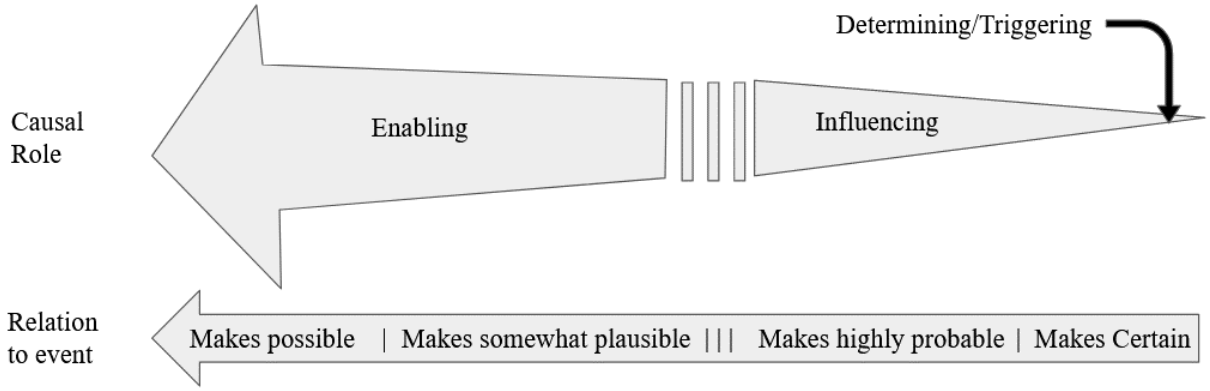
Chapman (2017) provided Coffin's (2004) linguistic categories with conceptual definitions. He defined "enabling causal relationships" as those where "one or more of the elements of a sequence of events or situation shapes actions or states of affairs to make another action or state of affairs possible or probable" (p. 137). For instance, the existence of stocks in U.S. *enabled* the 1929 stock market crash, but it would be strange to say that stocks *caused* the crash. In contrast, Chapman (2017) considers *determining causes* to be those that directly link cause to effect (e.g., Abraham Lincoln died *because* John Wilkes Booth shot him). Chapman (2017) offers the following heuristic to distinguish between enabling and determining causes: "Did X make Y happen as it did, or did X just make Y more likely?" (p. 137). If the former is true, then X is likely a determining cause. If the latter is true, then X is likely an enabling cause. Given that Chapman (2017) was writing for an audience of educators, this heuristic may represent a purposeful oversimplification. Nevertheless, it may be challenging to distinguish between what made an event "likely" and "certain" to happen.

Scholars in other fields, however, use the term *influencing* to identify causes that neither enable nor determine outcomes (e.g., Cheng, 1997; Jonassen & Ionas, 2008). This addition seems significant, and as I will show later, enables me to see greater nuance in students' work. Therefore, I consider *enabling causes* those that make an outcome possible or somewhat plausible and *influencing causes* those that make an outcome mostly or highly probable. As

implied by Figure 5, most historical causes exist somewhere on a spectrum between enabling and influencing.

Figure 5

A Visualization of Three Causal Roles and Their Relationship to an Event



To use the example of the 1929 stock market crash, a historian might cite each of the following as *influencers* of the crash:

- Stock speculation
- Bank insolvency
- Overexpansion of credit
- Low international and domestic consumption

Each of these, to varying degrees, *covary* with the crash, meaning that their onset coincided with the crash within a reasonable period of time. A historian would not say the same about a long-term cause, such as "capitalism," which only made the crash possible or plausible (i.e., served as an *enabling cause*). On the far-right side of the spectrum are *determining* or *triggering causes*. These are causes that lead to the explanandum when all the necessary conditions are present. A historian might argue, for instance, that the initial stock sell-off the week before triggered the big

market crash on "Black Monday." By calling a cause a "*trigger*," a historian sets it apart from the necessary *enabling* or *influencing* conditions of the event.

Identifying causes as *enabling*, *influencing,* or *triggering* also depends on the specific context of the event—highlighting a further ill-structured feature of causal problems in history. For instance, if we were accounting for the causes of a fire, we might consider the existence of oxygen to be an *enabling* cause (albeit one at the far end of *diminishing relevance* to our account). But, as Hart and Honoré (1959/1985) explain,

> If a fire breaks out in a laboratory or in a factory, where special precautions are taken to exclude oxygen during part of an experiment or manufacturing process…there would be no absurdity at all in *such* a case in saying that the presence of oxygen was the cause of the fire. (p. 35)

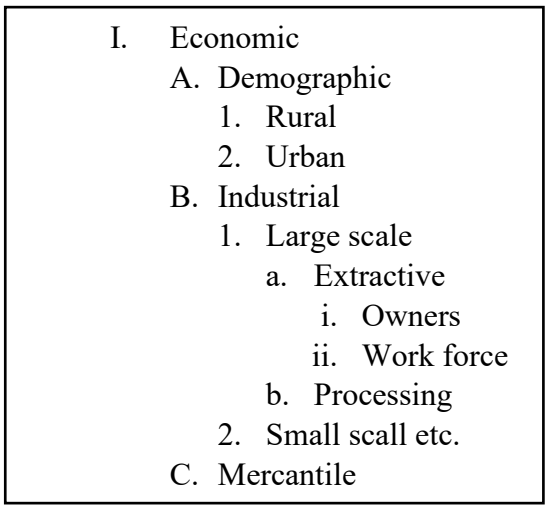
In this scenario, the presence of oxygen is no longer an *enabling* cause. Instead, it is an *influencing* cause that has made a fire highly probable. Therefore, the broader context of the account is necessary for the historian to define any individual causal role.

Historians' Reasoning about Causal Accounts. After considering individual factors and causal roles, the historian represents their conclusions in the form of an account. Done well, causal accounts reflect "the interrelations of times, places, persons, and circumstances" (Hexter, 1971, p. 118). Historians can organize their accounts in many ways and with varying degrees of complexity. For analytical purposes, scholars generally discuss two broad organizing schemes for accounts: *narrative* and *exposition* (Coffin, 2004; Gaddis, 2002; Hexter, 1971; Voss et al., 1994). Narrative is the primary form of historical accounts (Gaddis, 2002); however, historians' narratives often have expository elements and vice versa (Voss & Wiley, 2006), making the distinction between these two types of accounts not as clear cut in practice.

In *narrative,* the primary organizing feature is *time*. Events are related to each other based on their position in a sequence of events. In *exposition*, Coffin (2004) writes, "explanations are not restricted to chronological cause-and-effect chains. Rather, the focus is on more complex, laterally interconnected causal relations" (p. 263). In expository writing, a historian may organize their account into a hierarchical, thematic scheme, what Hexter (1971) refers to as "factor analysis" (p. 112) (Figure 6).

Figure 6

Example of Factor Analysis



(Hexter, 1971, p. 113)

Hexter (1971) argues against this type of accounting in favor of narrative representations, explaining that narrative affords "the chance to sense the force of the togetherness of events" (p. 118).

Causal accounts can range from simple to complex no matter the organizing scheme. For example, a student's narrative account might consist of a single chain of events where one action leads to another (Lee, 2005). Historians, in contrast, are far more likely to weave together

multiple stories of cause and effect (Evans, 1997). To illustrate, Evans (1997) discussed an account he wrote of the 19th-century cholera epidemic in Hamburg (Evans, 1987), where he "presented twelve separate narratives, each piling another layer of causation upon the previous ones and modifying them in the process" (Evans, 1997, p. 124). Through these narratives, he was able to show the relationship between causal factors such as hygiene, pollution, nutrition, and poverty. Likewise, expository accounts can be complex or straightforward. A historian might choose one thematic scheme or many, with multiple or few interconnecting factors.

Lastly, historians might structure their accounts using large-scale theories or frameworks. For example, historian Nayan Shah (2001), in his book *Contagious Divides*, used the sociological theory of "racial formation" to structure his account about why public health attitudes toward Chinese Americans in San Francisco changed from the mid-19th to the mid-20th century. In *Montaillou*, Le Roy Ladurie (1978) structured his historical account using "a whole battery of modern anthropological theories…brought to bear on everyday life" (Evans, 1997, p. 123). At their best, these theories or frameworks can help historians make sense of the complex morass of historical causation. At their worst, they can lead historians to overlook critical historical contexts in favor of more generalizable theories (Gaddis, 2002).

Causal Roles in Studies of Student Thinking and Instruction in History. Students' ideas about the past can have major implications for using or interpreting causal roles. Lee and Shemilt (2009) found, for instance, that many students hold an "undetermined" view of the past "in which things 'just happen'" (p. 43) (e.g., *X happened and then* Y *and then* Z). As a result, these students often fail to consider causal roles at all (Foster et al., 2008; Lee & Shemilt, 2009). On the flipside, novices may hold "a totally determined" (p. 43) view of the past where all causes are determining causes (e.g., X *caused* Y; Y *caused* Z), thereby failing to consider how factors

enabled or *influenced* the possibility or probability of an event (Lee & Shemilt, 2009). In their study of college-aged students, for example, Voss et al. (1994) found that participants frequently referred to economic and political structures "as causes, not contextual or enabling conditions" (p. 419). Lee (2005) also argued that students may inappropriately use *time* to determine causal roles by "fastening on arbitrary cut-off points between long and short instead of understanding the more context-related ways in which we pick 'causes' out from the mass of interconnected antecedents to particular events" (p. 54). Together, these different novice conceptions may hinder students in framing accurate or fruitful relationships between the causes in their historical problems spaces.

A few studies explicitly and implicitly address interventions related to causal roles. For instance, Stoel et al. (2017) found that whole-class discussions about causation may have improved students' identification and understanding of what they refer to as "causal connections" (p. 331). Masterman and Sharples (2002) created a causal mapping tool that their participants could use to draw arrows indicating causal relationships. They found that 84% of students in their study attempted to identify some causal relationships. Though not studied empirically, Seixas and Morton (2013) argue that counterfactuals might help students understand the idea of contingency in historical causation and, therefore, the possibility of different causal roles. Lastly, Coffin (2006) and Woodcock (2005) suggest that teachers might support students' causal reasoning by explicitly teaching causal role language.

Causal Accounts in Studies of Student Thinking and Instruction in History. Research on students' causal accounts suggests that students tend to represent causation either as "a linear chain" or as a series of "discrete entities, acting independently from each other" (Lee, 2005, p. 52). Students also struggle to understand or represent the complex "relationships among

a network of events, processes, and states of affairs" (Lee, 2005, p. 52). In a study of students' large-scale narratives, Foster et al. (2008) characterized students' accounts as more "event-like" than "process-like," as students listed one thing after another without identifying causal relationships (p. 8). In a study of students' use of a causal mapping tool, Masterman and Sharples (2002) found that "pupils had great difficulty linking causes into any coherent structure" (p. 180).

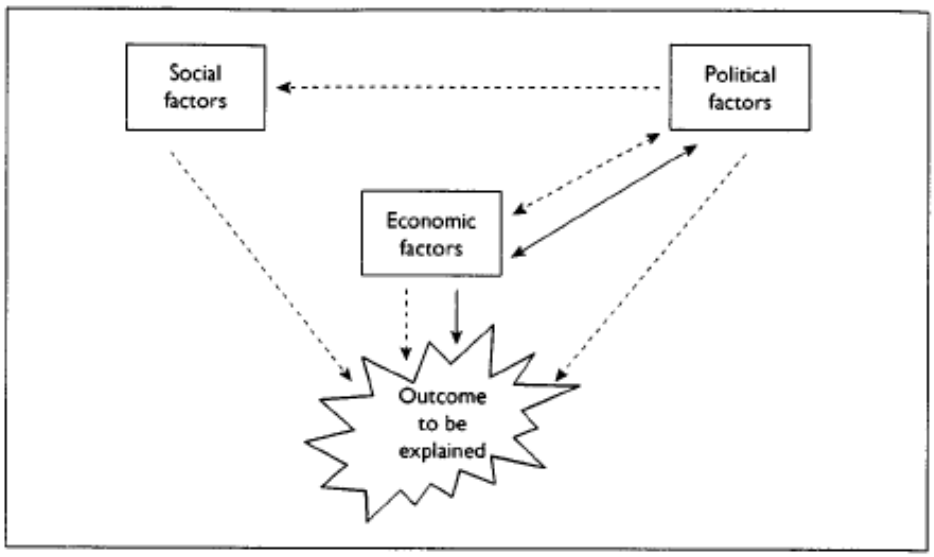
Working with college students, Voss et al. (1994) described participants' causal accounts as either narrative or expository, finding that a little more than half of participants wrote an expository account. Voss et al. (1994) also categorized the complexity of students' causal models as simple, intermediate, and complex, finding that most participants fell in the intermediate category for both types of accounts. In all, they found that although students "felt the need to consider a number of causes and how each led to the collapse [of the Soviet Union]," they mostly failed "to weave these factors into a single, coherent, narrative account" (p. 424). Carretero et al. (1991) conducted a similar study but with secondary students. They found that most 14 to 16-year-olds identified causes and effects but did not organize them in any meaningful way. Students aged 17 to 18, however, were more likely to identify "extensive causal chains" with some able to "establish links between some causal chains and others" (p. 41). Taken as a whole, this body of research suggests that constructing coherent and complex causal accounts can be a particularly challenging task for students of all levels.

Several studies have taken up interventions related to students' causal accounts. For example, some have found that concept mapping tools helped support the development of students' causal accounts (e.g., Horiguchi & Kashihara, 2016; Masterman, 2005; Masterman & Sharples, 2002). Stoel et al.'s (2017) study suggests that students may also benefit from explicit

instruction on multiple elements of causal reasoning, including the identification and discussion of structural causes, second-order concepts, and causal connectors. However, the aggregation of their findings makes it difficult to determine whether these interventions directly impacted what they called students' "explanatory model" (p. 328). Finally, Chapman (2017) suggests that students should practice "replacing chronological with factorial organization" (p. 138) when constructing or analyzing accounts (e.g., Figure 7).

Figure 7

Example of "Factorial Organization"



(Chapman, 2017, p. 138)

This may help students to see events as connected by more than chronology. Overall, interventions that represent the complexity of the interactions among influencing, enabling, and determining causes may enable students to develop or interpret more sophisticated causal accounts.

Additional Reasoning Processes Related to Framing Causal Problems: Counterfactuals, Comparisons, and Change and Continuity Over Time

In the sections above, I described how historians reason about metahistorical concepts, such as time, space, agency, structures, causal roles, and causal accounts. In this section, I describe three reasoning processes that historians often use when reasoning about causation: *considering counterfactuals* (Evans, 1997; Froeyman, 2009)*, making comparisons* (Evans, 1997; van Boxtel and van Drie, 2018), and *thinking about change and continuity over time* (Lee, 2005; Shemilt, 1983).

Counterfactual thinking usually takes the form of a "what if" question, such as *what if President John F. Kennedy had not been assassinated?* (Evans, 1997). Historians might engage in counterfactual thinking to identify a cause, distinguish between necessary and sufficient conditions (Evans, 1997; Froeyman, 2009), or reason about causal roles (Megill, 2007). Although historians commonly employ counterfactuals, many scholars criticize their inclusion in written accounts (e.g., Carr, 1961; Fischer, 1970; cf., Ferguson, 2000).

Historians often make *comparisons* to reason about causes (Evans, 1997). For example, Evans (1997) discusses how comparing the 19th cholera epidemic in Hamburg, Germany, to the unaffected parts of Western Europe enabled him to isolate causal factors specific to Hamburg. While comparisons can help a historian to isolate specific causal mechanisms, they can also help a historian to "identify recurring causal mechanisms" (van Boxtel and van Drie, 2018, p. 153), such as the role of ethnic tension in civil wars. In this sense, a historian might use comparisons to consider the relationship between general and specific causes.

Reasoning about causation also closely connects to identifying *changes* and *continuities over time*. What causes an event to happen at a particular time is usually related to some change

(e.g., a new law, a declaration of war). What historians describe as "context," "conditions," or "structures" are often entities that persisted for some time. For example, in the book *Crabgrass Frontier,* Jackson (1987) distinguishes between the causes of U.S. suburbanization (e.g., federal housing policies) from the longer-term conditions of U.S. suburbanization (e.g., the suburban ideal) by highlighting the change of the former and the continuity of the latter.

Counterfactuals, Comparisons, and Change and Continuity over Time in Studies of Student Thinking and Instruction in History. While historians often write and argue about counterfactuals, studies of students' reasoning with counterfactuals is limited (Wendell, 2020). Voss et al. (1994) observed that only a small fraction of their college student participants used counterfactuals in their causal essays, while those who did tended to write more sophisticated causal accounts. Wendell (2020) noted that students tended to use counterfactuals to reason about historical actors rather than historical structures. Furthermore, Carroll (2018) and Wendell (2020) found that students uses of counterfactuals improved when instruction explicitly included historical comparisons. Although not studied empirically, Chapman (2003) argues that graphic organizers that separate causal factors might facilitate students' thinking with counterfactuals. He reasons that if students can more readily see the different causal factors laid out before them, they might be able to make better predictions of what would happen if certain factors were eliminated or changed.

According to van Boxtel and van Drie (2018), "empirical research on comparative or analogical reasoning in the context of history education is scarce" (p. 153) and "less is known about how to promote reasoning about…comparisons" (p. 168). In one of the few studies about historical comparison, Stearns (2000) found that his college students often simply juxtaposed descriptions of different historical events rather than analyzing or comparing them in a

meaningful way. However, he found that giving students scaffolded homework assignments that broke down the task of comparing into component tasks (e.g., "identification of key features," "assessment of the degree of similarity or difference," p. 432) helped students make more meaningful comparisons. More research is needed to show how students use comparison to construct or evaluate causal problem spaces.

Blow (2011), Lee (2005), and Shemilt (1983) discuss how novices tend to think of continuities as synonymous with "nothing happened" (Blow, 2011, p. 51). This might help to explain why some students neglect to account for structural conditions in causal accounts. Lee (2005) also writes that some novices tend to see changes only as intentional actions and events, neglecting "gradual, unintended changes" (p. 44). Scholars have made several suggestions for developing students' ideas about change and continuity. These include teaching with analytical timelines (Counsell, 2017), analogies (Foster, 2008; Seixas & Morton, 2013), and explicit change and continuity vocabulary (e.g., "evolved," "progressed") (Counsell, 2017; Seixas & Morton, 2013). More research is needed to understand how students identify change and continuity in relation to causal problems and what interventions might support them in this process.

Discussion

For historians, framing a causal problem space implicates multiple metahistorical concepts such as *time, space, agency, structure, abstraction, causal roles,* and *causal accounts* as well as reasoning processes such as *counterfactual thinking, making comparisons,* and *identifying change and continuity over time.* Different historians, however, could take up a similar causal question, yet develop very different problem spaces given their uses of these concepts and reasoning processes. Historians' uses of these concepts and reasoning process also

depend, in part, on their interests, purposes, interpretations of their sources, understandings of the norms and logic of the discipline, and the contexts within which they're conducting their investigations. Thus, for historians, framing a causal problem is an *ill-structured* and complex, cognitive task—a task that scholars of historical thinking have illuminated.

In contrast, research on how students take up the task of defining a causal problem is scarce. Existing literature on causal reasoning, though extremely useful, begged the question of problem framing in two important ways. First, much of this research has relied on data drawn from work on well-defined tasks, typical of the assessments and curricular resources I discussed above. That is, the research began with a predetermined problem space or task. This enabled the research to isolate for analytical purposes distinctive elements of students' causal reasoning (e.g., Carretero, 1997; Coffin, 2004; Jacott et al., 1998; Stoel et al., 2015, 2017; Voss et al. 1994). For example, several of these studies use as their data participants' written responses or rank-choice selections (e.g., Carretero et al., 1997; Coffin, 2004; Stoel et al., 2015, 2017; Voss, et al., 1994). These kinds of data do not intend to capture students' exploratory thinking in deciding how to frame an ill-structured causal problem. While not a criticism of these studies, there remains a gap in our understanding about students' historical thinking related to the first dimension of the C3 Framework, "developing questions and planning inquiries" (NCSS, 2013, p. 12). Secondly, it is difficult to see from these studies how different aspects of causal reasoning (e.g., consideration of agency, uses of long-term causes) are interrelated in students' thinking. In short, the studies on student thinking in history leave much unanswered about how students frame historical problems and establish problem spaces both in and outside of school.

To try to understand both how students might work in such ill-defined spaces and to shed more light on experts' thinking, I turned to research on problem-solving outside the field of

history or history education. Scholarship in this area has paid more explicit attention to how beginners and skilled thinkers construct and structure problem spaces when taking up wicked or ill-structured problems. I speculated that these research studies would help me investigate students' thinking in history, speculations I discuss in the next chapter.

Chapter III

Causal Reasoning and Problem Framing in Wicked and Ill-Structured Problem-Solving

Simon (1973) argued that all problems exist on a spectrum from "well-structured" (p. 185) to "ill-structured" (p. 186). Scholars characterize well-structured problems by several features, such as the existence of a well-defined goal, definite ways to test solutions, a clear set of problem constraints, and a finite amount of information needed to solve the problem (Chi & Glaser, 1985; Jonassen, 1997; Reed, 2016; Simon, 1973). Ill-structured problems, in contrast, lack most or all these characteristics. Scholars argue that most policy and design problems are ill-structured problems (Reed, 2016; Rittel and Webber, 1973; Voss et al., 1983), whereas most puzzle games, such as Rubik's Cube, are well-structured problems (Reed, 2016). The same year Simon (1973) conceptualized a continuum for the structure of problems, Rittel and Webber (1973) identified policy and planning problems as "wicked problems" (p. 160), distinguishing them from the "tame" problems "that scientists and engineers have usually focused upon" (p. 160). Their characterization of wicked and tame problems corresponds with how scholars' characterize ill-structured and well-structured problems (Chi & Glaser, 1985; Jonassen, 1997; Reed, 2016; Simon, 1973; Voss et al., 1983). Therefore, I use "wicked" and "ill-structured" interchangeably.

Historiographers or scholars of historical cognition rarely reference work on ill-structured problems (cf., Voss & Wiley, 2006) or, as I argued in the previous chapter, rarely study novices thinking in this space. However, historical problems are often ill-structured in similar ways as policy problems. Historical problems, for example, typically lack objective solutions while

implicating an indefinite body of information (Voss & Wiley, 2006). Consequently, I speculated that research on wicked or ill-structured problem-solving might add value, complexity, and nuance to historiographers' and education scholars' conception of historical causal reasoning. And I wagered that this work, emerging out of the policy domain and not the history discipline, might help me see more clearly teachers' and students' work on problem framing in history and eventually determine supports to help students frame ill-structured problems. Exploring the similarities in the ways scholarship has characterized historical problems and "ill-structured" or "wicked problems" promises to extend our thinking about developing questions and planning disciplined inquiries in both historical and contemporary problems. Likewise, attending to the conceptual differences in these fields might provide some cautions in applying wicked problem scholarship to historical research and history education.

The structure of this chapter is similar to the previous chapter. First, I draw from problem-solving theory and research to identify critical aspects of causal problem framing. I then review relevant scholarship on students' thinking and interventions to support students' problem framing. I also explore the differences between historical and contemporary problems discussed in this scholarship.

Causal Problems in Wicked and Ill-Structured Problem-Solving Research

Most of what we know about how historians reasoning about causation comes from historiography and philosophy (e.g., Carr, 1961; Evans, 1997; Gaddis, 2002) rather than cognitive studies. In contrast, much of what we know about how experts in fields such as urban planning or public policy approach causal problems comes from cognitive studies, often analyzing experts' responses to an ill-structured problem statement (e.g., Fernandes & Simon,

1999; Jones & Read, 2005; Voss et al., 1983). For example, Voss et al. (1983) studied how policy experts responded to the following prompt:

> Suppose you were the Minister of Agriculture in the Soviet Union and assume that crop productivity has been low over the past several years. You have the responsibility to increase crop production. How would you go about solving this problem? (p. 174).

Others have given similar prompts about foreign policy conflicts (Jones & Read, 2005), instructional design decisions (Ertmer et al., 2008), traffic jams (Jacobson, 2001), and food insecurity (Fernandes & Simon, 1999).

These types of studies have shown important similarities in how experts approach ill-structured problems across a range of disciplines. Experts typically spend more time than novices interpreting the problem statement (Jonassen, 1997; Voss et al., 1983). They establish an initially wide problem space that then narrow as they approach a solution (Ertmer et al., 2008; Voss et al., 1983). They try to account for the complex ways that agents and structures interact (Grohs et al., 2018; Jones & Read, 2005; Voss et al., 1983). They develop abstract representations of the problem (Fernandes & Simon, 1999; Voss et al., 1983). They represent causation using appropriate causal models (Jonassen & Ionas, 2008; Meadows, 2008). Additionally, they use certain heuristics and strategies, such as engaging in counterfactual thinking (Kahneman, 1995; Roese, 1999). In the following subsections, I elaborate on these practices and their relationship to causal problem framing.

Representing Ill-Structured Problems and Establishing an Appropriate Problem Space

One of the first steps in solving any problem is establishing a "problem space," which Newell and Simon (1972) define as "the space that is generated by starting with a set of initial objects and working outwards from these to other objects that can be reached from them, without imposing any particular direction on the search" (p. 428). For an ill-structured policy problem, this may include the:

1. "information known or potentially available to the solver that may be useful in solving the problem," including goals, subgoals, and "possible states of the problem that may occur…",
2. "operators which enable the individual to move from state to state…", and
3. "solver's knowledge of the constraints under which a problem is to be solved" (Voss et al., 1983, p. 167).

Like a historian, an expert problem solver will establish an initial problem space which may expand or contract as they work through the problem and encounter new information (Simon, 1973). For example, a policymaker may initially frame the issue of food insecurity as a problem of crop production but may later consider it as a subproblem of more endemic problems like political and economic instability. As with historical problems, there is no rule for establishing the bounds of the problem space because, as Rittel and Webber (1973) explain, "there are no ends to the causal chains that link interacting open systems" (p. 162). Therefore, one "terminates work on a wicked problem, not for reasons inherent in the 'logic' of the problem," but "for considerations that are external to the problem," (p. 162) such as funding or time.

The problem space also includes the solver's representation of the problem, or, roughly, their "interpretation of the problem" (Voss et al., 1983, p. 167). When the problem is well-

defined and straightforward, a solver's representation tends to hew close to the problem statement and thus, the problem space remains relatively narrow. Take, for instance, the question: *what is a winning strategy in tic-tac-toe?* There is only one way to interpret this problem statement. Given the limited number of legal moves available in the game, there are only a small set of problem states, operators, and constraints. *How should the government respond to the increasing number of wildfires in California?* is a far more ill-structured problem. There are multiple ways to interpret this problem. Consider, for instance, how a conservationist, a rural mayor, a climatologist, and a local tribal leader might all interpret this problem. As a result, Jonassen (1997) explains, "selecting a problem space for ill-structured problems necessarily involves identifying alternative views or perspectives on the problem" (p. 80). This is something historians may also do but perhaps not as explicitly.

As with historians, the causes identified by problem solvers can exist at a wide range of temporal and spatial scales. In the case of wildfires, one might consider issues such as climate change, exurban sprawl, faulty power lines, forest mismanagement, fire suppression, and zoning laws. And one might strive to include all the possible solutions and constraints that might stem from those causes. In general, historians tend not to be as explicit as experts in other ill-structured fields when it comes to framing the scale of their problem spaces. Nevertheless, conscious attention to scale is critical to addressing both historical problems (Christian, 2005; Guldi & Armitage, 2014) and contemporary problems (Balint et al., 2011; Voss et al., 1983). Suppose a solver interprets a problem too narrowly or fails to consider critical information in their problem space. In that case, they may "misinterpret what the goal of solving the problem is or miss the whole picture of the problem" (Hung, 2016, p. 2). On the flip side, if a solver interprets a problem too broadly or has too congested a problem space, he or she may struggle to

consider any real solutions (e.g., "analysis paralysis") (Conklin, 2006). As discussed above, similar issues arise in historians' consideration of the appropriateness of different scales of analysis.

Problem Representation and Problem Spaces in Studies of Novice Thinking and Instruction in Ill-Structured Fields. Compared to experts, novices struggle to construct adequate and relevant problem spaces. They are less likely to use domain knowledge to expand out from what is provided in the problem statement (Chi et al., 1981; Voss et al., 1983) or question whether further knowledge is needed (Voss & Post, 1988). As a result, they tend to construct smaller problem spaces, often neglecting key conditions and stakeholders (Voss et al. 1983) and, in some cases, may include irrelevant information in their problem spaces (Hung et al., 2013). Novices also tend to focus on proximate factors, neglecting more distant ones (Grotzer & Basca, 2003; Grotzer et al., 2015). All of this may result, in part, from the fact that novices tend to move to generate solutions quicker than experts, spending less time interpreting the problem or developing an initial problem space (Ge & Land, 2004; Rowland, 1992; Voss et al., 1983, 1991). These findings suggest that no matter the type of problem, students may benefit from instruction or supports that push them to consider broader problems spaces or spend more time reflecting on their problem spaces.

Researchers propose several ways teachers can help students to expand or better define the scale of their problem spaces. The results of Hung et al.'s (2013) study suggest that including more context in the problem statement may help students refine their search for new information and help them to remove irrelevant information from their problem spaces. Furthermore, Zydney (2008) found that open-ended prompts in environmental problem-solving helped students generate more questions during problem representation, which may lead them to consider more

factors related to the problem. It seems plausible that history or social science teachers could use similar prompts or scaffolds to push students to ask more questions when conducting inquiry, thereby broadening their problem spaces.

Reasoning about Agent-Structure Interaction and Abstraction in Ill-Structured Problems

As with historians, problem solvers tend to populate their problem spaces with agentic and structural factors (Jonassen, 1997; Voss et al., 1983), factors that vary in degree of abstraction (Jonassen, 1997; Voss et al., 1983), and factors that represent one or more structural classifications (e.g., political, economic, social; Grohs, 2018). Consideration of these elements is essential for determining what stakeholders are involved and what the problem is about (Jonassen, 1997).

Framing Agentic and Structural Causes in Ill-structure Problems. The complex and emergent interaction of agents and structures often makes an ill-structured problem *ill-structured* (Grohs et al., 2018). The same is true for explaining complex historical events, although historians rarely use terms like "agent," "structure," or "emergence." To come to an adequate solution to a problem, a solver must consider a range of stakeholders with differing perspectives and the structural constraints that influence those stakeholders (Jonassen, 1997). For example, in the problem of California wildfires, stakeholders might include rural landowners, the U.S. Forest Service, local conservation groups, native tribes, and homeowners' associations. These agents' priorities and means of action intertwine with existing structures that might include the lack of affordable urban housing, the mandates of the U.S. Forest Service, and conservation legislation. Unlike in history, there is always uncertainty about the outcomes that may arise from complex interactions between agents and structures. Nevertheless, historians' and students' explanations

of the past may benefit from a greater focus on the complex, emergent nature of past agentic-structural interactions.

Framing Abstract Concepts in Ill-Structured Problems. A solver may struggle to consider all the specific causal factors connected to an ill-structured problem, given the complexity of such problems. Like historians, policy experts manage this complexity by subsuming many specific facts into more general or abstract causal forces (Voss et al., 1983). For instance, Voss et al. (1983) conducted a study on expert and novice approaches to addressing the problem of low-crop production in the Soviet Union. They found that "the expert sees [factors such as] the lack of fertilizer, lack of repair parts, lack of infrastructure, etc. as elements related to a more abstract concept, lack of capital investment" (p. 206). Problem solvers use these abstract concepts to arrive at the central issues of the problem. If a solver only focuses on the literal or concrete characteristics of the problem, they might only be able to address subproblems rather than the core problems (Voss et al., 1983). For a historian, focusing too heavily on specific causes may make it difficult to make claims about historical significance (Gaddis, 2002).

Framing Structural Classifications in Ill-Structured Problems. Like a historian, a problem solver might consider social, cultural, economic, ecological, or political contexts (Grohs et al., 2018). Factors from these different classifications will likely interact in complex ways in an ill-structured problem. For instance, the question of how to safely introduce self-driving cars into a city will run across a range of interwoven political issues (e.g., existing regulations), cultural issues (e.g., how people use the streets), and economic issues (e.g., demand for public transportation) (Zakharenko, 2016). A more conscious focus on structural classifications may help a problem solver develop a more robust problem space or a historian to provide a more comprehensive historical explanation.

Agentic and Structural Causes in Studies of Student Thinking and Instruction in Ill-Structured Fields. Research suggests that students often struggle to grasp or account for the *emergent* properties of agents operating within systems or structures. Compared to experts, novices tend to believe complex systems are controlled by some central agent or institution (Jacobson, 2001; Jones & Read, 2005; Yoon, 2008). As a result, they might try to identify a causal agent where none exists (Chi, 2005). Moreover, they tend to prefer explanations that include an apparent causal agent (Sinatra et al., 2008). Such findings might also be informative for interpreting students' historical reasoning. For example, students' tendencies to focus on agents in history may reflect students' epistemological ideas about the degree to which events in the past were the product of controlled systems versus emergent systems.

To help students better understand and represent the emergent property of agents in science problems, Resnick and Wilensky (1998) propose giving students "opportunities to design decentralized systems" (p. 3), often using dynamic modeling software (e.g., StarLogo). Such interventions are rarely used in history but may be useful for helping students to explain complex historical phenomena with multiple historical actors.

Specific and General Causes in Studies of Student Thinking and Instruction in Ill-Structured Fields. Compared to experts, novices seem to be less likely to surface or give significant weight to more abstract concepts. For example, in a study about how novices respond to real-world, ill-structured economics problems, Voss et al. (1986) found that "factors named by college educated individuals, and especially by those with formal economics training, were more abstract than those stated by individuals without a college education" (p. 279). This may be a reflection of how students interpret the initial problem. For example, novices tend to focus on the literal features of the problem statement rather than generalize about the problem (Lamberti &

Newsome, 1989; Reimann & Chi, 1989). Additionally, Voss et al. (1983) found that students often address specific subproblems without developing a more general representation of the problem. These findings suggest that researchers in history education may benefit from looking at whether students use specific or general causes in their explanations and how abstractly they frame the problem.

Not many studies address interventions related to specific and general causes in ill-structures problems. Writing mostly about science problems, Resnick (1994) and Resnick and Wilensky (1998) have suggested that dynamic modeling software might help students induce abstract ideas about causation from more specific instances. Again, history education literature is mostly mute on this kind of software, but it may help students see more general causal patterns in history.

Structural Classification in Studies of Student Thinking and Instruction in Ill-Structured Fields. Research on students' thinking within or between structural classifications is scarce. However, because students tend to construct smaller problem spaces than experts (Voss et al., 1983), we might assume they also tend to consider factors from fewer structural classifications. There also only seem to be a handful of studies that mention interventions related to structural classifications. Zydney (2008), for instance, found that the use of an organization tool for problem representation helped students to account for economic, political, and social aspects of the ill-structured problem of pollution. Given the importance of structural classifications to establishing or interpreting a problem space, researchers and instructional designers might devote more attention to the subject.

Framing the Causal Interaction of Ill-Structured Problems

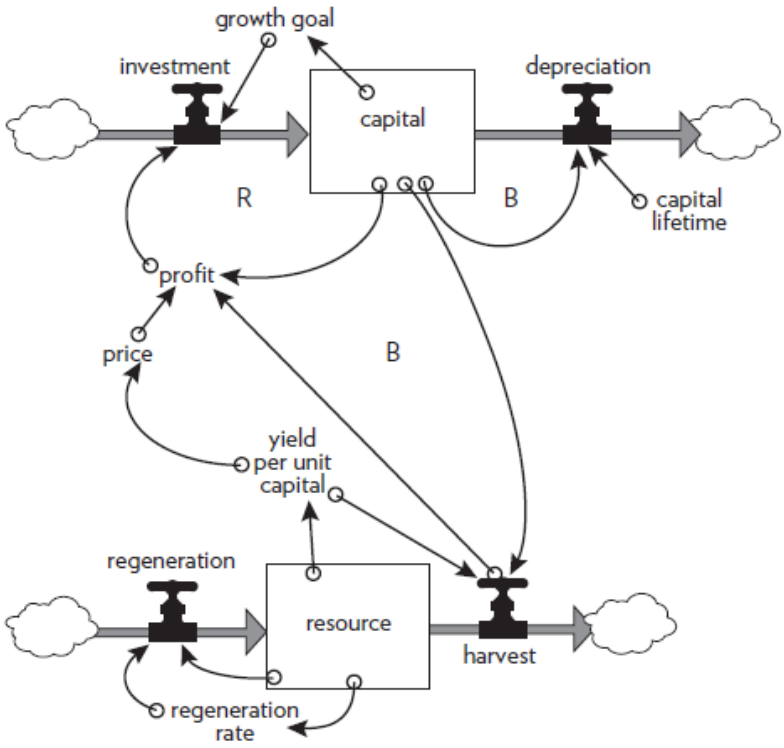
Compared to historiographic literature, scholarship on ill-structured problem-solving provides a more nuanced picture of how problem solvers represent individual or systems-level relationships between causal factors. Surfacing this nuance may help researchers to describe effectively historians' and students' approaches to making causal connections.

Causal Mechanisms in Ill-Structured Problem Literature. As in history, we might distinguish between individual causal roles (or causal mechanisms) and the overall causal model. Regarding the former, Jonassen and Ionas (2008) differentiate between "enabling" (less direct) and "influencing" (more direct) causal mechanisms (p. 299). Jonassen's and Ionas' (2008) conceptualization shares some similarities to Chapman's (2017) and Coffin's (2004) distinction between enabling and determining historical causal roles. Jonassen and Ionas (2008) go a bit further, however, highlighting other defining features of causal relationships, such as direction (e.g., positive or negative effect), valency (i.e., the strength of the relationship), probability, duration, and temporality (e.g., immediate or delayed effect). Applied to history, these terms could enhance researchers' ability to describe historians or students' uses of causal roles.

Causal Modeling in Ill-Structured Problem Literature. Perhaps the more salient feature of ill-structured problem-solving is the framing of a *causal model*—the complex interconnections of multiple and often challenging to predict causes and effects (Jonassen & Ionas, 2008). As described above, history education researchers and historiographers distinguish between narrative and expository representations of causal models. In contrast, problem-solving literature identifies many methods problem solvers use to represent causal models. A solver might, for instance, construct a systems diagram to depict causality in a complex system (e.g., Figure 8).

Figure 8

An Illustrative Example of a Systems Model, Depicting the Fishing Industry



(Meadows, 2008, p. 67)

In this particular diagram, Meadows (2008) depicts a fishing economy with multiple feedback loops involving capital (e.g., fishing boat technology), fish regeneration, price, and so on. As the solver considers more variables, their system diagram becomes more complex and unpredictable.

Several studies have shown that policy experts sometimes construct multicausal narratives to situate complex problems in time, space, and context (e.g., Jones & Read, 2005; Neustadt & May, 1988; Shreiner, 2014; Voss et al., 1983; Yetiv, 2011). For example, Jones and Read (2005) found that policy experts used causal narratives to explain political issues like the Israeli–Palestinian conflict. A "typical expert" in their study,

> …would start with the earliest historical aspects of the situation and describe how one event led to another, typically through an extensive use of causal reasoning, tying the present events as well as the expected future events to the overall causal analysis (pp. 74-75).

Problem solvers may opt to use a narrative representation especially if time is an important aspect of causation. However, using narrative may make it difficult to represent non-linear elements of a causal model, such as feedback loops.

Overall, problem-solving research offers additional methods for representing causes that historians may find useful in constructing their problem spaces. These different representation methods may also help researchers better interpret the complex ways historians and students frame causal interaction.

Causal Roles and Causal Modeling in Studies of Student Thinking and Instruction in Ill-Structured Fields. There are several potential challenges facing students in reasoning about "causal roles" in complex systems. Students tend to overlook indirect causal relationships (Grotzer & Basca, 2003; Grotzer et al., 2015). They also tend to assume proportionate causal effects, failing to account for small-scale causes that have large effects (i.e., "the butterfly effect") (Casti, 1994). Additionally, they tend to see causes as deterministic rather than probabilistic (Jacobson, 2001; Wilkerson-Jerde & Wilensky, 2015; Yoon, 2008). This work suggests that students might struggle to see the variety of ways causes can operate in a complex system.

Furthermore, students' causal models tend to be more reductive (Chi, 2005; Jacobson, 2001) and less interconnected (Eseryel, 2006; Hmelo-Silver, 2007). They also struggle to describe nonlinear or cyclical systems (e.g., Eilam, 2012; Jacobson, 2001; Jordan et al., 2014;

Yoon, 2008), opting instead to narrate causality linearly (Chi, 2005; Chi et al., 2012). In many ways, these findings reflect the linear nature of students' causal explanations in history. Seeing causal inquiry in history as akin to investigating multiple complex systems may enable researchers to describe the nuance of students historical causal models.

Scholars have suggested several instructional interventions that might help students overcome the challenges of representing complex causal relationships. For example, Grotzer and Basca (2003) found that explicit instruction on different types of causal organizations ("domino," "cyclic," and "mutual causality," p. 16) helped students deepen their understanding of complex systems. Similarly, findings from Jacobson's (2001) expert-novice study suggests that students might benefit from learning generalizable "complex system concepts" such as "homeostasis" (p. 42). Jonassen (2003) argues that creating semantic (concept) maps may "help in organizing learners' knowledge by integrating information into a progressively more complex conceptual framework" (p. 372). Hwang et al. (2014) also found that concept mapping helped reduce the heavy cognitive load associated with representing complex problems.

Scholars have also found that dynamic modeling software, simulations, and virtual worlds can help students develop more nuanced understandings and representations of complex systems. Metcalf et al. (2000), for instance, found that their systems modeling tool (Model It!) "helped [students] make the transition from novice representations to more expert like ones" (p. 98). Resnick and Wilensky (1998) found that "role playing activities" can help students "develop better intuitions on how complex phenomena can arise from simple interactions, and predictable patterns from random events" (p. 154). Lastly, Grotzer et al. (2013) found that using the virtual world called EcoMOVE helped students better understand the complex causal dynamics of an ecosystem. In general, history education scholars rarely suggest or study these types of

interventions. However, it is plausible that they may support students in constructing or describing more intricate causal accounts in history.

Additional Reasoning Processes Related to Framing Ill-Structured Causal Problems: Counterfactuals and Comparisons

Like historians, problem solvers may also consider counterfactuals and make comparisons when responding to an ill-structured problem. For example, decision-makers may use *counterfactuals* to determine the most appropriate course of action (Kahneman, 1995; Roese, 1999). Holyoak and Thagard (1996) also found that experts commonly make *comparisons* when engaging in creative problem-solving. Additionally, studies have found that policymakers engage in comparative thinking to manage some of the complexities and uncertainties of policy problems (Breuning, 2007; Houghton, 1998a; Houghton, 1998b; Janis, 1989; Khong, 1992) or to assess the role of stakeholders, evaluate stakes, and define the nature of the problem (Ghilani et al., 2017; Khong, 1992).

Comparisons and Counterfactuals in Studies of Student Thinking and Instruction in Ill-Structured Fields. There is limited research on how students use comparisons or counterfactuals to frame ill-structured problems. Research on problem-solving has found that, compared to experts, novices are more likely to surface superficial comparisons or analogies when attempting to solve problems (Gick, 1986). Even when researchers provide students with a relevant analogy, students do not often spontaneously apply the analogy (Gick & Holyoak, 1980, 1983). Furthermore, in creative problem-solving tasks, analogies may even stifle innovation (Smith et al., 1993; Ward et al., 2004). As for students' reasoning about counterfactuals concerning causation, there appears to be no existing research. Nevertheless, centering the use of

various reasoning strategies for problem framing may help students in history and other disciplines think more critically about the nature of their problem spaces.

Key Conceptual Differences Between Ill-Structured Historical and Contemporary Problems

Research on ill-structured problem-solving can provide new ways of thinking about historical problems and approaches to history and social studies education and research. There are, however, key conceptual differences between historical and contemporary problems that may constrain some of the ways that problem-solving research and instruction can be applied to history education research and instruction.

Goals

Historians and problem solvers often attempt to explain *why* something has occurred or continues to occur. For historians, this may be the objective of their inquiry. For problem solvers, however, establishing past causality is just one part of framing the initial state of the problem. The solver must then consider actions to advance closer to a solution (e.g., "what would happen if I implemented solution X").

Additionally, problem solvers seldom dwell on causes that do not help to advance a solution. For instance, a solver might pay more attention to structures within their locus of control than immutable structures. Because of this, teachers' and researchers' methods of evaluating students' thinking regarding contemporary or future-oriented problems may not always apply to historical problems. Nevertheless, for both types of problems, students may benefit from having the time and support to clarify their goal state (e.g., providing a comprehensive account of an event, proposing a practical policy).

Dynamicity

Relatedly, solving an ill-structured problem often entails understanding the multiple ways one or more dynamic systems operate or could operate. Historians, usually seeking to explain one particular outcome, are often less concerned with representing the dynamicity of a system than they are with explaining why a system operated a particular way in a particular time and place. As a result, historians often represent causality in a chronological narrative, whereas a problem solver might opt for a time-agnostic representation like a systems diagram (e.g., Meadows, 2008). Therefore, it may be inappropriate to expect students to use certain types of causal model representations in history. Still, history students may benefit from learning about some of the complex ideas that are often a part of these representations (e.g., cyclical causality, mutual causality).

Evidence

In general, those in ill-structured fields outside of history tend to have access to a broader variety of ways of gathering evidence for causal claims than historians do. Other than oral history interviews, historians primarily rely on an existing historical record to make claims (e.g., shipping logs, diaries, correspondences). In contrast, problem solvers might conduct surveys or design intervention studies to determine causal relationships. Even so, hypothesizing about what evidence is needed is an important part of establishing the problem space for any problem. More research and instructional attention on this subject would likely be valuable.

Discussion

Historians, policymakers, business leaders and designers all deal with ill-structured problems. These problems require careful consideration of scale (Gaddis, 2002; Voss et al., 1983). There are often affordances and constraints for focusing on agents or structures, or for

focusing on different kinds of causal structures (e.g., general, specific, economic, social, political) (Carlsnaes, 1992; Pomper, 1996). Different representations of causal accounts or causal models can reveal important characteristics of causal systems while obscuring others (Hexter, 1971; Meadows, 2008). When making decisions about framing these different aspects of causal problems, historians and problem-solving experts draw on a range of experiences, disciplinary knowledge, normative ideals, and even aesthetic preferences (Evans, 1997; Jonassen, 1997). For all these reasons, ill-structured or wicked problems frequently generate disagreement—even among experts in the same field.

The theory and research presented in this and the previous chapter serve as a useful starting point for conceptualizing ill-structured causal problem framing in history and social studies education and tools and methods that might support that type of thinking. However, history and social studies teachers and researchers may find it difficult to translate this complicated and diffuse body of literature, as it stands, into effective instructional interventions or assessments. Indeed, much of the research on student thinking in Chapter Two is about how students construct causal explanations in response to relatively well-defined causal tasks, but not necessarily how they frame ill-structured causal problem spaces. Literature reviewed in this chapter explored how students reason about ill-structured problems, including causal problems.

As rich as the literature is, however, a few substantive and related question remain. How do teachers represent problem framing? And how do students use their knowledge of historical or civic reasoning to frame ill-structured causal problems? What kind of thinking do they do when encouraged to think seriously about a historical or contemporary problem and plan an investigation rather, as is most often the case, jump into solving it? And, how might teachers or

curricula support their students in framing causal problems and planning investigations into causation? The remainder of this dissertation turns to exploring these under-studied issues.

Chapter IV

Methods

This chapter discusses the methods for three exploratory studies. The first was a year-long, qualitative case study (Yin, 2008) of an experienced AP US History teacher named Mr. Owens. Many scholars have used case studies to investigate instructional approaches in history and social studies (e.g., Brooks, 2014; Saye & Brush, 2006; Wills, 2011). As in these studies, I do not purport my teacher-participant's practices to be representative of teaching more broadly. Rather, focusing on one "case" enabled me to highlight the conceptual nuance both explicit and implicit in his relatively innovative instruction.

For the second and third studies, I explored how several of Mr. Owens' students responded to an ill-structured historical and contemporary problem framing task. Discussed below, I modified a series of causal reasoning tasks used in previous research (e.g., Carretero, 1991; Voss et al., 1994) to focus students on the task of problem framing rather than generating causal explanations. In the analysis, I present three distinct cases of student problem framing. Other studies have used individual students as cases to show more complex aspects of students' thinking (e.g., Petri & Niedderer's, 1998; Taber, 2008). As with my case study of Mr. Owens, I do not purport that these student cases are generally representative of student thinking; however, these cases help to show students' wide range of approaches in framing a novel, ill-structured problem. These cases also help to show patterns of student thinking across vastly different problem framing approaches.

Research Questions

The methods and analysis of the three studies are driven by the following research questions:

1. How does an experienced teacher represent the characteristics of historical causation for students?
2. When given the chance to represent historical and contemporary causal problems, how do secondary students work in these ill-structured spaces? What causal characteristics do they identify and how do they theorize about the interactions among these characteristics?
3. Given the findings from the literature and the studies of the ways the teacher and his students represent causal problems, what are key attributes in creating a framework to help support teachers' and students' framing of historical and contemporary causal problems?

Participants

The participants in this study included a high school teacher, Mr. Owens, and a small group of students (n = 7) in his one AP US history class. Of the seven students, I chose to represent three as cases of distinctive approaches to problem framing.

Teacher Participant

My choice to work with Mr. Owens was a purposive sampling decision. According to Silverman (2000), "qualitative researchers use purposive sampling to choose a case because it illustrates some feature or process in which we are interested" (p. 104). In this case, I wanted the best opportunity to observe systematic and effective causal reasoning instruction. I believed Mr. Owens' instruction would fit that description. First, he is a highly experienced and innovative history teacher. In addition to having taught history courses for over two decades, he has led

numerous workshops for other AP US history teachers, has contributed to a history textbook, and has written a published history book geared towards secondary students. Second, Mr. Owens told me prior to the study that he planned to designate significant instructional time to teaching about historical causation. As detailed in the next chapter, he also communicated to students a clear civic purpose for teaching about causation. Finally, as the study started, Mr. Owens began to develop instructional scaffolds that I saw as aligned with several interventions discussed in the literature review. Overall, I believed Mr. Owens' relatively unique attention and approach to causation made him a good choice for this study.

Student Participants

The majority of students in this study were 10th graders aged 15-16, and all were enrolled in AP US History. I was interested in looking at AP students because the AP curriculum includes cause and effect as one of the three key "reasoning processes." I also assumed that being AP students, the participants might offer more in-depth and more varied responses to the two cognitive tasks. I invited all 42 students in Mr. Owens' class to participate in the study. Thirty-one students agreed to participate in data collection related to class observations, and seven agreed to complete the two end-of-year cognitive tasks. On the whole, students who participated in the cognitive tasks did not seem to differ in any meaningful way from the rest of the students in the class. I chose to present analysis of three students' responses—Avery's, Robert's, and Ren's—as cases of distinctive approaches to problem framing. Avery, for instance, established one of the narrowest, yet most intricate problem spaces. Robert established one of the widest, most abstract, and least intricate problem spaces. And Ren established a problem space that fell somewhere in between, nesting proximate causes within broader historical contexts and establishing a moderate number of interconnections between causes. All other participants'

problem spaces fell somewhere in between these three. As a result, I use Avery, Ren, and Robert as cases that demonstrate a range of students' responses to the task.

School and Class Context

Most of the students at Mr. Owens' school (Dewey High School) identify as white or Asian. Less than one sixth of students identify as Black or Hispanic. This seemed to reflect the racial and ethnic composition of Mr. Owens' AP US history class. Dewey HS also has a relatively low proportion of students on free or reduced lunch, and the school ranks in the mid ninetieth percentile on college-readiness exams (US News & World Report, 2020).

Due to the COVID-19 pandemic, Mr. Owens taught his AP US History class virtually via a video-conferencing platform. During whole-class instruction, Mr. Owens often presented material using a digital slide deck and students participated both verbally and through the platform's chat function. Students also spent substantial time in "breakout rooms" where they worked together on assignments or engaged in small group discussion.

Coming into this study, I wondered if or how Mr. Owens' virtual instruction differed from his usual in-person instruction. Unfortunately, I did not have any data to compare these two formats. However, I asked Mr. Owens to self-report any changes he had observed. He said that most of the changes were "logistical," explaining that he reduced some content he would typically teach and made certain activities "a little simpler." However, Mr. Owens clarified that he did not simplify the "thinking" students were doing. On the topic of causation, in particular, he explained that there was little he would change after switching back to in-person instruction in the following 2021-2022 school year. Given this, I treat the observations of Mr. Owens' virtual instruction as representative of Mr. Owens' approach to instruction generally.

Researcher Positionality

I came to this study both as a former AP US history teacher and a scholar of historical thinking. Both of these experiences likely shaped my decision-making and analysis throughout the study. Through secondary teaching and doctoral studies, I came to see the work of history as the process of using historical evidence to "reconstruct the past" (Bain, 2000, p. 334) rather than an attempt to, in the positivist sense, "show [the past] as it really was" (von Ranke, 1824, p. vi). As a result, I believe that teaching history should make visible the structures of history as a discipline and the processes of historical inquiry—as opposed to simply transmitting information about the past. Mr. Owens seemed to hold and enact a similar vision of history education, which is one reason I focus on his instruction in this study.

I played two different roles in this study. In studying Mr. Owens' instruction, I was primarily an outside observer—accessing the course synchronously via the video conferencing platform. I introduced myself and the study to students at the beginning of the year, but I did not have many interactions with the students. I did, however, have frequent conversations with Mr. Owens, offering feedback on instruction and instructional design when asked. Sometimes Mr. Owens made instructional decisions in response to my advice. For instance, when Mr. Owens asked for feedback on the causal graphic organizer he created, I advised him to include the word "contexts" alongside the phrase "long-term causes" (See Figure 11, Chapter Five). The extent my advice influenced Mr. Owens is largely irrelevant as the main purpose for this data collection was to analyze instructional practices rather than comment on Mr. Owens' instructional decision-making.

In studying students' reasoning in response to the two cognitive tasks, I played an active role, providing instructions and facilitating the interview. I explore the affordances and limitations of this approach in the next section.

Data Collection

To address my research questions, I conducted 30 class observations, two semi-structured interviews with Mr. Owens, and two cognitive task-interview protocols with seven students. I also kept informal notes of my ongoing conversations with Mr. Owens throughout the year (however, I did not use data from these notes in this study). Table 1 shows the timeline of the data collection and the relevant research question for each data type.

Table 1

Data Type, Timing, and Relevant Research Question

Data Type	Timing (2020-2021)	Relevant RQ
Classroom Observations	September-June	RQ1, RQ2
Ongoing discussions with Mr. O	September-July	RQ1
First Semi-Structured interview with Mr. O.	January	RQ1
Student Cognitive Task 1	June	RQ2, RQ3
Student Cognitive Task 2	June	RQ3
Second Semi-Structured interview with Mr. O.	July	RQ1

Class Observation

To explore instructional practices related to reasoning about causal problems, I conducted thirty observations of Mr. Owens' AP US history class. I chose to observe classes in which Mr. Owens planned to teach about causation or other related second-order competencies (e.g., comparison). I did not record observations, but I did maintain extensive field notes. As a result,

the verbal exchanges I quote in Chapter Five are often close approximations recreated from my field notes. I also collected instructional artifacts and student work associated with the observations. Instructional artifacts included slide decks, assignments, and graphic organizers. Student work included essays, worksheets, and study guides. However, I did not end up including data from student work in this study.

Semi-Structured Interviews with Mr. Owens

To help contextualize and member-check what I was observing in class, I conducted two semi-structured interviews with Mr. Owens. I conducted the first over winter break and the second at the end of the school year. During these interviews, I asked Mr. Owens to clarify his instructional goals and approaches, explain how the virtual format of the class impacted his instruction, and comment on the larger instructional context of what I had observed. I audio-recorded and transcribed these interviews.

Student Causal Problem Framing Tasks

To explore students' causal problem framing, I asked student participants (n = 7) to complete two cognitive tasks during the last couple weeks of school. In the first task, students explained what they "know or might need to know" to design a museum exhibit about the causes and outcome of the 1894 Pullman Strike. In the second task, students discussed what they "know or might need to know" to write report for a workers' rights organizations about the causes and outcome of the unionization effort at Amazon's Bessemer warehouse in 2021. The purpose of these prompts was to elicit students' initial problem spaces rather than their conclusions about the causes of the events. This design differed from previous studies in historical causal reasoning requiring students to accept the problem as given and to respond to a direct causal question, like *what caused the Pullman Strike?* (e.g., Jacott et al., 1998; Stoel et al., 2017; Voss et al., 1994),

To encourage students to think out loud, I invited and prompted students to consider "anything" that they thought was relevant to the task.

I chose the Pullman Strike and the Amazon unionization events for two main reasons. First, I wanted to present students with events that have similar structures, themes, and content. Each event (1) dealt with union organizing against a large corporation, (2) was triggered by the actions of one or a handful of individuals, and (3) implicated critical structural conditions that one could trace relatively far back in time. Second, I wanted to present students with events that would be familiar enough that they could generate ideas about the problem but not so familiar that they might simply reiterate a framing of the problem they had already learned or heard. I did not assess students' background knowledge of the events out of fear that an assessment might predefine the problem space for students. Nevertheless, students likely had varied knowledge of the events which may have impacted how they framed their problem spaces. Chapter Eight's limitation section discusses this issue further.

Task Protocol. Each task began with a problem scenario and a passage (Appendix A). The tasks then proceeded in two parts designed to elicit students' problem spaces in different ways. In Part 1, students "brainstormed" on a blank piece of paper and then verbally explained their brainstorms in response to probing questions. In Part 2, I gave students a series of causal factors to consider and respond to verbally (Appendix A). Overall, each task took between 45-60 minutes to complete and were conducted two to seven days apart. I audio recorded students' verbalizations and transcribed them with the assistance of an automated transcription software. At the end of each task, I collected students' written brainstorms and transcribed them into a word processing document (Appendix B & C).

Task Scenario and Passages. Students began each task by reading a scenario (Table 2).

Table 2

Task 1 & 2 Scenarios

Pullman Case (Task 1) Scenario	Amazon Case (Task 2) Scenario
You have been hired by the Chicago History Museum to create an exhibit about the causes of the Pullman Strike in 1894. The exhibit should also help viewers understand why the strike happened when it did and why it unfolded the way that it did.	You have been hired by a workers' rights organization to write a report about the causes of the unionization effort at the Amazon warehouse in Bessemer, Alabama. The report should also help the organization understand why the unionization effort happened when it did and why it unfolded the way that it did.

After reading the scenario, students read a brief narrative passage describing the event (Table 3). The purpose of the passages was to give enough information to support students in generating a sizable problem space but not so much information that students could rely exclusively on the passages to frame the problem. As Lee et al. (1996) explain, figuring out the appropriate amount of background information to provide to students is a challenge endemic to historical thinking research.

> …[I]n history it is never possible to present children with all the evidence they require to arrive at the solution to some problem… There is always a more or less arbitrary limit in what is put before children to enable them to show how they tackle a problem. Given that children approach the past with very different sets of experiences and expectations about what is humanly possible or likely, it is difficult to make secure decisions as to what subjects "need to know" (p. 53).

The same can be said about eliciting students' approaches to contemporary ill-structured problems, which also implicate more information than is possible to provide to students.

With this in mind, I decided to limit both passages to around 300 words and focus most of the passage's content on events or developments that occurred less than a year before the event. I based the content of the Pullman Case (Task 1) passage on several historical accounts (e.g., Bassett, 1997; Rondinone, 2009; Salvatore, 1982). I based the content of the Amazon Case (Task 2) passage on news articles (e.g., Corkery & Weise, 2021; Selyukh, 2021). To facilitate comparison between students' reasoning on the two tasks, I tried to make the passages' content and structure as similar as possible.

Table 3

Task 1 & 2 Passages

Pullman Case (Task 1) Passage	Amazon Case (Task 2) Passage	Content
In 1867, George Pullman founded the Pullman Palace Car Company which manufactured luxury train cars.	In 1994, Jeff Bezos founded Amazon, an online marketplace for consumer goods and services.	*Company and its founder*
Towards the end of the 1800s, most of the workers at the Pullman company lived in a company town (Pullman, Chicago) where the company owned and operated the houses and stores and heavily regulated life inside the town.	Today, Amazon has over a million workers, many of whom work in large fulfillment warehouses. Amazon uses computer technology to closely monitor their warehouse workers' levels of productivity.	*Structural conditions that effect(ed) workers*
During the economic Panic of 1893, the demand for luxury train cars decreased. As a result, Pullman decided to lay off two-thirds of its workforce and cut wages by as much as half. However, the company refused to lower rent or prices in the company town. Many workers ended up owing more to live in the town of Pullman than they were making at the company.	When COVID-19 pandemic hit in 2020, the demand for home delivered goods increased. As a result, Amazon increased pressure on its warehouse workers to keep up with the higher demand. That year, Amazon workers reported workplace injuries at a rate 50% higher than the average warehouse worker in the U.S.	*A broad-scale, structural event that exacerbated those conditions*
In mid-May 1894, several frustrated Pullman workers formed a committee and presented a list of grievances to the Vice President of the company. Although these committee members were assured that there would be no retributions for stating their grievances, three of the members were immediately fired.	In mid-August 2021, Jennifer Bates, a warehouse worker in Bessemer, Alabama, was called in for a routine search for stolen goods. According to Bates, the computer system counted the time she was being searched as "time off task." Workers are not paid for time off task. In addition, Amazon sometimes uses too much time off task as a reason to fire a worker.	*An action by a worker or manager that precipitates(ed) action by a union*
Upon hearing the news of the firings, Pullman workers went on strike. The striking workers sought help from	Bates said that being counted as off-task during the search was the final straw. She decided to organize	*The union's action*

the American Railway Union (ARU) (a union is a group of workers that engages in collective bargaining with employers for better wages or working conditions). Headed by labor activist Eugene V. Debs, the ARU supported the strike at Pullman by refusing to operate trains that used Pullman Cars. This created a massive slowdown in train transportation from Chicago to the West Coast.	other frustrated workers at the warehouse. Together, they sought help from the Retail, Wholesale and Department Store Union (RWDSU) (a union is a group of workers that engages in collective bargaining with employers for better wages or working conditions). Headed by union president, Stuart Appelbaum, the RWDSU agreed to help organize a vote for the 3,000 workers at the Bessemer warehouse about whether or not they wanted to join their union.	
After refusing to negotiate with the striking workers, Pullman joined forces with 24 other railroad companies, forming a group called the General Managers Association (GMA). The GMA used their political connections to lobby the business-friendly president, Grover Cleveland, to put a stop to the strike.	Prior to the union vote, Amazon managers at the warehouse held mandatory meetings where they tried to persuade their workers not to join the union. The company also asked the town of Bessemer to reduce the number of stoplights near the warehouse. This made it harder for union representatives to talk to employees after work.	*The company's response*
In July of 1894, Cleveland sent in federal troops to end the strike. Many of the workers involved in the strike were fired and put on a blacklist which prevented them from getting jobs at other related companies. Eugene Debs was put in prison for six months for his role in the strike.	In April of 2021, 71% of the workers voted against the union. In interviews, many of the "no union" voters said that they did not feel that there was a need for a union at the warehouse.	*Outcome of the union action*

Part 1. Brainstorming and Discussing Student Thinking. Once students read the passage, I asked each student to "brainstorm" on a blank sheet of paper "anything you know or might need to know in order to make your exhibit" (Task 1) or "…to write your report" (Task 2). I did not give instructions about how to organize their brainstorming. As previously stated, the purpose of these questions was to elicit students' initial problem spaces rather than their completed causal accounts.

After eight minutes, I asked students to flip their paper over and, for two minutes, write down any additional questions they might consider investigating (See Appendix B & C for brainstorm examples). The purpose of this second part of the brainstorm was to elicit students' inquiry questions in addition to any declarative knowledge they might have already put in their brainstorm. However, this part of the task proved to be somewhat redundant as most students already included multiple inquiry questions in the first part of their brainstorms. The kinds of questions students wrote in this second part of the brainstorm did not appear to be meaningfully different than the kinds of questions they wrote in the first.

In the discussion portion of the task, I used probing questions designed to elicit students' explanations and elaborations of their thinking (e.g., Jacott et al., 1998; Shemilt, 1983; Lee & Shemilt, 2009). I began this part of the task by asking each student to "talk me through what you put down in your brainstorm." As students began explaining what they wrote down, I frequently interjected to ask clarifying or elaborating questions such as, "why did you put that?" or "can you tell me a little bit more about what you meant by that?" If a student provided a factor without a clear connection to the event, I often asked, "how does that connect to the Pullman Strike [or the Amazon unionization effort]?" The following exchange is a typical example of the latter type of question and illuminates my role in trying to probe but not direct student thinking:

> Falak: …if the president supports Pullman, then that gives like Pullman and the corporations a lot more power and that's probably why the workers bargaining with their employers to get [higher] wages didn't end up being successful, because the president supported the owner.
>
> Researcher: How is that related?
>
> Falak: Because the president sent in federal troops to end the strike and—the president really didn't care about workers getting like fair wages so that's why the workers that were in the strike ended up getting fired and put on a blacklist, which, like, I think this might have been different if the president was somebody that wasn't business friendly and might have ended up with the workers actually getting like higher wages and less working hours.

Falak started her response by mentioning a connection between the president's support for Pullman and the strike's failure. I then asked Falak to elaborate on that connection. She explained the president's role in ending the strike and offered that the outcome might have been different under a different president.

The advantage of asking probing questions over a more traditional "think-aloud" protocol (Ericsson & Simon, 1993)—where verbalization of thinking is largely uninterrupted—is that I could seek clarity and elaboration on students' responses in the moment. This allowed me to observe and describe students thinking in greater detail. One of the limitations of this approach is that the questions I asked students likely shaped their thinking to some degree. For instance, in the previous excerpt, it is unclear whether Falak would have entertained that counterfactual about President Cleveland if I had not asked her to elaborate on her thinking. To reduce my effect on students' thinking, I tried to keep these probing questions as general and open-ended as possible.

To properly account for my role as the interviewer in the findings sections, I have tried to present the broader contexts of my exchanges with students whenever it seemed relevant.

Once the students finished explaining their brainstorm, I asked them to "identify three factors that you think would be most important to include in your exhibit" or "in your report." I followed up by asking students to explain why they made their selections. The purpose of this portion of the task was to elicit from students their ideas about causal significance related to the two cases.

Part 2. Discussing Students' Thinking in Response to Provided Factors. Next, I presented each student with five potential causal factors, one at a time (Table 4). The purpose of this part of the task was to see how students integrated these factors in their problem spaces or how students altered their problem spaces in response to the factors.

I constructed the five factors for Task 1 by drawing from the historical accounts and newspaper articles mentioned earlier. I purposefully chose factors that were a mix of agentic and structural content and reflected differing proximities to the event in time and space. To the best extent I could, I tried to match the factors in Task 1 and 2 along these lines.

Table 4

Task 1 & 2 Provided Factors

			Shared features	
#	Task 1 Potential Factors	Task 2 Potential Factors	*Size*	*Content*
1	***[Pullman Town isolation]*** Pullman Town and its workers were largely isolated from the rest of the city of Chicago.	***[Work task isolation]*** Most of the work tasks at Amazon's Bessemer warehouse are done individually. Workers are often isolated from one another.	Proximate, Medium-term	Structural
2	***[Industrialization, low regulation]*** American cities industrialized rapidly after the Civil War with very few government rules or regulations on businesses.	***[Surveillance technology]*** Modern computer technology enables companies to monitor workers' behavior in very detailed ways.	Broad, Long-term	Structural
3	***[Anti-immigrant newspapers]*** Major newspapers at the time often associated worker strikes with Eastern and Southern European immigrants and political radicals.	***[Minimum wage vs. Amazon wage]*** The federal minimum wage is $7.25 an hour, which is almost half of the starting wage of $15.30 an hour at Amazon's Bessemer warehouse.	Broad, Long-term	Structural
4	***[Pullman's Tribune statement]*** In a statement to the New York Tribune, George Pullman accused the labor organizers of acting like dictators and opposing freedom of business.	***[Amazon Twitter use]*** Top Amazon officials used the company's Twitter account to criticize politicians and celebrities who supported the unionization effort at the warehouse in Bessemer.	Broad, Short-term	Agentic
5	***[Prior ARU Strike]*** There was a successful strike against the Great Northern Railroad (GNR) one year before the Pullman strike. Led by Eugene Debs and the American Railroad Union, the GNR strike led to an increase in wages for workers at the GNR.	***[RWDSU Record]*** In the 20 years before the Bessemer warehouse union vote, The Retail, Wholesale and Department Store Union (RWDSU) successfully unionized 3 poultry plants in Alabama, leading to increased wages and working conditions in those plants.	Intermediate, Medium-term	Agentic

For each factor, I asked students to "tell me how you think the factor might be connected to your task of designing the museum exhibit" or "writing your report." They could take as much time as needed to consider each factor, but most took no more than 30 seconds. As in Part 1, I asked probing and clarifying questions. After students talked through each potential factor, I asked, "If you had to choose 2 of these factors to include in the [exhibit | report], which would you choose?" As in Part 1, the purpose of this question was to elicit students' ideas about causal significance.

The design of Part 2 of the study was an adaptation of Carretero et al.'s (1991) study. In their study, they gave students cards with various events that occurred within a country and then asked students to give their opinion about what "influence [each card] may have had on the prosperity of the country" (p. 39). However, they designed this question to elicit students' causal explanations whereas I designed my question to elicit students' problem spaces ("tell me how you think the factor might be connected to your task"). They also explicitly elicited students' counterfactual thinking about the provided factors. I mostly did not ask counterfactual questions because I wanted to see whether students surfaced counterfactuals without prompting.

Data Analysis

Initial Coding Scheme

Drawing from my reading of historiography and history education literature (Chapter Two), I developed 11 initial codes to categorize instruction and student reasoning. Table 5 identifies these initial codes and the relevant literature.

Table 5

Initial Codes and Relevant Literature

Code	Scholarship in Historiography/ Philosophy	Scholarship on student thinking	Scholarship on instruction
Time (e.g., long-term causes, short-term causes)	Brien (2013); Christian (2005); Gaddis, (2002); Gottschalk, 1950/1963); Guldi and Armitage (2014);	Nersäter (2018); Voss et al. (1994)	Chapman (2003)
Space (e.g., local causes, national causes)	Christian (2005); Guldi and Armitage (2014)	Voss et al. (1994)	None found
Agency (e.g., historical actors, intentionality) and structure (e.g., conditions, institutions)	Evans (1997); Pomper, (1996)	Barton & Levstik, (2004); Carretero et al. (1997); den Heyer, (2012); Halldén (1997, 1998); Jacott et al. (1998); Lee & Shemilt (2009); Reisman (2009); Stoel et al. (2015, 2017)	Chapman (2003); Barton and Levstik (2004); Fertig (2008); Reisman (2009); Wendell (2020)
Structural classification of causes	Pomper (1996)	Carretero et al. (1997); Voss et al. (1994); Wendell (2018)	Chapman (2017)
General causes	Gaddis (2002); Lee (2004)	Carretero et al. (1994); Stoel et al. (2015, 2017); Voss et al. (1994)	Coffin (2006); Kemp and Sadoski (1991); Shreiner (2017); Twyman et al. 2006)
Causal roles	Coffin (2004, 2006) Evans, (1997); Tapp, (1952)	Coffin (2004, 2006); Stoel et al. (2015, 2017); Voss et al. (1994)	Chapman (2017); Coffin (2004, 2006); Woodcock (2005)
Causal accounts	Evans, (1997); Gaddis, (2002); Hexter (1971); Voss & Wiley (2006)	Carretero et al. (1991) Foster et al. (2008); Lee (2005); Lee & Shemilt (2009); Stoel et al. (2015, 2017); Voss et al. (1994)	Chapman (2017); Horiguchi & Kashihara, 2016); Masterman (2005); Masterman & Sharples (2002)
Comparisons	Evans (1997); van Boxtel and van Drie, (2018)	Stearns (2000)	Stearns (2000)
Counterfactuals	Evans (1997); Ferguson (2000); Fischer (1970); Froeyman (2009); Megill (2007)	Carretero et al. (1991); Voss et al. (1994); Wendell, (2020)	Chapman (2003); Carroll (2018)
Change/continuity over time (CCOT)	Lee (2005); Shemilt, (1983)	Blow (2011); Lee (2005); Shemilt (1983); Stoel et al. (2015, 2017)	Counsell (2017); Foster, (2008); Seixas & Morton (2013)

As detailed in Chapter Two, historians and education scholars argue that these concepts and reasoning practices are crucial for engaging in causal explanation. These concepts also overlap with theory and research in ill-structured problem-solving (Chapter Three).

Updated Coding Scheme: Coding Students' Individual Utterances

In early rounds of coding students' responses to the two tasks, I saw the need for two levels of coding: one to describe students' individual utterances and one to describe students' problem spaces as a whole. For the former, I took the initial 11 codes I developed using the literature and added task-specific definitions as well as additional subcodes (Appendix D). I developed these subcodes using my initial interpretations of students' responses, the specific context of the tasks, and existing literature in history education and ill-structured problem representation (Table 6).

Table 6

Task 1 & 2 Coding Scheme for Individual Causal Claims and Utterances

Codes:	Time	Space	Agency	Structure	Causal role	Additional Reasoning
Subcodes:	Short-term	Prox.	Subjectivity/ intent	Specific	Enabler	Comparison
	Medium-term	Inter.	Character	General	Influencer	CCOT
	Long-term	Broad	Action	Political	Catalyst	Generalization
				Economic	Trigger	Indicator
				Social	Conditional	Counterfactual
				Geographic		Personal exp/ opinion.

1) no earlier than the Panic of 1893 or the onset of COVID-19; 2) between 0 and 10 years back from before Panic of 1893 or the onset of COVID-19; 3) more than 10 years back from before Panic of 1893 or the onset of COVID-19 a) confined to the company or company town; b) confined to the region (e.g., county, state) or related industries; c) extends into national contexts and/or different industries

The following is an example of how I broke up the code *reasoning about time* into three subcodes.

Table 7

Definition and Example of Time Subcodes

Code	Subcodes	Definition	Example
Time	short-term	A causal factor that originated no earlier than the Panic of 1893 (Task 1) or the onset of COVID-19 (Task 2)	For short term causes: So just details on how like the labor workers were treated in terms of wages and not just wages, just like treatment, working conditions and stuff like that. And then all that just like leads to the pullman strike. (Dakini, T1)
	medium-term	A causal factor that originated between 0 and 10 years before Panic of 1893 (Task 1) or the onset of COVID-19 (Task 2)	What is Amazon's record with unions? From what I understand this [Bessemer] was the first union vote in Amazon but was there are similar struggles in the past in other warehouses or just this warehouse in particular? (Ren, T2)
	long-term	A causal factor that originated more than 10 years back from before Panic of 1893 (Task 1) or the onset of COVID-19 (Task 2)	so you could say like if the Federal Government was definitely like a lot more corrupt back then, as larger businesses had that much power over what happened (Robert, T1)

I added and developed several subcodes solely from my interpretation of students' responses. For example, I saw the need to add a new causal role which I called a *conditional* role. I define conditional roles as contingent causal relationships that involve an "if-then" logic about how an *unknown* causal factor might operate under certain conditions. All *conditional* codes were dual coded with another causal role (e.g., *a conditionally influencing cause, a conditionally enabling cause*). Here's an example:

> Avery: If they [Amazon] were making a much higher profit, wouldn't they [Amazon] be able to make the wages higher to reward the workers for working harder? …I think that would make the workers even more frustrated and likely to join the union because they [the workers] know [Amazon is] not caring about the workers.

Here Avery explained "profit" as a *conditionally enabling* role. If "higher," then profit enables Amazon to pay workers more. If not higher, profit *constrains* Amazon's ability to pay workers more. This is different than a "counterfactual." In a counterfactual, one knows the true nature of the independent variable but hypothesizes about what would happen if that variable were removed or altered in a critical way. In a conditional, the true nature of the independent variable is unknown.

The other subcodes I added include: all the agency subcodes, the catalyst role, students' identification of indicators, and students' use of generalizations and personal experiences and opinions. Finally, I distinguished between students' reasoning *with* and *about* these different aspects of causation. For instance, many students surfaced long-term causes without labeling them as a long-term causes or explaining the significance of those causes' place in time. However, several students explicitly tied long-term causation to historical significance. I make these distinctions clear in my analysis.

To apply these codes and subcodes (Table 6), I took the transcripts of students' interviews and underlined each causal factor they surfaced. Here is an example:

> Researcher: Can you talk me through what you put down in your brainstorm?
>
> Falak: Well, so factors that I think led to the strike—first the Panic of 1893 because that was the first event that led to workers getting angry because they

couldn't pay off the rent to live because their wages were so low and like Pullman had to make the wages low because there was like less demand for the cars. And then also another factor that I think led to this strike was just in this time period corporations have like a lot of power and then the federal government didn't really have a say …it didn't like have the power to regulate big businesses, so owners could basically do whatever they wanted the workers…

Then, I categorized each underlined factor by its position in time and space, its causal role, and whether it was an agent or structure. If it was a structure, I subcoded whether it was a specific or general structure and whether it was a political, economic, geographic, or social structure. If students surfaced an additional reasoning process, such as raising a counterfactual or identifying an indicator, I marked that as well.

The vast majority of coding decisions were relatively straightforward. However, I still found it challenging to apply codes unequivocally at several points in the data. This was not a major surprise as several of the code categories exist on a continuum, and students sometimes use ambiguous language to describe causality. Take, for instance, the following exchange:

Avery: Maybe it's harder to get jobs because of the Panic [of 1893], so they [the workers] don't really have any other options. They only have the job that they have now, but again they're not getting enough money.

Researcher: Why does that matter?

Avery: Because if they had another option, they might quit and go and see if they can get higher wages, but since there's a lack of jobs, they have to stick with what they can get…

In this exchange, Avery identified that the Panic of 1893 (*a short-term, broad-scale* cause) likely led to a reduction in job opportunities, which had consequences for the choices available to workers. What's unclear in this exchange is whether Avery was thinking about the factor of "harder to get jobs" locally or nationally. In situations like these, I often looked at the broader context of the student's statement or other places where the student might have surfaced that factor or role. In the above case, I determined that Avery was likely referring to job availability on a local scale because she discussed similar factors (e.g., wages, cost of living) explicitly within the context of Pullman Town. If the context did not provide any further clarity, I chose not to apply the code in question.

Updated Coding Scheme: Categorizing Students' Problem Spaces

After coding each student's individual utterances, I developed broader categories to describe students' problem spaces as a whole (Table 8). As with the codes for individual utterances, I developed these categories by triangulating my understanding and interpretation of the literature, students' responses, and the tasks themselves.

Table 8

Coding Scheme for Problem Spaces

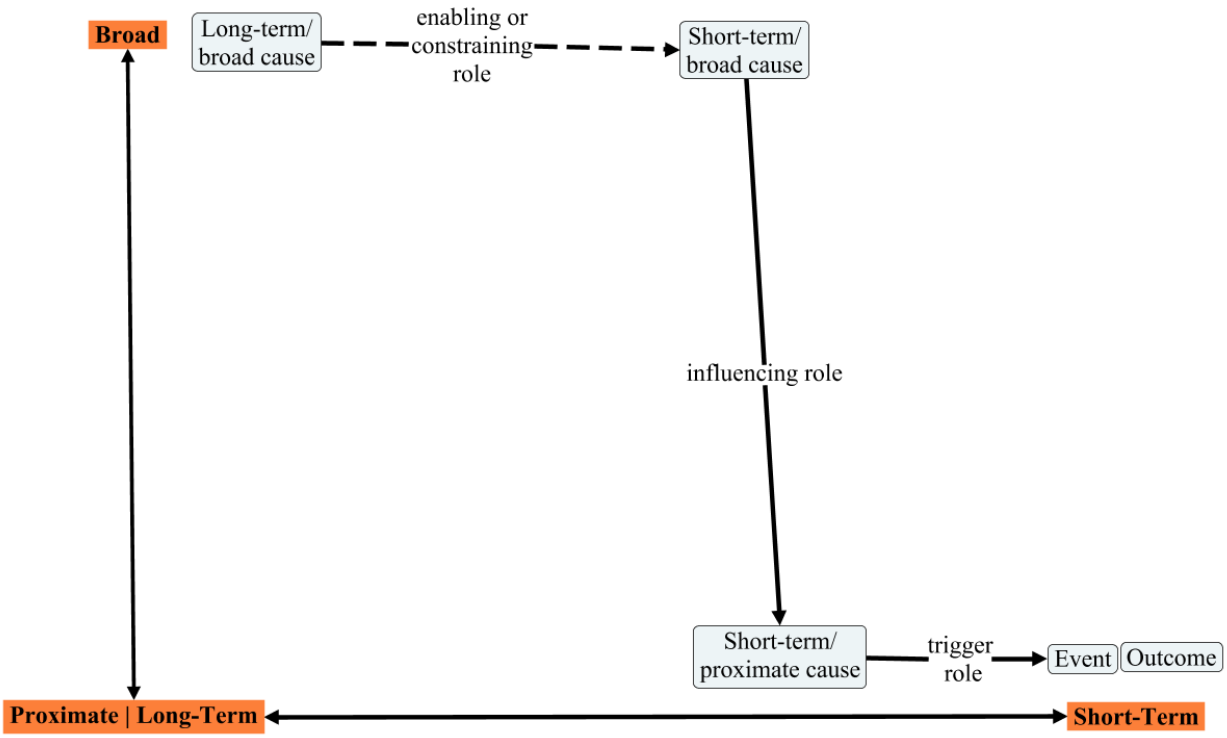
Problem Space Dimensions	Descriptive Categories
1) Temporal Scale	1) Narrow 2) Wide 3) Nested (narrow and wide foci)
2) Spatial Scale	1) Narrow 2) Wide 3) Nested (narrow and wide foci)
3) Degree of Agency	1) Mostly agentic 2) Mostly structural 3) Combination agentic and structural
4) Degree of Abstraction	1) Mostly specific 2) Mostly general 3) Combination specific and general
5) Use of Structural Classifications	1) Factors from mostly one classification 2) Factors from multiple classifications
6) Organization of the problem space	1) Linear (narrative) 2) Non-linear (expository)
7) Problem space complexity	1) Simple 2) Complex

To define and operationalize the first five categories, I first counted the total number of factors that fell in each category (e.g., the total number of long-term causes vs. the total number of short-term causes; the total number of agentic causes vs. the total number of structural causes). While this was a useful starting point, the raw counts sometimes obscured the real focus of the students' explanations and what they considered most significant. For instance, a student might have listed many short-term causes but then spent most of the interview explaining two or three long-term causes. Therefore, in categorizing students' problem spaces, I also paid close attention to how students' attributed significance to different kinds of causes.

To categorize how students organized their problem space and how complex their problem spaces were, I constructed diagrams of the students' responses for each task (Figure 9).

Figure 9

Theoretical Map of a Student's Problem Space



This is similar to other studies that have used researcher-created causal diagrams to analyze students' causal explanations (e.g., Voss et al., 1994). As mentioned earlier, I extracted the causal factors from students' transcripts and categorized each by its position in time and space. I then plotted each causal factor from Part 1 on a graph with time and space as the x-axis and y-axis. If a student referenced a causal factor that persisted for a while, I plotted the cause at the most likely point of origin (e.g., the "Panic of 1893" lasted until 1897, but I plotted it with other events occurring in 1893). Because students surfaced factors of varying temporal and spatial

scale, the reader should interpret the distance between the factors on the diagram as ordinal rather than interval.

After plotting each cause, I then drew different types of arrows to signify the causal roles students surfaced. If a student provided a factor that mediated the effect of another cause-effect relationship, I drew an arrow from the mediating factor to the middle of the arrow connecting the initial cause and effect. If the student did not provide a causal role or I could not infer one, I drew no connections.

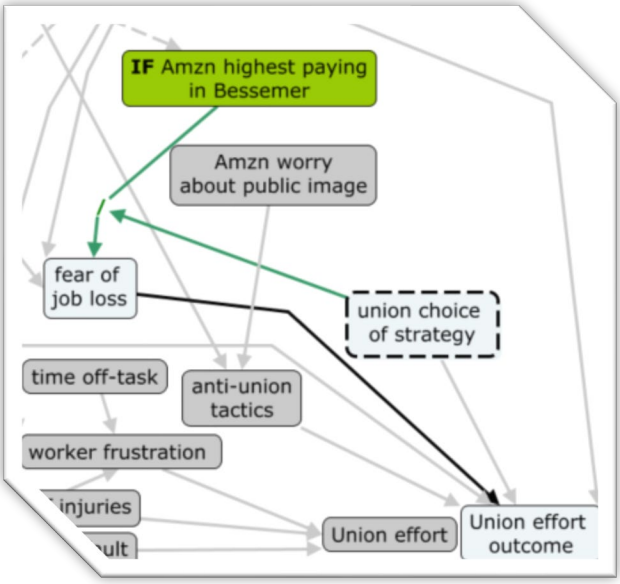
I then repeated these steps with students' responses to the provided factor in Part 2, using different colors to distinguish between the two parts. Lastly, I indicated the factors the students selected as "most important" by adding a dashed border to the appropriate boxes.

To give an example of both my role in helping students think out loud and how I incorporated a student's response into a diagram, here is a selection from Avery's transcript and the relevant portion of the causal diagram I created (factors not mentioned in the excerpt are greyed out in the diagram) (Figure 10). In the following excerpt, Avery responded to a provided factor about Amazon's comparatively high pay (Factor 5).

> Avery: if [Amazon] was the highest paying job in Bessemer, then I think less people would be likely to join the union, because it's their best option, so they might be like, I'll just deal with the difficulty of the job because I need this high wage.
>
> Researcher: But why not join the union?
>
> Avery: Because they—maybe they don't want to risk losing their job, but also again that kind of depends on the strategy of the union, if they're just trying to negotiate or they're just trying to do a strike.

Figure 10

Selection of Avery's Task 2 Transcript



Here Avery explained that the comparatively high pay at Amazon might intensify workers' fears of losing their job. This effect, however, is mediated by the union's choice of strategy. Therefore, I drew an arrow from "union choice of strategy" to the middle of the arrow connecting Amazon's pay and fear of job loss. The three factors that are in light blue are factors Avery had previously surfaced in Part 1 (the black arrow signifies a causal role that she previously surfaced in Part 1). Examples of full maps can be found in Appendices E and F.

Once I created the causal diagrams, I categorized each by its organization type and level of complexity. To determine if a response was primarily narrative, I looked for whether there was a clear causal chain of events leading to the explanandum. If the student seemed to establish a clear causal chain of events, I coded the students' problem space as narrative. If the student seemed to connect multiple causes directly to the explanandum with no clear causal chain, then I coded the students' problem space as expository. As for the level of complexity, I looked at how

many connections the student made between causal factors or whether the student provided multiple contextualizing factors or conditions. Simply counting the number of connections did not always give a complete picture of the level of complexity in a students' response. As a result, I used these diagrams in conjunction with close readings of the transcripts to give a more detailed description of the level of complexity in the findings section.

Classroom Observation Analysis

During the 30 classes I observed, I took extensive field notes of Mr. Owens' instruction (all of which occurred before the two cognitive tasks). During this time, I developed the initial coding scheme referenced in Table 5 above. After completing my analysis of students' problem framing, I decided to reanalyze the class observation data using the updated coding scheme in Table 6 above. Doing so enabled me to make comparisons between instruction and student reasoning, which I explore in Chapter Six.

There was one significant difference in how I approached the analysis of Mr. Owens' instruction compared to his students' reasoning. Whereas I had analyzed students' thinking *with* and *about* the concepts and reasoning processes listed in Table 6, I decided only to analyze Mr. Owens' instruction *about* these concepts and reasoning processes. I defined instruction *about* causation as any of Mr. Owens' teaching practices that explicitly or tacitly communicated something generalizable about engaging in causal reasoning or problem framing. For instance, Mr. Owens provided students with a note sheet with the following explicit piece of advice: "Any explanation that focuses on the short-term is inadequate. Long-term must be the heart of a response on cause or effect." I coded this as instruction *about* the temporal dimension of causation.

I also coded instances when Mr. Owens made less explicit and direct references to causation in guiding students to a more generalizable understanding of causation. For example, in the following exchange, Mr. Owens offered a more tacit yet common feature of causal reasoning:

> Mr. Owens: What kinds of specific things could we point to, to tell the story of what's changing as far as which party [Federalist or Democrat] is more popular?
>
> [*students responded in the chat. Multiple students' responses include the phrase "common man politics*"]
>
> Mr. Owens: Okay, "the common man." Yes, so we would probably have that term somewhere. What about like some specific events or something even more a little more concrete?

Here Mr. Owens implied that students' causal explanations might benefit from "specific events" and more general concepts like "common man politics."

Not all exchanges between Mr. Owens and the students, however, moved toward a meta-cognitive feature of causation since some were tightly bound to a specific example, and thus I did not code these. For example, in the following exchange, Mr. Owens tried to help a student named Ren understand the causal relationship between farmers' debt and the monetary standard in the 19th century and did not seem to surface any generalizable ideas about causal relationships in history.

> Mr. Owens: How would [the silver standard] help the farmers?
>
> Ren: It's my understanding they have outstanding debts, so printing more money would cause inflation and help them to pay back their loans.
>
> Mr. Owens: how does higher prices help?

Ren: higher profit margins?

Mr. Owens: and you can pay off your debt…

I chose not to include this since I did not see it as communicating any generalizable ideas about causation or problem framing.

Because I was interested in Mr. Owens' instruction *about* causation rather than his causal explanations (c.f., Montanero & Lucero, 2011), I did not attempt to diagram Mr. Owen's problem spaces. Instead, I applied problem space codes (Table 8) when Mr. Owens surfaced generalizable ideas *about* the organization or complexity of causal accounts. For instance, in a lecture on the causes of the Market Revolution, he told students that "causes have causes" and suggested that students "create a mind map of these causes." I coded both of these utterances as related to the organization and complexity of ill-structured problem spaces.

Chapter V

Analysis of Mr. Owens' Causal Instruction

This chapter explores how Mr. Owens, an experienced AP US history teacher, taught his students to reason about causation, paying particular attention to Mr. Owens' instructional practices related to critical problem framing concepts, such as *time, agency, structure, causal roles, causal accounts*, and reasoning processes, such as *counterfactual thinking* and *making comparisons.* The data come from thirty observations of Mr. Owens' AP US History class, including materials he created for those class sessions. I focus on moments in the data where Mr. Owens explicitly or tacitly communicated an idea or strategy for problematizing or reasoning about causation. These moments mainly occurred during direct instruction and whole-class discussions. I analyzed the data using a coding scheme described in the methods chapter.

I begin by summarizing Mr. Owens' general goals and approaches to teaching history before analyzing the component features Mr. Owens used to problematize or reason about causation. In the discussion section, I explore how Mr. Owens' practices relate to and informed my thinking about the existing literature on causal reasoning and problem framing instruction.

Mr. Owens' Goals and Instructional Approaches

Mr. Owens was explicit about his year-long instructional goals and his understanding of instructional constraints embedded in teaching complex history to high school students and the limitations imposed in teaching AP U.S. history. One of Mr. Owens' main instructional goals was to help students develop large-scale, coherent historical narratives. In our first interview, he said that he wanted students "to see that history is more than just a pile of bits" and "that the

bits… connect and give us coherence." Not confined to historical topics, he wanted students to use historical narrative to explain how the past "leads up to today." Mr. Owens had been thinking about and referenced the tumultuous events of the summer of 2020, especially the murder of George Floyd and subsequent protests. He felt that emphasizing coherence and interconnectedness in history would enable his students to see these events "all have a backstory," and knowing these backstories would help students better understand current events.

Mr. Owens planned to support students in developing these narratives by focusing on three "historical thinking skills": causation, comparison, and change and continuity over time. He frequently referred to these skills as the "connective tissue of history." These three concepts are also identified in the AP US Course Description as the three focal "reasoning processes" (College Board, 2020, p. 17).

Before the start of the school year, Mr. Owens explained he would devote a large amount of instructional attention to causation. His main instructional goal in devoting time to causation was to help students identify and distinguish between long-term and short-term causes for both historical and current events. This, Mr. Owens believed, would equip students to more frequently and effectively inquire into the "backstory" of events they encounter outside of his class.

Mr. Owens used three major instructional interventions to promote this kind of causal thinking. First, he engaged in direct instruction using a non-historical analogy to introduce students to the multicausal, multitemporal nature of causation in history, similar to Chapman's (2003) "Alphonse the Camel" story. Second, he conducted a concept formation lesson (Parker, 1988) to introduce students to the substantive concept of "civil disruptions." Throughout the year, Mr. Owens and students used civil disruptions to frame historical events with similar causal structures—namely, events with long-term causes and a clear trigger event (e.g., the 1967 Detroit

Rebellion). The "civil disruptions" category worked like a scaffold, initially narrowing the types of causal problems students encountered. Third, Mr. Owens constructed a graphic organizer that students used to identify and distinguish between causes at different time scales.

In addition to his belief that understanding short- and long-term causation is fundamental to understanding current events, he also grounded his thinking on what he perceived as instructional constraints. In our first interview, Mr. Owens explained that asking students to analyze and make causal claims, such as short-term and long term-causes, was likely new for his students and, therefore, he worried that introducing too much complexity might hinder students learning. "If it's too much," he explained, " kids won't be able to wrap their heads around it" (Interview, January 4, 2020). Additionally, the AP US History course and exam required Mr. Owens to cover over 400 years of content and many historical thinking skills (e.g., "sourcing," "contextualization") and reasoning processes (e.g., "comparison," "change") (College Board, 2020, pp. 16-17). To keep up with the pace of the AP course content, Mr. Owens decided not to deliver several causation-focused lessons he had planned.

Guided by these learning goals and instructional constraints, Mr. Owens did explicitly teach several important aspects of causation while tacitly communicating other aspects.

Mr. Owens' Explicit and Tacit Historical Causation Instruction

Teaching Students to Use Time to Identify Causes and Reason About Historical Significance

Mr. Owens focused most of his causal instruction on the temporal dimensions of causation, explicitly teaching students to distinguish between "long-term" and "short-term" causes and integrate both those types of causes in their historical explanations. Mr. Owens used several instructional approaches to introduce students to the idea of short- and long-term causes and scaffold students' application of these concepts, including a causal analogy (Chapman,

2003), a graphic organizer, class discussions, and feedback on writing that helped reify principles of thinking with or writing about causes across time.

Mr. Owens introduced the idea of historical causation by showing students a news clip about a California wildfire ignited in September 2020 by a pyrotechnic device at a "gender reveal party." He then asked students to respond to the prompt, "how would you explain what caused the California wildfire?" Students identified a range of causal factors, such as "climate change," "the carelessness of people," or "the very dry climate of California." Mr. Owens then used students' responses to demonstrate that major events have many causes, some of which are "long-term causes" (e.g., "climate change") and others "short-term causes" (e.g., "the gender reveal party"). He finished the lesson by explaining his year-long goal for students to be able to identify short- and long-term causes of both current and historical events (Observation 9/21/2020).

Throughout the year, Mr. Owens used this wildfire analogy as a heuristic to help students identify and distinguish between short- and long-term causes. In the following exchange, Mr. Owens surfaced the wildfire analogy to clarify a student's (Falak) short- and long-term causes of King Phillips's War.

Mr. Owens: Let's start with causation. What led to King Phillip's War?...

Falak: There were tensions between colonists and natives, and then I talked about when the English executed three Wampanoag, which stoked hatred.

Mr. Owens: To go back to the wildfire analogy, would you say that the last part is like the "gender reveal" part?

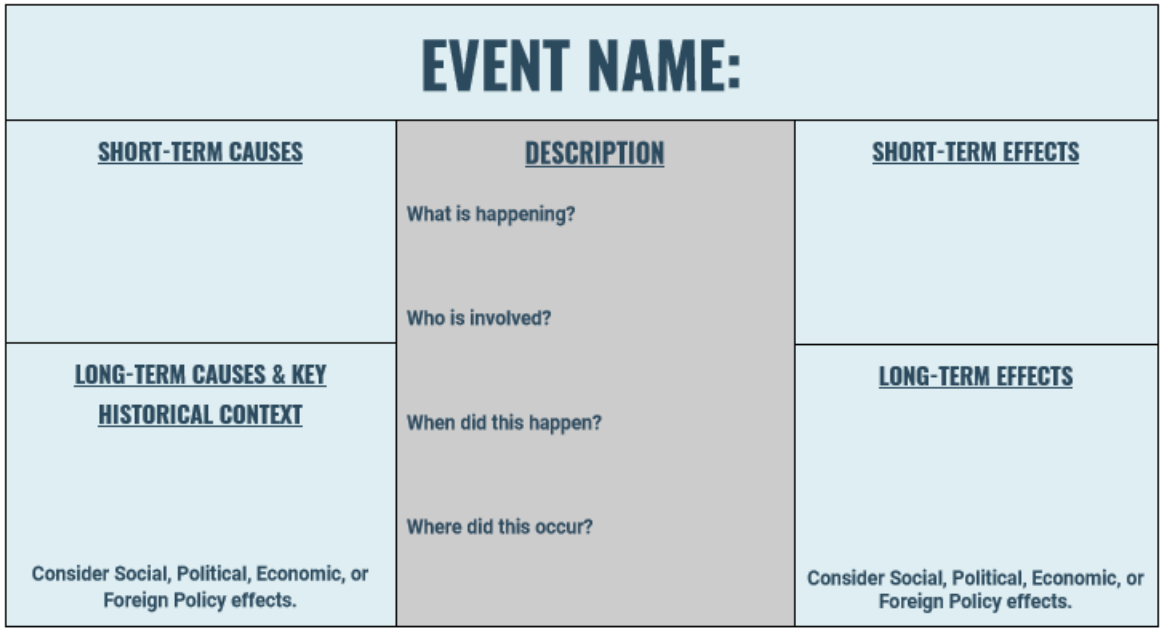
Falak: Yeah (Observation 10/21/2020).

There is nothing in the data to suggest that students used this particular analogy themselves. However, during discussions about short- and long-term causes, students surfaced similar "fire" metaphors (e.g., "logs on a fire," "spark").

The day after the initial wildfire analogy lesson, Mr. Owens introduced students to a graphic organizer (Figure 11) that they used throughout the year to identify and analyze the causes of historical events. The organizer was divided into five sections: short-term causes, long-term causes, event description, short-term effects, and long-term effects (because of time constraints, Mr. Owens rarely assigned students to analyze effects).

Figure 11

Mr. Owens' Graphic Organizer for Historical Causation



Mr. Owens first explained to students that the purpose of the organizer was to help them "understand civil disruptions more deeply" (Observation 9/22/2020). However, a few months into the year, Mr. Owens began to assign the graphic organizer to support students' investigations into the causes of other kinds of historical events or eras, such as Westward

Expansion or the Great Depression. Overall, students used the organizer about fifteen times in small-group and independent activities. And towards the end of the year, Mr. Owens stopped including the scaffold in students' writing prompts.

In addition to the graphic organizer, Mr. Owens frequently used lectures and discussions to communicate his expectation that students include both short- and long-term causes in their historical explanations. In the following exchange during a class discussion, Mr. Owens held up a student's response to exemplify the kind of multi-temporal thinking he expected from students.

> *[In response to the writing prompt, "Analyze the causes of the KKK's rise as a force of domestic terrorism in the US," a student named Soomin identified two causal factors: "[the KKK's] desire to end Radical Reconstruction policies…and their belief in the idea of white supremacy."]*
>
> Mr. Owens [to the class]: Why is this [response] good?
>
> Avery: I think it's good because it uses white supremacy as a long-term cause, because that's always been around… And then [Soomin] uses the short-term cause of Radical Reconstruction, how they [the KKK] don't like the new like laws and everything.
>
> Mr. Owens: That's correct. Thank you. Very good job (Observation 3/17/2021)

Although Mr. Owens wanted students to explain causation at multiple time scales, he did not usually explicate specific boundaries between "short-term" and "long-term" causes. The one exception to this was when Mr. Owens instructed students to think of the short-term causes of King Phillip's War as occurring in the "immediate days or months before the event" (Observation 10/21/2020). In general, Mr. Owens used the wildfire analogy or historical examples to communicate flexible guidelines about differentiating short- and long-term causes.

When evaluating students' graphic organizers or causal explanations, he also tended to accept students' varying interpretations of short- and long-term causes for different events.

Even though Mr. Owens expected students to identify causes in both temporal categories, he stressed that longer-term causes tend to be more historically significant. For example, in early December, Mr. Owens distributed a document called "APUSH Thinking Skills" that stated, "Any explanation that focuses on the short-term is inadequate. Long-term must be the heart of a response on cause or effect." In mid-March, he reinforced this idea, informing students that causal essay responses that lacked a long-term cause could not receive an "A" grade (Observation 3/17/2021).

Finally, Mr. Owens sometimes used verbal or written prompts to elicit students' understanding of short- and long-term causation. In June, for instance, Mr. Owens asked students to write a reflection about their ability to think about "short-term, long-term [causes] on your own—without being prompted" (Observation 6/9/2021). Mr. Owens used these kinds of student reflections to inform his direct instruction or assignments.

I did not observe Mr. Owens explicitly address the spatial dimensions of causation. Sometimes he tacitly connected space and time by, for instance, imploring students to discuss "big, long-term things." He also created assignments that helped students draw connections between proximate events, such as the 1834 Ursuline Convent riots, to more broader phenomena like 19th-century nativism. However, Mr. Owens did not often make these underlying ideas about space explicit.

Teaching Students about the Role of Agents and Structures in Causal Reasoning

Although Mr. Owens never explicitly used the terms "agent" or "structure" with students, data from class observations suggest that Mr. Owens and students frequently grappled with ideas

about the role of agency and structure in historical explanation, pertaining especially to how one should identify causes or weigh causal significance.

In several discussions with students, Mr. Owens seemed to privilege the historical importance of structures over agents and agentic properties. One of these instances occurred when Mr. Owens asked students to share aloud why they thought Andrew Jackson had won the popular vote in 1824. Students' initial responses focused on Jackson's appeal, such as "Jackson was a national hero" or "he was humble." Mr. Owens, however, pushed students to try to identify "big, long-term things," such as loosening restrictions on voting or the decline of the Federalist Party. Mr. Owens went on to clarify that the "biographical stuff" about Jackson is "relevant," but "only when you attach it to the context." He emphasized this point further by replacing the title of the graphic organizer, "Jackson Wins Popular Vote in 1824," with its previous subtitle, "Rise of Common Man Politics." Whereas students had initially framed Jackson as the major agent of change, Mr. Owens pushed them to consider the broader historical development of "common man politics" that enabled Jackson's rise to power. Additionally, Mr. Owens tied the idea of *structure* to *time* and *space*, referring to various structural conditions as "big, long-term things" (Observation 12/3/2021).

Mr. Owens also asked students at times to inquire into agentic intent. In a whole-class discussion about the Stamp Act Riot, he asked students the question, "What was the goal [of the riot]? Why use violence?" A student named Gi responded in the chat: "to cause a reaction from the officials, to make changes to the Stamp Act." Mr. Owens then validated Gi's response, remarking that "[The rioters] got what they wanted" (Observation 10/30/2020). This exchange reflects both teachers', students', and historians' tendencies to personify structures (e.g., den Heyer, 2012; Halldén, 1997, 1998; Pomper, 1996). Relatedly, during a lesson in mid-March, Mr.

Owens asked students to compare the intent of current Georgia state legislators to legislators in the mid-19th century who also voted to increase barriers to voting. During this discussion, a student named Ren explained the problem of only looking at intent.

> …We should look not just at the intent but the outcome of what these people are doing. Obviously, they didn't explicitly say Democrats can't vote, right? But what we know from the past and know now is that these laws will disproportionally affect one party or one race regardless of the intent of the bill… The intent can be good or bad, but the outcome is always the true indicator of what really the effect of that was (Observation 3/12/2021).

In problematizing the idea of "intent," Ren also raised the issue of *unintentional* outcomes in history—an ill-structured aspect of historical causal explanation. In this case, the legislators could have good intentions but still pass a racist law. Mr. Owens validated Ren's response but generally did not raise the idea of *unintentional* causes in his instruction.

Teaching about General and Specific Structures. On a few occasions, Mr. Owens distinguished "specific" structures from "broad" structures. However, compared to his discussions weighing the explanatory value of agents and structures, he seemed more ambivalent about whether students should emphasize "specific" or "broad" structures in their explanations. For instance, in a causal-essay outline assignment, Mr. Owens included in the directions that evidence "can be broad like the Euro-mindset" or it "can be specific like the Salem Witch Trials."

There was one instance in the data—a class discussion about 1820s politics—where he called on students to provide more "specific" factors to substantiate their broader claims.

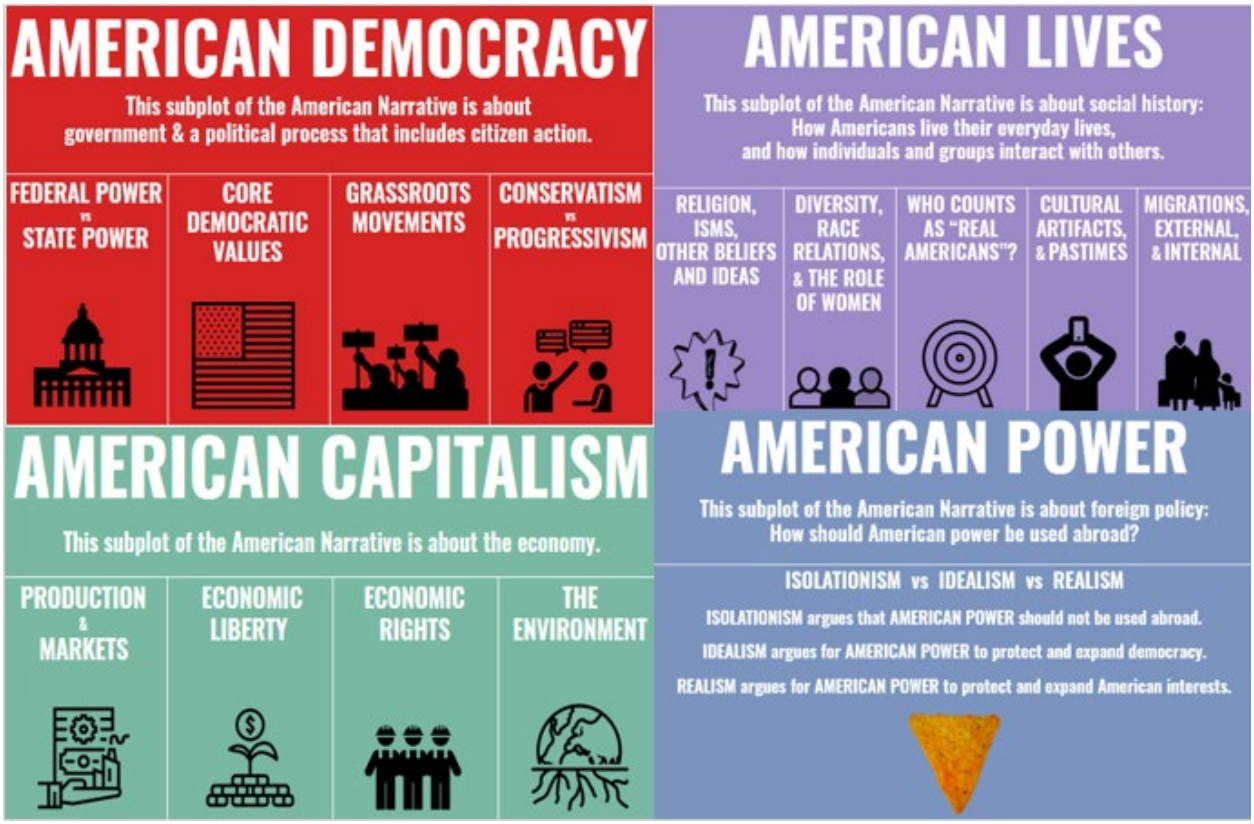
> Mr. Owens: What kinds of specific things could we point to, to tell the story of what's changing as far as which party [Federalist or Democrat] is more popular? [*students responded in the chat. Multiple students' responses include the phrase "common man politics"*]
>
> Mr. Owens: Okay, "the common man." Yes, so we would probably have that term somewhere. What about specific events or something a little more concrete? (Observation 12/4/2021).

In this exchange, Mr. Owens accepted the students' proposed general structure of "common man politics," but pushed them to substantiate the claim with additional "concrete" factors.

Teaching about Structural Classifications. Mr. Owens often categorized—or called on students to categorize—historical structures as political, economic, social, or foreign policy-related. Mr. Owens introduced these categories to students as the four "subplots" of U.S. history (Figure 12).

Figure 12

Mr. Owens' Four Narrative "Subplots" Handout



Along with this digital handout, Mr. Owens also delivered direct instruction about these four structural classifications, including specific historical examples. Mr. Owens mostly paired this handout with a type of assignment he referred to as the "American Narrative," completed by students at the end of each historical era. In these assignments, students categorized the major changes and continuities of that era by the four subplots and then wrote a narrative account of the era that brought the subplots together. Mr. Owens saw this tool and activity as a way to help students manage the breadth of content covered in the class.

Mr. Owens occasionally tied the idea of "subplots" explicitly to causation. For example, in the directions of one of the American Narrative assignments, he pressed students to "try to show causal connections across the subplots" (American Narrative Assignment 1754-1824). Mr.

Owens also included a written reminder in students' causal organizers (Figure 11) to "consider social, political, economic, or foreign policy causes." However, I did not observe Mr. Owens evaluate students' causal organizers or causal explanations based on their use of the subplots. Nevertheless, the use of these subplots and related scaffolds could plausibly influence the way a student searched for historical causes or organized their causal explanations.

Teaching Students about Causal Roles

Mr. Owens did not use the term "causal roles" with his students. Still, he explicitly introduced causal role terms such as "trigger event" (Observation 5/17/2021), "catalyst" (Observation 3/17/2021), "spark" (Observation 3/17/2021), "underlying causes" (Observation 2/8/2021), and "context" (Observation 12/7/2021). As with short- and long-term causes, he used analogies and examples to help communicate the meanings of these terms. For instance, he often invoked the wildfire analogy to help students distinguish between trigger events and underlying causes and contexts. In a lecture, Mr. Owens modeled this language using a historical example, stating, "if we're talking in the language that we've been using this year, then [Lincoln's election] is the spark" (Observation 3/17/2021).

Mr. Owens also related causal roles to time, using the phrases "context" and "underlying causes" synonymously with "long-term causes," or using words like "spark," "trigger event," and "catalyst" as synonymous with "short-term causes." For example, when Mr. Owens taught a lesson on the January 6th Capitol insurrection, he told students, "I want you to not just talk about short term causes—those are the things that triggered what happened—there are also underlying, longer-term forces that are at work here" (Observation, 1/8/2021).

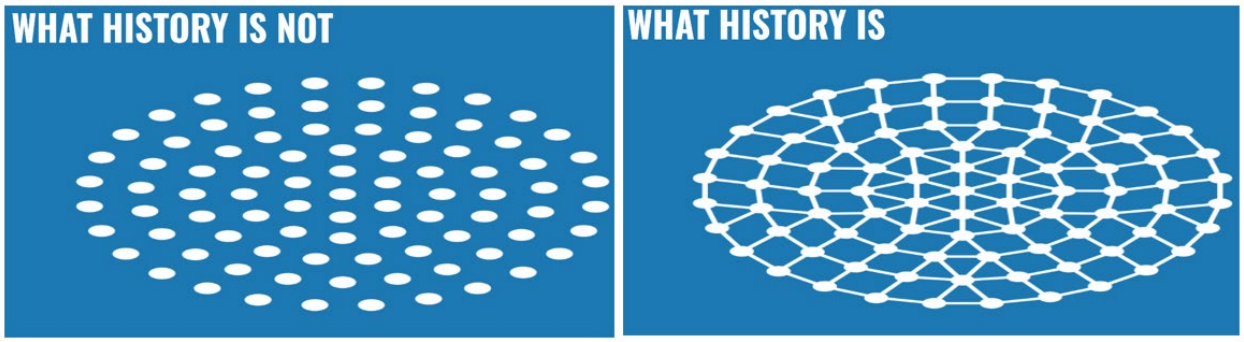
Teaching Students about Causal Accounts and How to Organize Causal Accounts

Mr. Owens introduced two frameworks for understanding and organizing causal accounts. The first, what I refer to as the "causal web," stressed the multi-causal and interconnected nature of causation, though it was agnostic about chronology. The second, what Mr. Owens referred to as "analytical storytelling," stressed the chronological nature of causal accounts (Observation 3/17/2021).

Mr. Owens began the first "causal web" lesson by explaining that causation is the "connective tissue of history." He then went on to show two slides, the first an array of unconnected dots, which Mr. Owens titled "what history is not." The second showed a web of connected dots titled "what history is" (Figure 13) (Observation, 9/21/2020).

Figure 13

Mr. Owens' Visual Representation of the "Causal Web" Model of History

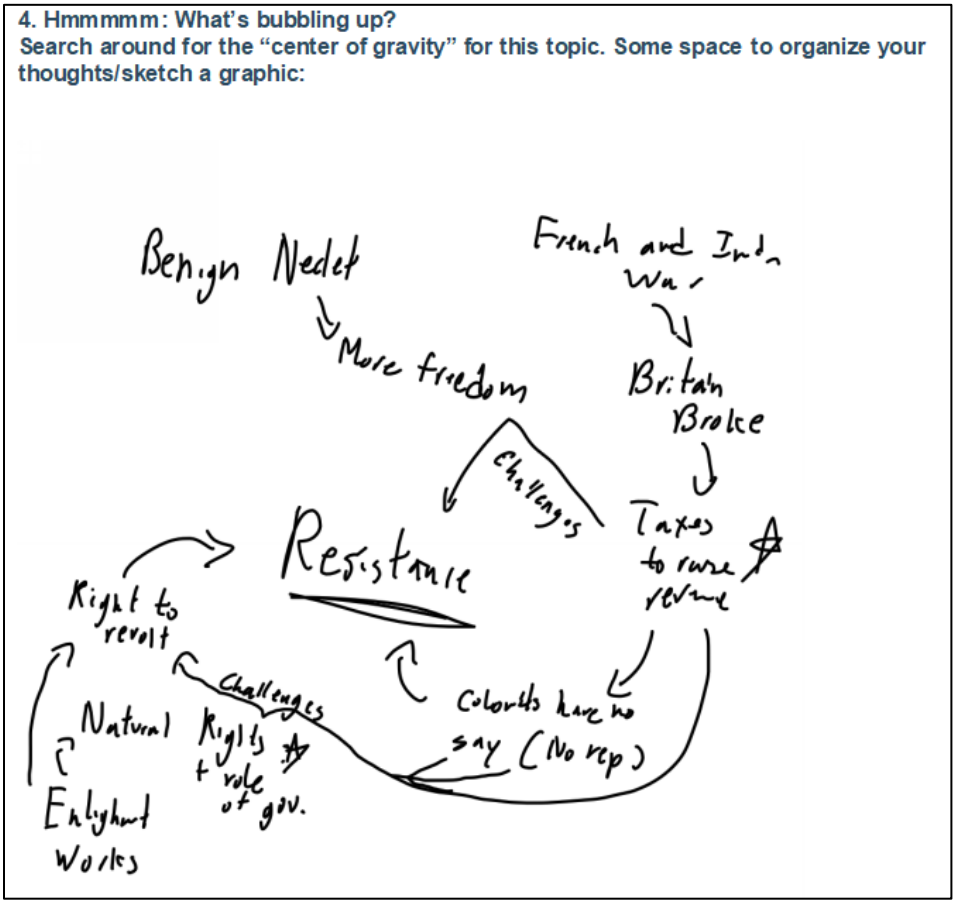


Mr. Owens resurfaced these diagrams throughout the year to remind students about the complex and interconnected nature of events in history. For example, in a recap assignment of the first few historical eras, Mr. Owens asked students to "give an example" that shows that "history is not individual dots." Mr. Owens also promoted this idea of causal complexity in reference to specific topics. For instance, he explained to students that there were many causes of the Market Revolution and that many of those "causes have causes" and suggested that students "create a

mind map of these causes" (Observation, 12/17/2021). As part of his recurring essay outline assignments, Mr. Owens provided students a "space to organize your thoughts/sketch a graph." Thus, he afforded students the freedom to represent complex causal relationships in multiple ways within this space. Figure 14 provides an example of how one student sketched out his "map" of causes.

Figure 14

Portion of Mr. Owens' Essay Outline Assignment with Student Response



Through the causal web model, Mr. Owens chose to represent causation as multi-dimensional and complex, eschewing the typical, linear, one thing after another pattern of instruction that is common in many history classes (Bain, 2000).

In mid-March, Mr. Owens noticed that although students were using short- and long-term causes in their written work, they often mixed up or neglected to represent the overall sequence of events—something Mr. Owens identified to students as "jumbled chronology." He then introduced another framework for organizing causal accounts, which he referred to as "analytical storytelling." He explained the concept to students as "telling the reader why things are happening the way that they're happening," adding, "it's not about dates, but if you grasp the story, then you know what comes first, second, third" (Observation 3/17/2021). By introducing an emphasis on narrative, Mr. Owens hoped students would continue their complex causal analysis with increased attention to the sequence of events. Mr. Owens' explanation of "analytical storytelling" seemed to reflect the hybrid of narrative and expository accounts commonly used in history (Voss & Wiley, 2006).

Teaching Students to Think about Causes Using Additional Reasoning Processes

Teaching Students to Reason about Causation Through Comparisons. Mr. Owens occasionally asked students to make comparisons to think about causation. For example, as part of a semi-regular assignment called the "American Backstory," Mr. Owens sometimes tasked students with comparing causes in the past to causes in the present. In one of those assignments, Mr. Owens asked students to compare the intent of Georgia's legislators to legislators in the mid-19th century who also increased restrictions on voting (Observation 3/12/2021).

Teaching Students to Reason about Causation by Considering Change and Continuity Over Time (CCOT). Mr. Owens sometimes discussed the idea of CCOT in relation to causal explanations. For example, when one student (Ren) asked to what extent Alexander Hamilton's death changed the course of history, Mr. Owens explained that the structures Hamilton put in place were more significant than the timing of his death. He then asked all the

students whether the "structure of the government"—referring mainly to changes brought by the Federalists— "is a change or continuity story?" Multiple students in the chat replied that it was a "continuity story." Mr. Owens validated their responses, explaining, "The Federalist Party is dead. It's extinct. However, their structure mostly remains" (Observation 12/4/2021). Here Mr. Owens highlighted the continuity of Federalist principles to underscore the importance of structures in history in relation to individual historical actors.

Teaching Students to Reason about Causation by Applying Generalizations. Mr. Owens sometimes identified historical generalizations students could use to make or support causal claims. At times Mr. Owens referred to these generalizations as "sorta laws of history" because they were broadly, but not universally, applicable. For instance, when Mr. Owens taught about the rise of the Populist movement in the late 1800s, he explained, "If there's a sorta law of history, [it's that] in an extreme economic context, much of the mainstream is open to otherwise extreme ideas" (Observation 4/23/2021). Mr. Owens then asked students for examples of other historical cases that might support that generalization (students gave responses like "WWI" and "Nazi Germany").

Discussion

Mr. Owens often represented causation in multiple and complex ways. His images and descriptions were multi-dimensional and factored in a range of critical causal problem framing concepts, including *time, agency, structure, causal roles, causal accounts*, and related reasoning processes, such as *making comparisons* and *considering change and continuity over time.* At times, Mr. Owens was explicit in naming and scaffolding these concepts and reasoning processes, encouraging students to use them in their thinking. For instance, Mr. Owens purposefully designed scaffolds to support students' differentiation of short- and long-term

causes and application of various structural classifications (or "subplots"). Other times Mr. Owens' instruction was implicit, teaching concepts without naming them or creating a scaffold to help students employ them for themselves. For example, when he asked students to weigh the significance of President Jackson's personal appeal against the structural conditions that enabled Jackson's presidency, Mr. Owens appeared more interested in students' thinking about Jackson than their thinking about causal attributes of structure or agency. Nevertheless, Mr. Owens' explicit and tacit treatment of causation consistently represented for students the ill-structured nature of causal problems and the ways historians have and students could widen and factor in more variables when framing a problem. As an exploration of teaching, there is much we can learn from what Mr. Owens did to make his thinking about causation and causal problems visible.

Representing the Ill-Structured Nature of Causal Problems

Many popular instructional resources in history include causal questions, such as "What caused the Salem Witch Crisis of 1692?" (SHEG, n.d.b), to prompt students' analysis of a given set of sources and to shape their writing. Typically, these instructional activities and the ways teachers approach them focus students on evaluating sources and creating an argument, and thus pre-define and frame the problem space for students. Such activities and instruction likely obscure for students the ill-structured nature of causal problems in history by either failing to make problem framing part of the intellectual work or failing to clearly communicate that the activity is but one way to approach the problem or frame the problem space.

Though no less concerned about source analysis, Mr. Owens made time to explicitly or tacitly represent several characteristics of ill-structured causal problems. For instance, in introducing the concept of causation using the wildfire analogy, Mr. Owens showed students that

there are multiple ways one might explain the causes of the fire, adding that explanations will often differ depending on what time scale one considers. In the news clip Mr. Owens showed, the reporters only seemed concerned with the party and the explosion. However, as Mr. Owens explained, historians are often concerned with both short- and long-term causes.

Mr. Owens' approach in this example and others was similar to Chapman's (2003) allegory lesson about what broke Alphonse the Camel's back. Neither teacher predefined the problem space for their students in the way that many document-based inquiries do. In fact, Mr. Owens explicitly instructed students to consider causes beyond those presented in the news clip. The data in this and Chapman's (2003) study is insufficient to comment on how this type of allegory problem might inform students' ideas about the ill-structured nature of historical causal problems. However, it is plausible that these problems might help students see the possibility of multiple problem framings and the futility of accounting for all the possible factors involved. More research on the subject is needed.

Engaging and Supporting Students in Widening the Problem Space

Mr. Owens did more than just represent the complexity of causal problems, he named features of the complexity (e.g. short- and long term causes) and offered scaffolds for students to use. He also afforded students opportunities to practice framing a useful problem space amid all available possible problem spaces. Again, this is not a type of thinking that typical inquiry resources or teaching, including those in AP courses, engage students in doing. Instead, Mr. Owens gave his students multiple opportunities to construct problem spaces without being confined to predetermined sources or evidence. In several activities, students identified their own sources in response to topics they selected. To support students in this process, Mr. Owens used several scaffolds to guide students in framing the problem and problem space. For example,

students often investigated events that fell within Mr. Owens' concept of "civil disruptions," which Mr. Owens used throughout the year to frame events with similar structures (e.g., long-term causes, a trigger event). As Shreiner (2017) found, explicit instruction around a substantive concept can help students interpret new events. It is also plausible that a substantive concept like "civil disruptions" may help students anticipate the shape of the event they are investigating, thus helping them better define their problem space.

In class activities, in discussions, and through his graphic organizers, Mr. Owens invited students to consider events or developments not immediately evident in a given problem statement or the kinds of documents that AP courses tend to provide on exams. He did this by consistently asking students to consider long-term causes, often praising students for identifying structural causes that stretched back hundreds of years (I did not observe Mr. Owens tell a student that they had identified a cause that went too far back in time).

Though still bounded by the AP curriculum and exam, neither of which includes activities to improve or assess students' capacity to work with ill-structured problems, Mr. Owen made time and devised tools to represent complex and important aspects of ill-structured problems. He also engaged in practices that might support students in framing problem spaces in response to complex causal problems. Many of his instructional activities and images proved useful in helping me design a problem framing framework, particularly after analyzing students' thinking on two causal tasks, which I turn to in the next chapter.

Chapter VI

Characteristics of Students' Historical Causal Reasoning:

Students Tackle the Pullman Strike Case (Task 1)

This chapter explores how three of Mr. Owens' students constructed problem spaces in response to an ill-structured historical task. For the task, students "brainstormed" what they "know or might need to know" to design a museum exhibit about the causes of the 1894 Pullman Strike. I designed this task and the prompt to elicit students' reasoning about the problem space rather than to elicit their conclusions about the causes of the event. This design differed from previous studies in historical causal reasoning requiring students to accept the problem as given and to respond to a direct causal question, like *what caused the Pullman Strike?* (e.g., Jacott et al., 1998; Stoel et al., 2017; Voss et al., 1994), Furthermore, I asked probing questions to help students make their thinking visible as they brainstormed.

I analyzed the data in two stages. First, I coded students' individual utterances using the codes and subcodes referenced in Table 6 in the previous chapter. Then, I created diagrams to represent students' problem spaces. I used the coding scheme in Table 8 in the previous chapter to describe the overall organization and complexity of those problem spaces.

I begin by giving a brief overview of the task before identifying and describing three cases of students' problem construction, each representing a distinct, yet complex problem space. I then explore relationships between different elements of students' problem spaces. The student thinking I discuss in this chapter informed the research and instructional framework I describe in Chapter Eight. This chapter closes with a brief discussion of how these cases of student thinking

did or did not fit with what I saw in Mr. Owens' instruction and learned from existing historical causal reasoning literature.

Overview Of Task 1: The Pullman Strike Problem (1894)

Students began the historical, problem framing activity by reading the following open-ended task scenario:

> You have been hired by the Chicago History Museum to create an exhibit about the causes of the Pullman Strike in 1894. The exhibit should also help viewers understand why the strike happened when it did and why it unfolded the way that it did.

The scenario provided students with only a few loose constraints in establishing a problem space: the eventual mode of representation ("an exhibit") and the content focus of the exhibit ("why the strike happened when it did and why it unfolded the way that it did").

After taking up the task, students then read a brief narrative passage describing the events leading up to the Pullman Strike and its aftermath, providing them modest background information about the event (Appendix A). I then asked students to "brainstorm" on a blank sheet of paper "anything you know or might need to know in order to make your exhibit." After eight minutes, I asked students to flip their paper over and, for two minutes, write down any additional questions they might consider investigating.

I started the interview by asking each student to "talk me through what you put down in your brainstorm." During this time, I frequently asked clarifying or elaborating questions (e.g., "why does that matter?", "can you tell me more"). Once the students finished explaining their brainstorm, I asked them to "identify three factors that you think would be most important to include in your exhibit." This first part of the study generally lasted 20 to 25 minutes.

Next, I presented each student with five causal factors that could be related to the strike (Table 9).

Table 9

Pullman Strike (Task 1) Provided Factors

#	Task 1 Provided Factors
1	***[Pullman Town isolation]*** Pullman town and its workers were largely isolated from the rest of the city of Chicago.
2	***[Lack of government regulations]*** American cities industrialized rapidly after the Civil War with very few government rules or regulations on businesses.
3	***[Anti-immigrant Newspapers]*** Major newspapers at the time often associated worker strikes with Eastern and Southern European immigrants and political radicals.
4	***[Pullman's Tribune Statement]*** In a statement to the New York Tribune, George Pullman accused the labor organizers of acting like dictators and opposing freedom of business.
5	***[Prior ARU Strike]*** There was a successful strike against the Great Northern Railroad (GNR) one year before the Pullman strike. Led by Eugene Debs and the American Railroad Union, the GNR strike led to an increase in wages for workers at the GNR.

For each factor, I asked students to "tell me how you think the factor might be connected to your task of designing the museum exhibit." After students talked through each potential factor, I asked, "If you had to choose two of these factors to include in the exhibit, which would you choose?" This second part of the study generally took 20 to 25 minutes.

The data in this chapter comprises students' written brainstorms and transcriptions of students' verbal responses to both parts of the task.

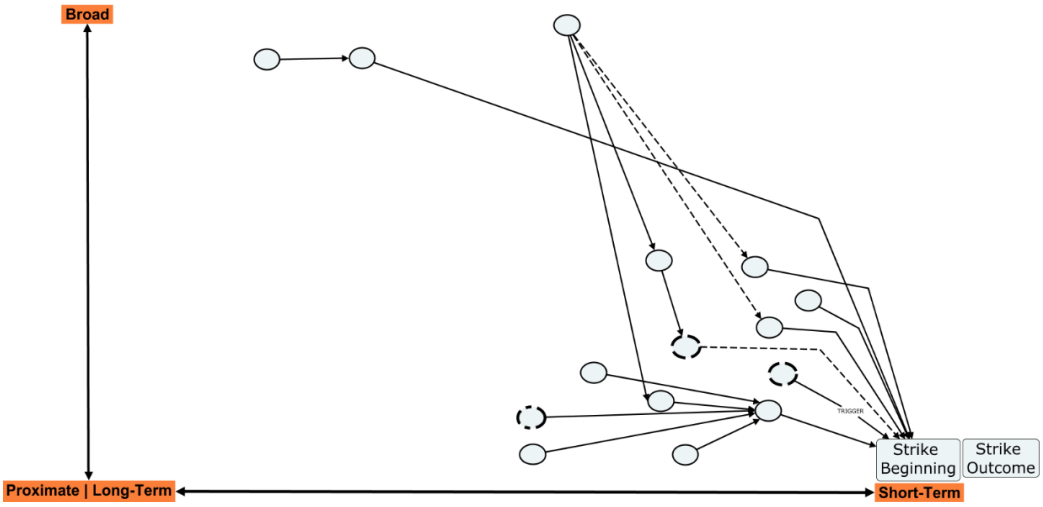
Three Problem Framing Approaches: Avery, Ren, and Robert

Although seven students worked on the Pullman Strike problem (Task 1), I limit discussion in this and the following chapters to three students, Avery, Ren, and Robert. Since each constructed a distinct problem space, I treat these as *cases* of student thinking. While each

case was unique, I did not see and do I argue that any were objectively more or less expert, more or less sophisticated, or more or less useful. Nor am I claiming these as stages in developing student thinking. Rather, this chapter is surfacing the kind of thinking these students could do when prompted to make time to think about a problem. For example, Avery framed her problem space quite narrowly but with multiple, often contingent, interconnections between causal factors. In contrast, Robert framed a wide, narrative problem space with fewer interconnections. Finally, Ren framed a problem space that fell in between these two, employing nested scales and surfacing a moderate number of interconnections. Though I discuss each in detail later in this chapter, Figures 15 through 17 highlights these differences in the ways students constructed problem spaces in responding to the same task. In the figures, the X axis represents time to the event, from long-term to short-term. The Y axis represents spatial distance from the event, from proximate to broad. Each of the dots represent a causal factor students identified in the first part of the task (the bolded dots represent factors they identified as "most important").

Figure 15

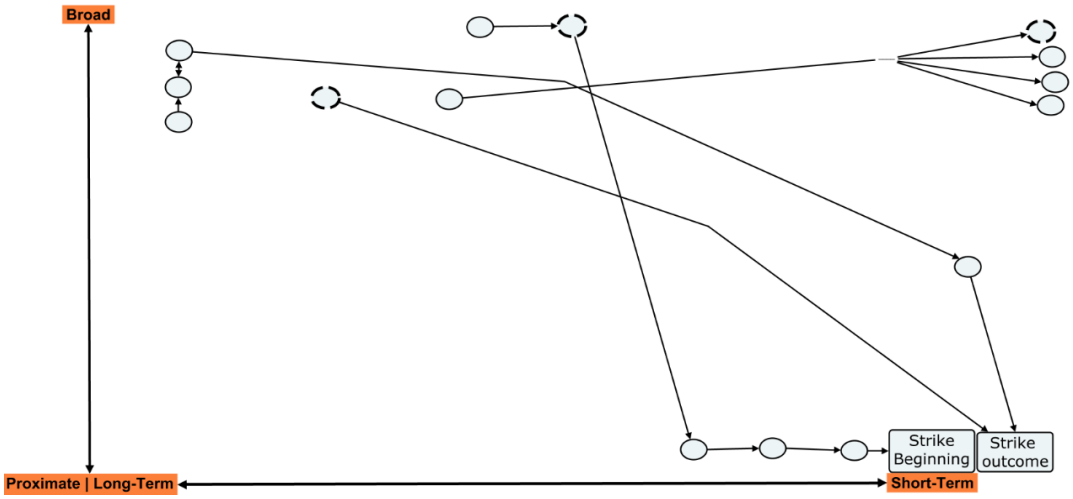
A Map of Avery's Task 1 (Part 1) Problem Space



As show in the diagram, Avery mostly identified causes close to the strike in time and space. However, she established several interconnections between causes.

Figure 16

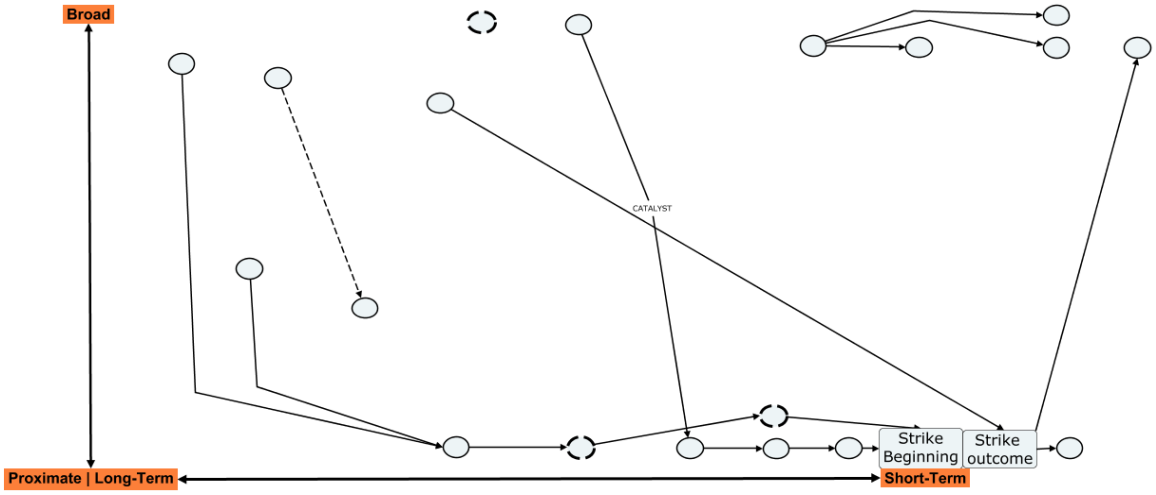
A Map of Robert's Task 1 (Part 1) Problem Space



In contrast, Robert identified mostly broad scale or long-term causes, but with fewer interconnections than Avery did.

Figure 17

A Map of Ren's Task 1 (Part 1) Problem Space



Falling between Avery's and Robert's representations of the problem, Ren used several short- and long-term causes as well as several proximate and broad causes. Compared to Avery, he also identified fewer interconnections.

While these overviews suggest high-level differences among the students program framing, the distinctions resides in the details that I discuss in what follows.

Framing a Narrow, Agentic, and Highly Interconnected Problem Space (Avery)

Avery began the task by dividing her brainstorm into two sections: "what I need to know," which included five questions, and "what I know," which included two statements of fact and "2 possible trigger events." In the second part of the brainstorm, she added three additional questions about the strike (Figure 18).

Figure 18

Avery's Pullman Strike (Task 1) Brainstorm

[Page 1: Initial Brainstorm]

What I need to know

- Were the wages fair before they were cut in half?
- Did the company have justifications or reasoning for firing the specific 3 workers?
- Was it mathematically possible for the works to pay rent and buy necessities for life? (food, water, etc.)
- How hard was the workers jobs and how long were their workdays?
- How long did the wage-cut last before workers decided to go on strike?

What I know

- I know how drastic the wage cut was (50% lower)
- I know 2 possible trigger events
    1. The wage-cut
    2. The firing of the 3 workers
- I know they kept the rent prices the same

[Page 2: Additional Questions]

- How did the Panic affect the workers besides the wage cuts? (were prices of goods higher or lower)?
- What were the workers' end goal for the strike?
- Was there any other way the company could have saved money besides cutting

She began the interview with the following:

> Okay, so the first thing I thought I needed to know was "*were the wages fair before they were cut in half*?" because I thought that might contribute to like a

> long-term cause where [the workers] were already frustrated with wages, and then the wage cut set them off as a short-term cause.

Though she did not use these terms in her written brainstorm, in her verbal response, she frequently categorized causes as "short-term" and "long-term." She also explicitly considered the role of time in identifying causal roles or explaining causal significance. For example, Avery explained that the duration of the workers' wage cut had implications for the *trigger* of the strike.

> Avery: [reading from her brainstorm] "*how long did the wage cuts last before workers decided to go on strike*?" I basically just said that because I had two possible short-term causes—and it could be both—but I also just want to know exactly how long, because it would show which one was more likely the trigger event: the three workers being fired, or the wage cut.
>
> Researcher: How would that show which was the more likely trigger event?
>
> Avery: If the wage cut lasted a while and then they [the workers] went to talk about the problems—hold on, let me think about how to say this—I'm leaning towards the workers being fired is the main trigger event because the wage cut had happened, and they didn't automatically decide on a strike. They decided to just go to the business about their problems. So, I just wanted to know how long that lasted. But now that I'm saying it out loud, I'm thinking it's more likely that the firing of the workers was the trigger event, the main one at least.

After considering the chronology of events, Avery reasoned that the wage cut was the less plausible trigger event because another significant event occurred between the wage cut and the strike: the workers' decision to "go to the business about their problems."

Despite her explicit use of temporal categories and attention to *time*, Avery framed a relatively narrow problem space compared to other students in the study. She only referred to two factors that I coded as long-term and broad-scale: the existence of "unfair…labor practices" and "inspiration from other strikes and unions." When I asked her which three factors "would be most important to include in your exhibit?," Avery selected two short-term, proximate factors and one temporally ambiguous, but spatially proximate factor ("Were the wages fair before they were cut in half?").

Within her problem space, Avery focused heavily on agentic actions and properties. She discussed factors like the "workers' end goal for the strike," the workers' feelings of frustration, and whether the company had "justifications" for firing the initial three workers. She also frequently talked about choice—such as the workers' choice to strike or not to strike and the company's choice to fire or negotiate with striking workers. For example, she argued that industrialization and low regulations (Factor 2) made it "so the businesses could be like selfish… and make as much profit for themselves and just not care for workers." In response to the newspaper coverage (Factor 3) and Pullman's Tribune statement (Factor 4), Avery argued that they were both "trying to make it seem like it was the workers' fault." However, when I asked her what effect that might have, she offered a more general, socio-political framing:

> Avery: I think it would definitely make it harder for the workers to actually achieve something, because I feel like the audience of those newspapers would be wealthier people…
>
> Researcher: … why does that matter?
>
> Avery: Well, from what I learned in history, whenever there's like a problem—and I don't know if this really connects—for example, like racial problems,

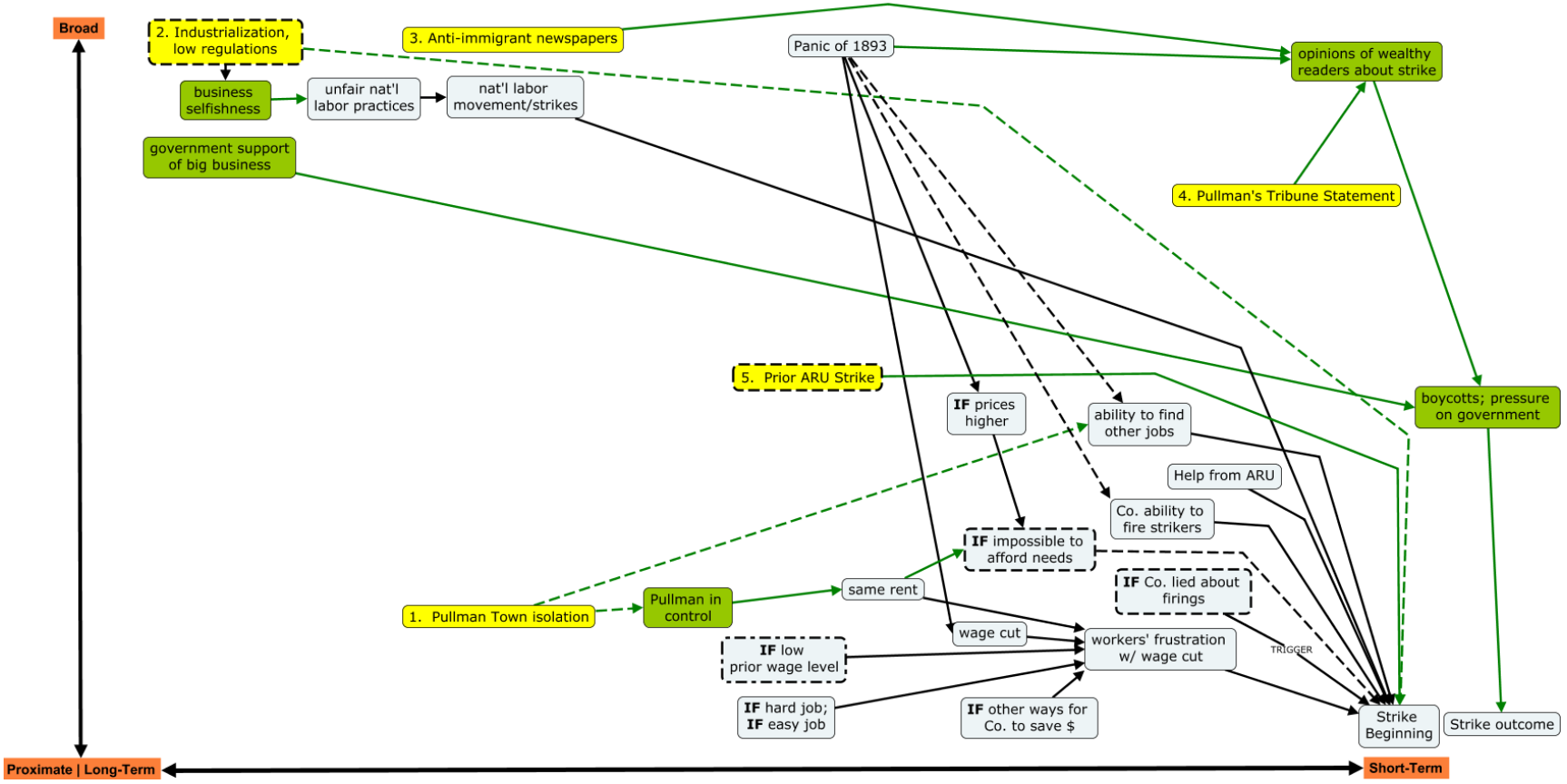
> eventually wealthy people also started to advocate against or go against the racial problems. So, it's like once all the different classes, I guess, start to go against something, it really, really starts to make a difference…

Previously Avery had only considered "wealth" in economic terms, such as workers' ability to buy necessities. In this exchange, Avery implied that "wealth" is also a type of political capital that can influence the outcome of social movements. In general, the structures Avery considered tended to be specific economic structures, such as the current wage level, working conditions, and prices in Pullman Town. The only other general structure she surfaced was the existence of the labor union movement, which she thought may have provided some "inspiration" for the Pullman strikers.

To see how Avery related these different causal factors, I constructed a diagram of her problem space (Figure 19).

Figure 19

Researcher-Created Map for Avery's Pullman Strike Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

As shown in the diagram, Avery considered a wide variety of causal roles. She also used relatively precise language to describe those roles. She identified a host of *influencing* causes that made the strike and its outcome "more likely" or "less likely." These included factors like "how hard [the workers] worked" or the degree to which workers could "buy things that they needed." Avery also identified multiple factors as *enabling* or *constraining* workers' or Pullman's choices. In the following exchange, for example, I asked Avery to clarify how the lack of jobs during the Panic of 1893 (a factor she had previously mentioned) might have impacted the likelihood of the strike:

> Avery: I guess it could be less [likely] because they don't want to get fired, but in this case, I think it's *more* because if they all collectively know that that they have no other option and they all collectively make a move, then it's more likely to get a result. And they [the company] can't really just fire—I mean, I guess they could fire everybody since people are looking for jobs—but that would be a really big hassle, and also the company itself is struggling too.

Here Avery identified two opposing conditions that shaped the workers' choice of whether or not to strike. Avery explained that the workers "don't want to get fired" because jobs are scarce, but, if they cannot survive on their current wages, "they have no other option." She ultimately decided that this latter condition was more salient. Avery also identified the economic conditions of the time as both enabling and constraining the company's ability to fire striking workers. This choice was enabled by the fact that "people are looking for jobs" but constrained by the fact that "the company itself is struggling too."

As discussed above, Avery identified two possible "trigger events" for the strike and used chronology to reason about the most appropriate one. To better understand Avery's

conceptualization of the role of a trigger event, I asked her a counterfactual question: "Would the workers have gone on strike if it wasn't for the three workers being fired?" She responded, "I think they would have [struck] still if the company just disregarded their needs because, again, if they were unable to buy necessities, they obviously had to do something more extreme than talking about their problems." Here she implied that the workers' ability "to buy necessities" was the necessary condition that gave rise to the trigger event.

Perhaps most unique to Avery's response was her identification of *conditional* roles. She considered the conditional effects of a host of factors like how "fair wages were before they were cut," the company's "reasoning for firing those three workers," workers' ability to "pay rent and buy necessities for life," the difficulty of finding other jobs, and whether "there was another way that the company could have effectively saved money, besides cutting wages." In the following example, Avery considered the effect of wages on the strike to be *conditional* on the length and difficulty of the workday.

> [Avery reading from her brainstorm] "*How hard was the workers' jobs and how long were their workdays?"* I think the wages, depending on how hard they worked and how long they worked, is also a big factor, because you know if they're getting paid really little for an easy job—which I'm pretty sure it wasn't—but then it would be a little bit less likely, or make less sense, to have a strike if they weren't doing as much work. But if they're putting like a bunch of physical work and mental work for the job and staying there for long hours, then it'd be more likely for them to strike and be a bigger cause.

Here Avery identified the magnitude of a causal relationship (i.e., the effect of wages on the likelihood of a strike) as conditional on another factor (i.e., the job's demands).

Overall, Avery constructed her problem space by adding and integrating factors to her increasingly complex causal explanation. Unlike Robert, she did not appear to surface an overarching narrative to interpret causal factors. Instead, she connected multiple factors directly to the strike, situating these factors within an intricate web of indirect causes, some of which played multiple, even counteracting roles. For instance, Avery determined that if the Panic of 1893 increased prices, "it would be even harder…to buy things…So, that would make it even more of motive to go on strike." Yet, at the same time, she considered that the Panic might have made it "harder to get jobs," which she considered to increase the likelihood of Pullman firing workers, thus increasing the risk of striking. Avery also tended to integrate the provided factors into her existing problem space. For instance, Avery related Pullman Town's isolation (Factor 1) to issues of prices and job availability she raised earlier.

> I think that [Factor 1] is important because…[the Pullman Company] kind of controlled the rent and the prices of things. …Again, it went back to like it was nearly impossible to provide everything [the workers] needed for life. And also, because they're all isolated, I think that might affect getting alternative jobs, like I said with the Panic [of 1893].

In this response, Avery identified Pullman Town's isolation (Factor 1) as exacerbating the Panic's effect on job availability.

Avery used several additional reasoning processes to establish or justify her problem space. In the following, she identified a possible *indicator* of workers' prolonged discontent.

> Researcher: You also wrote "*What were the workers' end goal for the strike*."
>
> Why did you write that one?

> Avery: …So, was their end goal just to get the wages higher or was it even more than that? Was it to get wages higher and better conditions or like shorter workdays?
>
> Researcher: Would an answer to that question help you to better understand what caused the strike or how the strike unfolded?
>
> Avery: I think maybe because if the end goal was to get like shorter workdays too, then you'd know that these problems started even before the wage cuts because that [the length of the workday] didn't change as far as I know.

Here she argued that the existence of workers' other goals might indicate a *continuity* in worker discontent that dates before the wage cut. In this and several other instances, Avery identified change and continuity over time (CCOT) to make sense of the complex interaction of causal forces she considered.

Avery also made two past-present *comparisons*. For instance, in explaining the implications of lax Gilded Age regulations (Factor 2), she stated, "nowadays, for example, there's a minimum wage… but back then, there was little to no regulation, so the businesses could be selfish." Avery made this past-present comparison to underscore that lax regulations *enabled* the "selfish" business practices of people like Pullman. Finally, as discussed above, Avery raised a historical *generalization* about how the support of wealthy people for social causes often leads to major changes. She then used this generalization to reason about how damaging the newspapers' anti-immigrant and anti-radical stances (Factor 3) might have been for the workers' goals.

Overall, Avery framed a narrow, agency-focused problem space that was multicausal, highly interconnected, and contingent.

Framing a Nested Problem Space, Balancing Agentic and Structural Causes (Ren)

Ren began the task by writing down a series of questions that he wanted to investigate (Figure 20).

Figure 20

Ren's Pullman Strike (Task 1) Brainstorm

[Page 1: Initial Brainstorm]

- What was the Panic of 1893[V] What overall trend did this represent economically
- What conditions before the strike/cutting of wages, did the workers complain about
- Using what sort of business practices did Pullman use to come to power? (i.e. Taylorism?)
- What was a day to day operation/life like for a worker?
- What was the list of grievances?
- Did Cleveland ever use his authority in a similar way before?[^] or after
- What was Eugene Debs charged with and how did the court rule?
- How was this event covered in the press?
- Did Pullman give any anecdotal rationale for not meeting with the workers?
- How did the strike impact labor laws in the future?
- How did Pullman's operations/ hiring change after the incident?
- Did similar strike happen during this time period?
- How did this impact other unions at the time?

[Page 2: Additional Questions]

- What economic conditions led to a place where LUXURY car were being produced?
- How did GMA effect future strikes?

Like Avery, Ren made explicit verbal references to causal temporality, identifying "long term and short-term causes" and "catalysts." However, unlike Avery, Ren framed a nested problem space, situating smaller-scale causes (e.g., "cutting of wages") within broader historical developments (e.g., "the Gilded Age", the labor movement, and "economic conditions" prior to 1893). His selection of "most important" causes reflected a mix of factors from different positions in time and space. Ren also further expanded his problem space by inquiring into

developments that occurred years after the strike and by considering how small-scale developments might hold information about larger-scale phenomenon. For example, Ren explained that he wanted to investigate newspapers' coverage of the strike as a "kind of gauge what was the public opinion at the time."

Ren also identified historical significance at *both* the level of the strike itself and the context that surrounded it. For example, Ren wanted to track down the workers' "list of grievances" because, he explained, "I feel like what I read [in the passage] gave an overall kind of arc of the strike itself. I wanted to get a little bit into more of what the workers want." Several minutes later, he identified the broader historical significance of that list of grievances.

> I feel like looking at all the things on the list [of grievances] might help us to understand other exhibits in the museum that are further down along the line. So, it's sort of planning ahead in terms of looking at the past, if that makes sense. Like maybe there's something in there like, "Hey, we want cleaner air emissions out in our factories because it's making our neighborhoods terrible" and that would be something that, you know, a kid could walk down three exhibits and say, "Hey, here's a strike on environmental regulations, and you know, while it wasn't popular, it was mentioned in this list at the Pullman Factory Strike"…

To Ren, uncovering the specific details of the workers' demands is important for understanding this particular strike and may also have implications for historicizing strikes "further down the line." Relatedly, Ren identified one of his factors, "similar events around the country in the time period," as one of the three most important, explaining that "while we might isolate one event, one event is usually an indicator of a larger movement in history." At the same time, he argued that knowing about "similar events" can help us to better understand the Pullman Strike.

Within his problem space, Ren made substantial references to agent actions and properties. He brought up workers' "grievances" and Pullman's "character" and "business practices." However, Ren often contextualized agency in more general, socio-political structures.

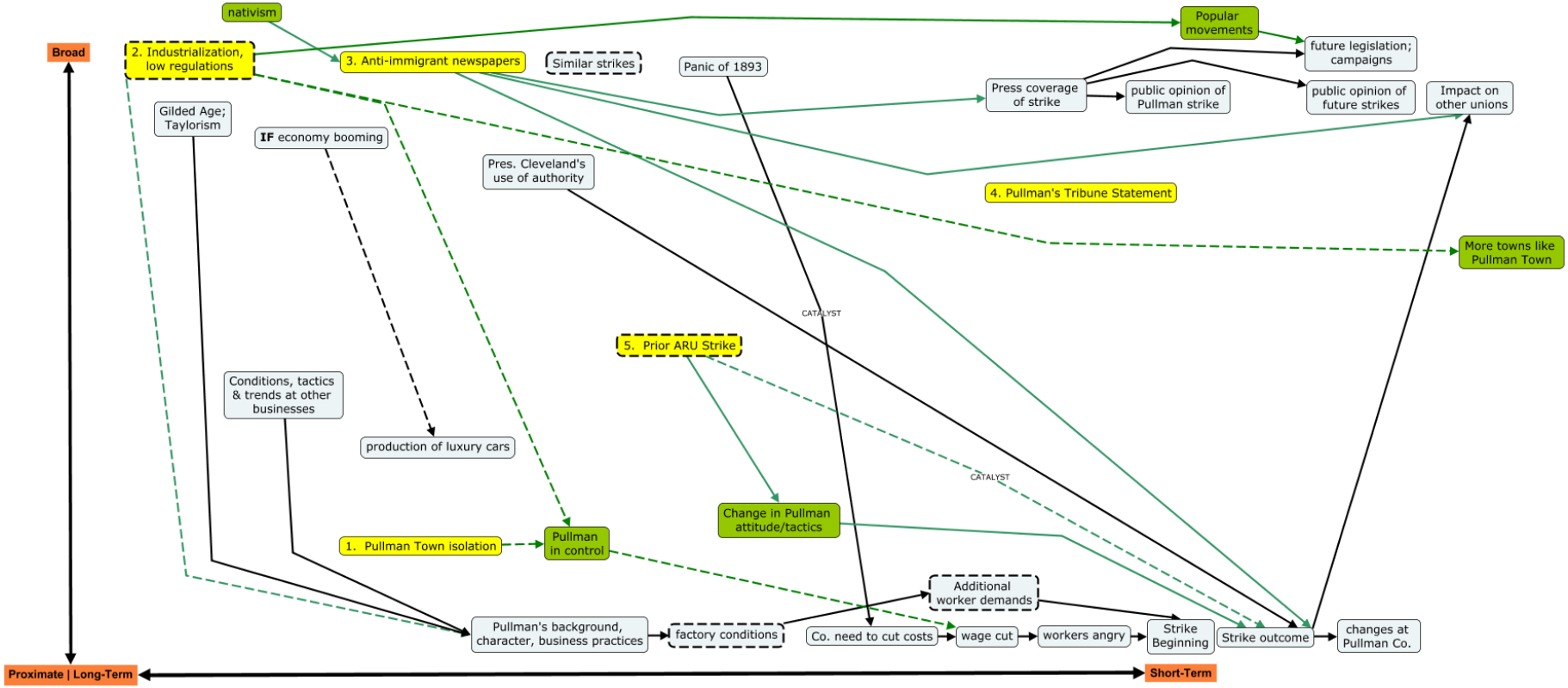
> Researcher: You wrote: "*What sort of business practices did Pullman use to come to power?*" Tell me a little bit about that one.
>
> Ren: I was thinking, you know, Gilded Age stuff, like the effects of kind of Taylorism, that scientific manipulation of workers and making them more efficient, because sometimes that led to business practices that were not the most ethical and put stress and strain on the workers themselves. So I wanted to know what was Pullman known for in his businesses? It seems like he was a wealthy person, how did he get there? What sort of businesses did he start off with? What were conditions like in his factory? What sort of visions or ethics did he impress upon, you know, those factories? So, I feel like that was important to know—more like a character thing, you know, for this exhibit. It'd be important to know, if you want to put an antagonist, you got to know what kind of guy this guy was.

In this instance, Ren used contexts like the "Gilded Age" and "Taylorism" to establish lines of inquiry about Pullman's practices and character. At other times during the interview, he used agentic actions to inquire into broad structures. For instance, Ren considered whether Pullman's statement to the Tribune (Factor 4) might indicate "a larger trend of business owners at the time."

To see how Ren related these different causal factors, I constructed a diagram of his problem space (Figure 21).

Figure 21

Researcher-Created Map for Ren's Pullman Strike Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

In explaining his initial brainstorm, Ren identified primarily *influencing* causes that "led to" or "impact[ed]" the strike. However, he also explained that "the Panic of 1893 feels like a *catalyst* to Pullman cutting the salaries which is obviously the short-term cause of the strike." In this statement he intermixed causal roles ("catalyst) and temporal categories ("short-term"). He also identified Eugene Deb's previous success with the ARU (Factor 5) as another "*catalyst* to the strike." Near the end of the interview, he identified the lack of regulations (Factor 2) as a significant factor in *enabling* Pullman's business practices.

> It [Factor 2] sets up the stage for why the strike happened in terms of explaining the broader historical of context of how we got to the point where Pullman has this sort of business practice, how he has a railroad luxury car [company], and how he has workers living in a sort of manmade, factory-village—that sort of business practice—and, obviously, the conditions that the workers are in. Factor 2 encompasses all that sort of larger, long-term build up to this event.

Here Ren tied together time and causal roles, connected enabling conditions to the "long-term" developments preceding the strike. Overall, however, he tended to use fewer and less precise causal roles than Avery.

Ren initially organized his problem space as a short-term chain of events: "[the] Panic [of 1893] happens, you have to cut down business costs, you cut the employees' wage, they get mad, they go on strike. It's kind of a dominoes thing." But after laying out this chain events, Ren spent the majority of interview discussing the historical context surrounding it. He seemed to discuss these contexts as factors rather than part of an overarching historical narrative, as Robert did. Sometimes he raised lines of inquiry that did not seem causally connected to the strike at all:

Researcher: You wrote, "*How was the event covered in the press*?" Tell me why that is significant.

Ren: So, I think the reason I want to investigate that question in order to make an exhibit is to really kind of gauge what was the public opinion at the time...

Researcher: Is there any causal effect of the newspapers in your mind?

Ren: yeah…depending on who wrote it, who this author was, if newspapers were a large source of information for many about the strike, it could impact again how the public felt about the strike and would lead to, you know, the actions they took regarding future possible legislation or possible campaigns or just their general opinion on unions and strikes…

Here Ren considered how media coverage might have affected public opinion of the strike but did not link public opinion to the strike's direct outcome. Instead, he focused on how public opinion might have shaped future legislation or political campaigns. Mostly, however, Ren put the Pullman Strike at the center of his problem space. This was not the case for Robert as will be discussed in the next section.

Finally, Ren used several additional reasoning processes to establish or justify his framing of the problem. For instance, he frequently identified *indicators* to expand his problem space:

I see that Pullman incident and I see that Pullman factory and the town where he controlled everything as sort of…what could have happened if the government eventually didn't step in and at least regulate a little bit, … an indicator.

In using this indicator, Ren expanded the scope of the problem space from Pullman Town to labor relations more broadly. On two occasions, Ren used hedging language to temper the

generalizability of his indicators. For example, he explained that he wanted to investigate newspaper coverage of the event to "gauge…public opinion," but clarified that "newspapers are also sort of corporations [and] are not always great indicators of how the American public felt."

Ren also made historical *comparisons* to expand the scope of his problem space. For example, he compared the press coverage of the 1877 San Francisco riots to the press coverage of the Pullman Strike (Factor 3) in order to support the *generalization* that "the press, in some eras of history, often pinned all their problems on immigrants or political radicals." Ren then used this generalization to reaffirm a previous line of inquiry: "So Factor 3 definitely makes me want to consider what, again, the newspapers were writing about and, again, how the public perceived this event as a result of what the newspapers were putting out."

Finally, Ren identified CCOT to conjecture about causes and causal roles. For instance, he explained that Pullman's manufacturing of luxury cars likely indicated a "booming" economy ("you know, you only make luxury cars when times are good"). He then cited the sudden end of this "booming" economy as why he wanted to investigate the "societal impact" of the Panic of 1893. He also explained the ARU's previous success (Factor 5) as an indicator of a continuity, that "strikes, in general, are not new, especially in the railroad industry." This continuity led Ren to conjecture that "Pullman would have likely known about people who strike or events like this that happened, and he might have been better prepared for that."

Overall, Ren framed a nested problem space that situated agentic action within both specific and general socio-political structures.

Framing a Wide Problem Space Around a Structural Causal Narrative (Robert)

Robert began the task by dividing his brainstorm into three temporal categories: "before," "during," and "after." Each section consisted of two to three declarative statements (Figure 22).

Robert explicitly used these temporal categories to structure his verbal explanation of his brainstorm.

Figure 22

Robert's Pullman Strike (Task 1) Brainstorm

[Page 1: Initial Brainstorm]
Before: - 1800's America had seen failed attempts at unions before (steel ind. Carnegie as Focus)
- Federal resistance due to political ties

During: - Economic panic had caused layoffs + lower wages
- Many workers unable to afford rent
- Created unions to Battle unfairness, saw workers coming together
- Put down by Feds

After: - Unions seen gaining more traction as more + more appeared
- Feds sought to protect workers after Progressive Era left distaste w/ large businesses
- Now businesses have to abide by unions + other laws that improve working conditions

---

[Page 2: Additional Questions]
Questions:
We often saw the Federal Government side with large businesses. Why was this?
What was the cause of the Panic of 1893?
Were any Pre-Progressive Era unions successful?

Robert started the interview by explaining the "context" of the strike, which included previous failed attempts at unionization and strong business-government relationships. I then asked Robert, "Why is that context important if you're going to create an exhibit?" He responded,

> I feel like it would help people kind of better understand [the strike] because, you know, you could just like say this is what happened, but that's—especially like some of the stuff we've been talking about in class—that's just memorizing a term and regurgitating it back. It's not really an understanding of what's

happening. So, by going back a little bit, you can just kind of see how things started to form like, "Oh, I can see the connection here," rather than just yeah, "the Panic of 1893 caused this."

To Robert, "going back a little bit" makes history meaningful by revealing connections between what might otherwise be an array of historical "term[s]." He also implied that long-term causes are needed to uncover "how things started to form."

This attention to the big picture characterized Robert's response to the task. He discussed nearly three times as many broad scale factors as he did proximate ones, and he referenced twice as many long-term factors as he did short-term factors. Furthermore, the three factors he considered "most important" were all either long-term or broad scale ("the Panic of 1893," "the steel industry unions," "Progressive Era changes"). Like Ren, Robert expanded his problem space by discussing events or developments that occurred after the strike.

Robert also tended to focus on general, socio-political concepts and structures, such as the pro-business orientation of government, business influence over government, the union movement, and the "Progressive Era." He surfaced some specific economic structures, such as rent, wages, and layoffs. On the occasions that he referenced agents, he tended to refer to large institutions or groups of people. For example, he wrote in his brainstorm "*We often saw the Federal Government side with large businesses. Why was this*?" When I asked Robert why he had written this question, he explained,

Robert: … I had trouble choosing the right words to say it, so what I really wanted people to know—what I thought people would be questioning is like, hey, this is the American government right? We stand for the people, by the people, you know? So why is our freedom-loving government attacking its own people

> and siding with, I guess, a tyrannical business, right? That doesn't make much sense. So, I feel like that would be something people would want to understand.

In considering the agentic properties of the federal government, Robert surfaced an abstract structure: that people in the present hold certain normative ideas about government. This sets up a dissonance between present expectations and past actions that Robert believes museum goers would be interested in learning more about.

In another example, Robert used a broad socio-political structure to contextualize Pullman's Tribune statement (Factor 4).

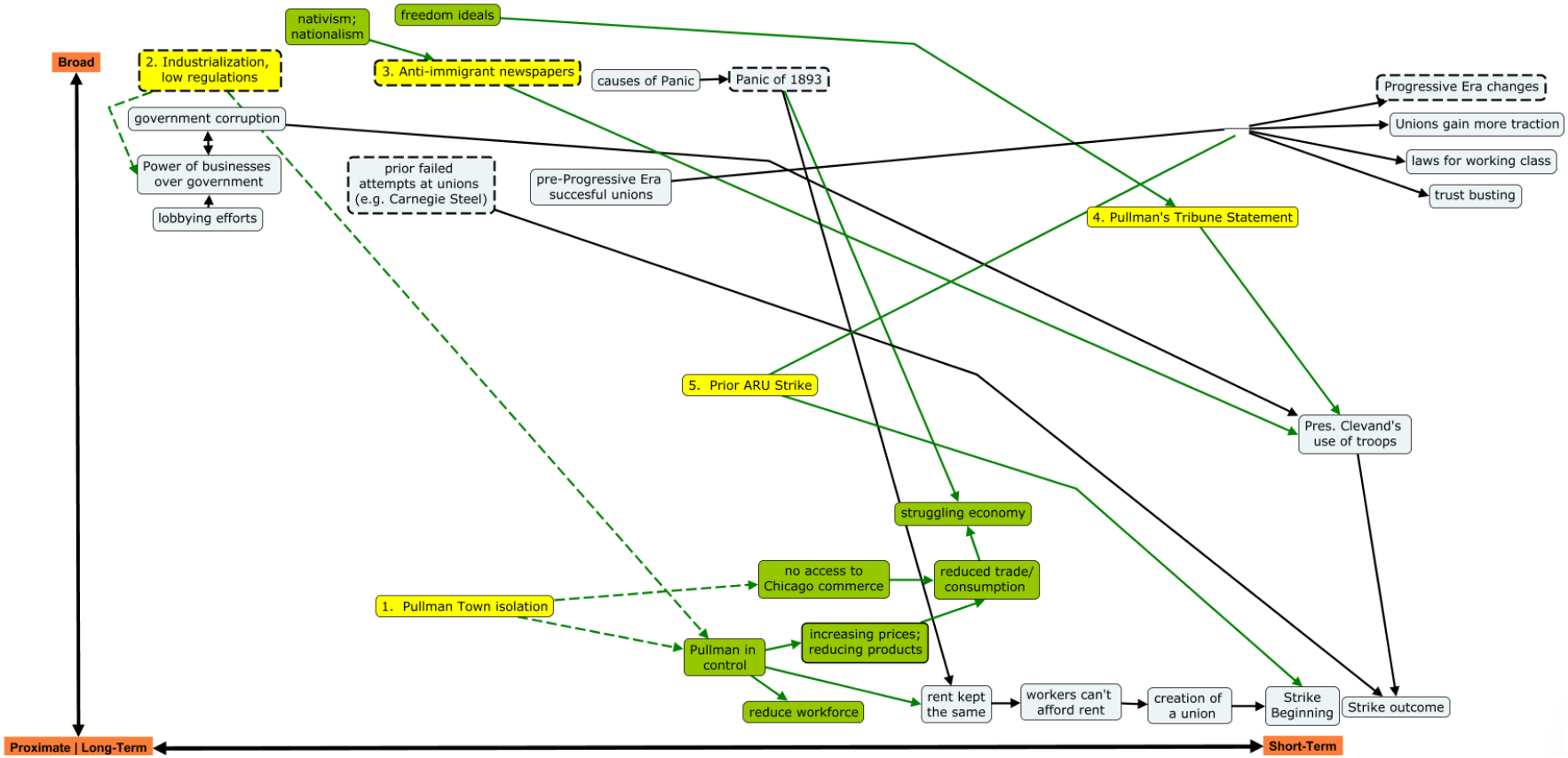
> [Pullman's] trying to engage that anger in American citizens as—especially back then, but now you see it too—Americans, we are very protective of our freedom ideals, and we see America going to war over democracy—especially the Cold War was literally about the battle of two ideologies and necessary rights to freedom listed in the Constitution and the Declaration of Independence. So, I would definitely be fine with mentioning this [factor], showing like the crafty ways that attempts were made to put strikes down by the business owners.

Here Robert surfaced a broad assumption about U.S. political culture that he used to conjecture about Pullman's intention in framing strikers as anti-American. This is similar to how Ren used ideas about the Gilded Age to inquire into Pullman's character.

To see how Robert related these different causal factors, I constructed a diagram of his problem space (Figure 23).

Figure 23

Researcher-Created Map for Robert's Pullman Strike Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

As is shown in the diagram, Robert mostly identified *influencing* causes. He also tended to use relatively tacit causal role language. For instance, Robert discussed the influence of business power over the outcome of the strike in the following way: "The federal government was definitely like a lot more corrupt back then as larger businesses had that much power over what happened as you see federal forces mobilizing to strike down workers." In this statement, he implied causality without the use of overt causal language, something Fitzgerald (2014) refers to as an "causal asyndetic construction" (p. 2). Relatedly, Robert often used the ambiguous term "context" to imply causation.

There were some instances where Robert appeared to identify causal roles other than influencing roles. For instance, Robert explained that he wanted to investigate "*Were any Pre-Progressive Era unions successful?*" because "it'd be good to know just in case any major events were to happen that could get the ball rolling [toward Progressive Era reforms]." The "ball rolling" implies that one or more strikes during this time might have served as a *catalyst* for the series of events that led to the Progressive Era. Robert also identified the Panic of 1893 as either a trigger or catalyst for the Pullman Strike, explaining it as the event that "caused this whole thing to happen." Finally, he identified the lack of regulations (Factor 2) as an enabling cause, explaining that it "*allow[ed]* [the Pullman Company] to…do whatever they want."

Robert appeared to establish a problem space that nested a proximate chain of events (similar to Ren's) within a broader historical narrative. He described this initial chain of events in the following way:

> [T]he Economic Panic had caused layoffs and lower wages… [the reading] stated that it left many workers unable to afford rent…because the landlords didn't want to decrease prices. So, we saw the creation of

> unions to battle the unfairness that businesses owners had… when dealing with workers and their issues. And we saw [Pullman] workers coming together and, eventually, it was put down by Grover Cleveland and federal resistance.

However, for most of the interview, Robert framed a broad narrative of labor relations that spanned from the failures of strikes in the 1800s to Progressive Era reforms in the early 1900s. At times, the Pullman Strike no longer seemed to be at the center of Robert's problem framing. Robert even recognized this tendency, stating, "I'm kind of noticing I push a little bit towards the Progressive Movement, but sometimes I drop it." Overall, Robert seemed to frame the Pullman Strike as just one of several 19th-century strikes (like "the steel industry and Carnegie" strikes) that either worked to facilitate or inhibit the coming reforms of the Progressive Era.

Although Robert established a primarily linear narrative, there was some evidence of more dynamic causal relationships in his response. Discussing Pullman Town's isolation (Factor 1), Robert explained, "…it's probably safe to assume that [Pullman Company would] be that frugal with [Pullman Town] businesses, maybe increasing prices and reducing products, which also were decreasing economic consumption and just kind of spiral the whole thing, making things worse." In this line of reasoning, Robert appeared to identify a *positive feedback loop* between Pullman Town's isolation and economic struggles.

Finally, Robert used several different reasoning processes to establish or justify aspects of his problem space. For example, Robert *compared* business-government relations in the past and present to underscore corruption as an influencing factor during the late 1800s.

> …The federal government was definitely a lot more corrupt back then, as larger businesses had that much power over what happened as you see federal forces

> mobilizing to strike down workers. And as today, right, you wouldn't see any of that happening, so it's become a lot more reformed.

As mentioned earlier, Robert also made a past-present *comparison* and *generalization* to explain the intention behind Pullman's Tribune Statement (Factor 4 ("[Pullman's] trying to engage that anger in American citizens as—especially back then, but now you see it too—Americans, we are very protective of our freedom ideals"). Lastly, Robert expanded his problem space by identifying Pullman's Tribune Statement (Factor 4) as *indicative* of the "crafty ways" business leaders at the time acted to put down strikes.

Overall, Robert framed a wide, narrative problem space that mainly focused on broad, socio-political structures.

The Features of Students' Pullman Strike Problem Spaces

To summarize, the three students, Avery, Robert, and Ren, framed distinctive problem spaces reasoning about the causes of the Pullman Strike. Avery framed a narrow problem space comprised of agentic actions and properties and specific economic structures. She also identified various causal roles, including conditional roles, to establish a highly interconnected and contingent problem space. In contrast, Robert established a wide problem space comprising mostly abstract structures and historical contexts. He also situated the Pullman Strike within a large-scale, historical narrative spanning the 19th-century steel industry to Progressive Era reforms. Compared to Avery, he used fewer and less explicit causal roles and did not establish as many interconnections between causes. Ren's problem space fell between Avery's and Robert's. He framed a nested problem space comprising agentic properties and specific and general structures. He also contextualized a small-scale narrative of the strike within broader historical developments (e.g., "Gilded Age", "Taylorism"). Overall, he tended to use more precise causal

roles than Robert, but compared to Avery, he established a less precise, interconnected, or contingent problem space.

Despite establishing distinct problem spaces, the students used similar reasoning processes to justify causal claims or lines of inquiry. For example, all three compared past and present to underscore the significance of attitudes toward labor or the lack of regulations in shaping the Pullman Strike. Additionally, all three identified some change or continuity over time to identify a cause or causal role.

Finally, all three students used explicitly temporal language and concepts to frame the scale of their problem space. Avery and Ren both used the terms "long-term" and "short-term" to characterize causes and make claims about causal significance. Robert explicitly used chronological categories ("before," "during," and "after") to organize his brainstorm.

Though their representations were distinctive, I also identified several interesting patterns in how students framed different elements of the problem space, including the ways students connected scale and agency/structure, connected agency/structure and causal roles, and connected scale and the complexity of the problem space.

Relationship Between Scale and Agency and Structure. In general, *agency* seemed to play a clearer and more significant role in the narrower parts of students' problem spaces. This did not come as much of a surprise. Short-term, proximate events usually have more readily identifiable agents with specific intentions and subjectivities (e.g., *Pullman workers* decided to strike because they were *angry* with the wage cut). This may be why Avery, who constructed a relatively narrow problem space, tended to frame the problem around agentic intent. On the flip side, students like Ren and Robert, who considered factors further afield in time and space, were more likely to frame the problem in terms of social and political structures. This is not to say that

one could not construct an account identifying long-term agentic causes or consequences. However, as Carr (1961) and Evans (1997) have argued, the explanatory power of individual actions, in the long run, tends to pale in comparison to that of historical trends and structures.

Furthermore, the narrow parts of students' problem spaces tended to comprise more specific structures and the wider parts tended to comprise more general structures. Again, this may be why students like Avery, who framed the scale of the problem narrowly, tended to also focus more on specific structures than general structures. This relationship also seems intuitive as specific structures always exist in a more well-defined position in time and space than the general structures that bind them together. Ren, for instance, saw Pullman's business practices (*specific, short-term*) in the context of the Gilded Age (*general, long-term*). The same was true for Robert's discussion of the Pullman Strike and the pre-Progressive Era labor movement.

Lastly, the narrower parts of students' problem spaces seemed to align mostly with one structural classification (in this case, an economic framing), whereas wider parts of students' problem spaces often contained additional structural framings, such as political or social framings. Students may have drawn on these additional framings to provide a broader context for the passage's short-term, economic focus.

Relationship between Agency and Structure and Causal Roles. Among the three students, there appeared to be some connections or tradeoffs between how abstractly they framed their problem spaces and their identification of causal roles. Avery, who tended to frame the problem around human agents and specific structures, also tended to use more precise role language and identified a greater variety of causal roles, including conditionals. Robert, who tended to frame the problem relatively abstractly, used fewer and underdefined causal roles. One potential explanation for this is that the more well-defined the content of the problem space (i.e.,

the more agentic actions and specific structures), the easier it will be for students to explain the precise role of causal factors. Likewise, it might be difficult for students to ascribe precise causal mechanisms to more general causes. For example, concepts like "political power" or "capitalism" may eschew precise causal explanations. This may be why Robert, and sometimes Ren, referred to these broad structures as "context" without assigning them precise causal mechanisms.

Scale and the Complexity of the Problem Space. Within students' problem spaces, the highest concentration of causal interconnections seemed to exist closer to the event in time. One explanation for this is that students understood the short-term events better because they were included in the provided text. Therefore, they were able to draw more connections between these events. Another explanation is that events in the short-term were more likely to be co-occurring and, therefore, have more multiple, dynamic causal relationships, such as feedback loops. Take, for instance, this short-term series of events: *Pullman Company is struggling, so they lowered wages, which caused more workers to quit, which led to lower profits, which the company compensated for by lowering wages again*. In a short-term series of events like this one, it may be easier to see the intricate, dynamic nature of causality. As causes are spaced further apart in time, there are perhaps fewer dynamic connections, or the connections are more challenging to observe.

Overall, there appeared to be important connections between different aspects of students' problem framing which may have implications for instruction and future research.

Students' Problem Spaces and Mr. Owens' Causal Instruction

A substantive challenge in educational research is determining the effect of teaching on learning. My research did not take up that question and thus does not allow me to make any

causal claims about the degree to which Mr. Owen's instruction "caused" changes in students' analysis of the Pullman case. However, I was interested if there was any correspondence in the way Mr. Owens represented causal thinking in class and how the students tackled the Pullman case. Below I discuss how the similarities and differences in students' responses and Mr. Owens' causal instruction.

Temporal Scale of the Problem Space. As discussed in Chapter Five, Mr. Owens focused most of his explicit causal instruction on supporting students to differentiate between short- and long-term causes. To do so, Mr. Owens engaged in various instructional practices, including the regular use of the wildfire analogy and a scaffolded graphic organizer.

During the time they worked on the Pullman case, all the three students used temporal language and concepts similar to Mr. Owens' instruction. Both Avery and Ren specifically used the phrases "short-term" and "long-term." While Robert did not use those terms, he used close synonyms, differentiating between contexts "going back a little bit" and contexts closer to, or "during" the event.

Additionally, Mr. Owens—both verbally and in written materials—stressed that long-term causes were generally of greater historical significance than short-term causes. I also found that the three students tended to discuss long-term causes as significant. Of the three, Robert addressed this most explicitly:

> …you could just say this is what happened, but that's—especially like some of the stuff we've been talking about in class—that's just memorizing a term and regurgitating it back. It's not really an understanding of what's happening. So, by going back a little bit, you can just kind of see how things started to form…

Robert's explanation seemed very similar to how Mr. Owens explained the significance of long-term causes. Although Ren and Avery did not express an explicitly metahistorical idea about the significance of long-term causes, they each brought up *time* or temporal categories in justifying the significance of a specific causal factor. For example, Avery argued that knowing about prior wages (which she considered a "long-term" factor) was "really important to know" because "if that was a long-term cause that's been happening over time, then the wage cut was a short-term cause." And Ren used the phrase "long-term" to justify his selection of the lack of regulations (Factor 2) as one of the most important factors, explaining that it helped show the "build up" to the event.

Nevertheless, the three students applied temporal concepts like "long-term" to different scaled causes and framed varying-sized problem spaces. The data in this study is insufficient to draw a causal connection between this finding and Mr. Owens' instruction. However, students' varied approaches may be related to the fact that Mr. Owens rarely provided strict guidelines for applying temporal concepts. Rather, he taught and reinforced the concepts using flexible heuristics, such as historical case studies and the wildfire analogy.

Agency and Structure. Compared to temporality, Mr. Owens was less explicit about historical agency. However, at several points during the year, he did suggest to students that structural-focused explanations tend to be more significant in history than agentic ones. He also stressed that students should try to contextualize the actions and beliefs of historical agents.

In completing the Pullman task, the three students emphasized agency and structure differently. Robert hardly discussed agents, focusing instead on broad historical developments. Avery focused the most on agentic actions and properties but also emphasized proximate structures that shaped agents' feelings and choices. Ren spent significant time talking about

agents but, unlike Avery, tended to contextualize agency against the backdrop of much larger, more abstract structures, such as "the Gilded Age." As a result, it is difficult to see a clear connection between Mr. Owens' instruction and students' framing of agency and structure.

In general, Mr. Owens was ambivalent about the role or significance of general and specific structures, tending to accept both types of causal explanations. In responding to the Pullman Strike case, some of the students framed the problem using many specific structures (e.g., Avery) while others used more general structures (e.g., Robert). Furthermore, Ren and Robert identified some general structures that Mr. Owens used in class, such as substantive concepts (e.g., "nativism" and "isolationism") and period concepts (e.g., "the Progressive Era" and "the Gilded Age"). They also identified general structures that I did not observe in class, such as "corruption," "media," and "public opinion." Additionally, students identified causes reflecting a range of structural classifications, but none of the students seemed to explicitly use structural classifications to reason about causes. Again, the data in this study is insufficient to make causal claims about instruction. However, students' varied approaches to framing agency and structure may be related to Mr. Owens' openness to different kinds of causal explanations.

Causal Roles. To varying degrees, the three students used much of the same causal role language I observed Mr. Owens using in class (e.g., "trigger," "context," "catalyst"). Similar to Mr. Owens' uses of these terms, the three students often tied causal roles to *time*. For example, Avery sometimes used "short-term" and "trigger" interchangeably. Ren and Robert often connected "long-term" causes to "conditions" and "contexts." However, all three students used *enabling* or *constraining* language that I did not directly observe in instruction. And, Avery used *conditional* language, which I also did not observe in Mr. Owens' instruction.

Organization of Causal Accounts. Mr. Owens provided students with two broad frameworks for thinking about the organization of causal accounts: the "causal web" and "analytical storytelling." These two frameworks seemed to aptly describe the students' problem spaces in the Pullman task. Avery created a problem space akin to the "causal web," surfacing multiple causal relationships between agents and structures, often without organizing events chronologically. In contrast, Robert's problem space was laid out the most like "analytical storytelling," tracing political and social developments over a large time period but ultimately lacking the level of interconnectivity found in Avery's problem space. Ren, again, fell somewhere in between.

Students' Problem Spaces and Previous Studies

It is difficult to situate these students' responses to this task to prior research in historical causal reasoning or even ill-structured problem-solving because this study, unlike most others, made problem framing the object of inquiry and not, as most others have done, the analysis of sources or proposing a conclusion (e.g., Stoel et al., 2015, 2017; Voss et al., 9984; Voss et al. 1994; Wineburg, 1991). This activity treated the Pullman Strike question as an ill-structured problem that students needed to think about rather than a well-structured task calling for students to produce a solution. Previous ill-structured problem-solving research notes that novices tend to shift quickly from developing an initial problem space to proposing solutions (Ge & Land, 2004; Rowland, 1992; Voss et al., 1983, 1991). The same cannot be said about students in this study because they were not actually required to propose a solution (in this case, design a museum exhibit). Therefore, the data does not show if students would have spent less time developing the problem space if the task was simply to design an exhibit.

Nevertheless, there are some elements of students' approaches that are comparable to prior research, such as students' thinking about scale, agency, structure, and causal roles, and their organization of causal relationships. On these elements, we can see that Avery, Ren, and Robert both conformed to and defied expectations in a variety of ways. For instance, in contrast to students or novices in other studies of causal reasoning (e.g., Nersäter, 2018; Voss et al. 1994), Ren and Robert constructed relatively wide or nested problem spaces. They also did not rely heavily on specific or agentic causal explanations as students have in other studies (e.g., Carretero et al., 1994; Jacott et al. 1998; Halldén 1986; Halldén, 1993; Voss et al., 1994). Avery's problem space did seem to conform to much of these previous findings. However, she also considered a high level of contingencies in her account, something students in other studies rarely seem to do (Lee & Shemilt, 2009). Lastly, all three established complex, coherent problem spaces which stand in contrast to students' causal accounts in previous studies (e.g., Lee, 2005; Masterman & Sharples, 2002; Carretero et al., 1991).

Discussion

My exploring students thinking about the causes of one historical event cannot prove or disprove any previous research on students' causal explanations or approaches to ill-structured problem-solving, nor did I intend it to do any such thing. However, the task facilitated a different kind of intellectual work not common in other studies of causal reasoning or problem-solving. Once engaged in thinking about the dimensions of the causal problem, rather than merely accepting the problem as given, these students demonstrated they could use temporal and spatial scale, agentic and structural causes, and varying degrees of abstraction to construct complex, but distinctive framings of the causes of this historical event. Table 10 summarizes these key dimensions of the students' problem spaces.

Table 10

Summary of Students' Framing of the Pullman Strike Problem (Task 1)

	Focal Participants		
Dimension	Avery	Robert	Ren
Temporal Scale	Narrow	Wide	Nested
Spatial Scale	Narrow	Wide	Nested
Degree of agency/structure	Mostly agentic	Mostly structural	Both agentic, structural
Degree of abstraction	Mostly specific	Mostly general	Both specific, general
Use of Structural Classifications	Factors from mostly one classification	Factors from multiple classifications	Factors from multiple classifications
Organization of the problem space	Expository	Narrative	Narrative
Complexity of the problem space	Complex	Complex	Complex

While different, each employed a range of concepts and contextual attributes to develop a complex representation of the causal features of the Pullman strike. If each shaped an investigation, likely each would seek out different sources and yield distinctive conclusions about the relative causes.

However, teachers, assessors, or researchers might miss the complexity, sophistication, and nuance of the students' thinking depending on how a curriculum, assessment, researcher, or teacher represented the causal space. For example, a teacher who only focuses on students' framing of agency could easily consider Avery's problem space as simplistic or novice-like. In so doing, such an evaluation could overlook the complex connections Avery made among

agentic actions, often through enabling or conditional causal roles. Similarly, an assessment that privileged causal language might focus on Robert's imprecise word choice and miss how he situated the events of the Pullman Strike within a broader historical narrative. In fact, the abstractness of this narrative may have constrained Robert from using more precise causal language.

Articulating explicitly the features entailed in problem framing—features that I saw in my analysis of students' reasoning as well as in Mr. Owen's teaching and the scholarship on ill-structured problems—might help teachers, assessors, and curriculum designers. My exploration highlights more than just the need to look at multiple dimensions of students' causal reasoning but also the conscious or unconscious tradeoffs students make when establishing their problem spaces. Such a framework might aid teachers and assessors in crafting different tasks or rubrics to capture the nuance of students' thinking before and after instruction. It is plausible, for instance, that framing a narrow problem space may help a student to identify more precise, interconnected causal relationships. Or, it is plausible that framing a wide problem space may help a student to consider broad political, social, and economic structures.

Before pulling these explorations together to hypothesize or theorize about such a causal framework, I turn next to explore students' thinking about a contemporary problem.

Chapter VII

Characteristics of Students' Current Event Reasoning:

Students Tackle the Amazon Unionization Case (Task 2)

This chapter explores how three of Mr. Owens' students constructed problem spaces in response to an ill-structured *contemporary* task. For the task, students " brainstormed" what they "know or might need to know" to write a report for a workers' rights organization about the causes of the 2021 unionization effort at an Amazon warehouse. I designed this task and the prompt to elicit students' reasoning about the problem space rather than to elicit their conclusions about the causes of the event. This design differed from previous studies in ill-structured problem-solving that asked novices to produce a solution or final accounting of the problem (e.g., Fernandes & Simon, 1999; Jones & Read, 2005; Voss et al., 1983). Furthermore, I asked probing questions to help students make visible their thinking as they brainstormed.

I analyzed the data in two stages. First, I coded students' individual utterances using the codes and subcodes referenced in Table 7. Then, I created diagrams to represent students' problem spaces. I used the coding scheme in Table 7 to describe the overall organization and complexity of those problem spaces.

As in the previous chapter, I begin by giving a brief overview of the task before identifying and describing three cases of students' problem construction, each representing a distinct, yet complex problem space. I then explore relationships between different elements of students' problem spaces. Finally, I discuss how these cases of student thinking do or do not fit with what I learned from existing ill-structured problem-solving literature.

Overview Of Task 2: Amazon Unionization Effort

Students began the contemporary problem framing activity by reading the following open-ended task scenario:

> You have been hired by a workers' rights organization to write a report about the causes of the unionization effort at the Amazon warehouse in Bessemer, Alabama. The report should also help the organization understand why the unionization effort happened when it did and why it unfolded the way that it did.

The scenario provided students with only a few loose constraints in establishing a problem space: the eventual mode of representation ("a report") and the content focus of the exhibit ("why the unionization effort happened when it did and why it unfolded the way that it did").

After taking up the task, students then read a brief narrative passage describing the events leading up to the unionization effort and its aftermath to provide them modest background information about the event (Appendix A). I then asked students to "brainstorm" on a blank sheet of paper "anything you know or might need to know in order to write your report." After eight minutes, I asked students to flip their paper over and, for two minutes, write down any additional questions they might consider investigating.

I started the interview by asking each student to "talk me through what you put down in your brainstorm." During this time, I frequently asked clarifying or elaborating questions (e.g., "Why does that matter?", "Can you tell me more"). Once the students finished explaining their brainstorm, I asked them to "identify three factors that you think would be most important to include in your exhibit." This first part of the study generally lasted 20 to 25 minutes.

Next, I presented each student with five potential causal factors that could be related to the unionization effort (Table 11).

Table 11

Amazon Problem (Task 2) Provided Factors

#	Task 2 Provided Factors
1	***[Work Task isolation]*** Most of the work tasks at Amazon's Bessemer warehouse are done individually. Workers are often isolated from one another.
2	***[Surveillance technology]*** Modern computer technology enables companies to monitor workers' behavior in very detailed ways.
3	***[Minimum wage vs. Amazon wage]*** The federal minimum wage is $7.25 an hour, which is almost half of the starting wage of $15.30 an hour at Amazon's Bessemer warehouse.
4	***[Amazon Twitter use]*** Top Amazon officials used the company's Twitter account to criticize politicians and celebrities who supported the unionization effort at the warehouse in Bessemer.
5	***[RWDSU Record]*** In the 20 years before the Bessemer warehouse union vote, The Retail, Wholesale and Department Store Union (RWDSU) successfully unionized three poultry plants in Alabama, leading to increased wages and working conditions in those plants.

For each factor, I asked students to "tell me how you think the factor might be connected to your task of writing your report." After students talked through each potential factor, I asked, "If you had to choose two of these factors to include in the report which would you choose?" This second part of the study generally took 20 to 25 minutes.

The data in this chapter comprises students' written brainstorms and transcriptions of students' verbal responses to both parts of the task.

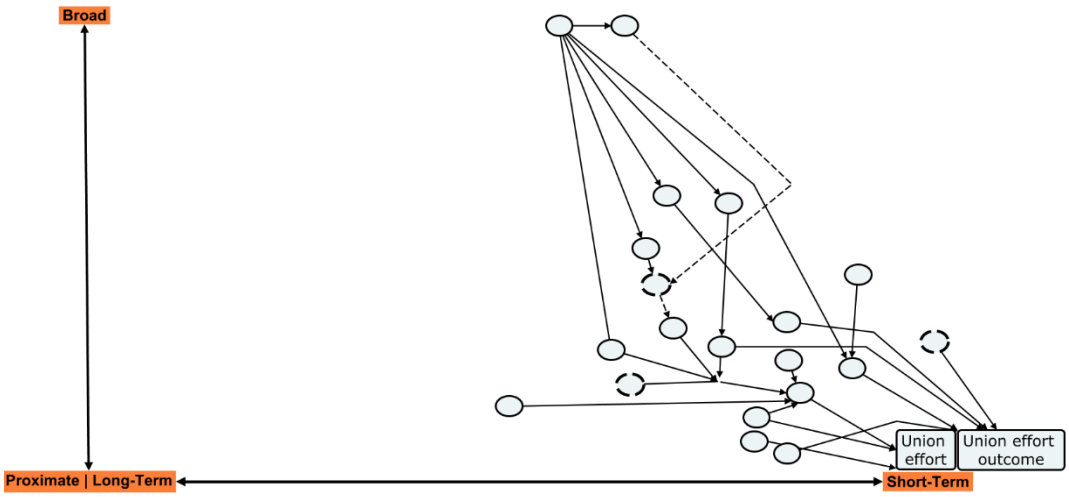
Three Problem Framing Approaches: Avery, Ren, And Robert

Although seven students worked on the Amazon unionization problem (Task 2), I again limit discussion to three students, Avery, Ren, and Robert. By concentrating on the same students, I attempt to show how this framework may inform research and instruction on contemporary ill-structured problem framing in addition to historical problem framing. While

each case was unique, I did not see and do I argue that any were objectively more or less expert, more or less sophisticated, or more or less useful. Nor am I claiming these as stages in developing student thinking. Rather, this chapter surfaced the kind of thinking these students could do when prompted to make time to think about a contemporary problem. In response to this task, both Avery and Robert framed relatively narrow, agentic-focused problem spaces. Robert tended to frame most of the causes in relation to Amazon's goals whereas Avery connected factors in a multitude of ways. Finally, Ren framed a nested problem space, surfacing a moderate number of interconnections between causes. Though I discuss each student's problem framing, the Figures 24 to 26 provide an overview and foreshadowing of the similarities and differences in the ways these students constructed a problem space and how they shaped the task. In the figures, the X axis represents time to the event, from long-term to short-term. The Y axis represents spatial distance from the event, from proximate to broad. Each of the dots represent a causal factor students identified in the first part of the task (the bolded dots represent factors they identified as "most important").

Figure 24

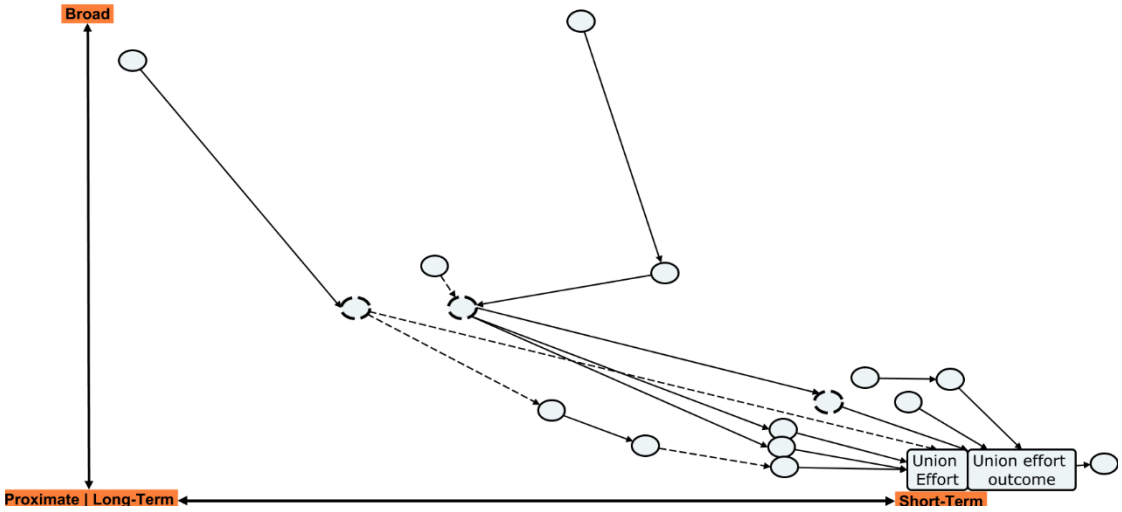
A Map of Avery's Task 2 (Part 1) Problem Space



As with the prior task, Avery tended to identify causes closer to the event and established multiple interconnections.

Figure 25

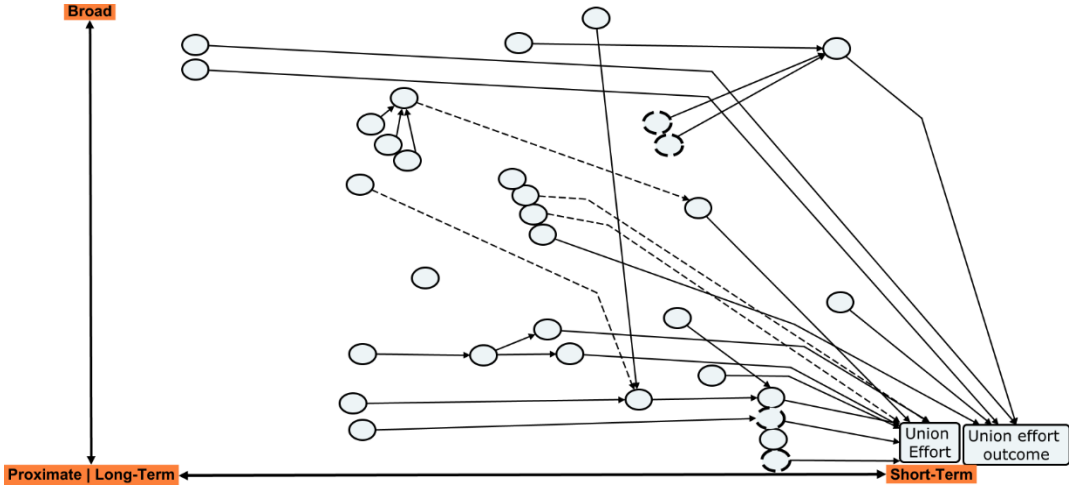
A Map of Robert's Task 2 (Part 1) Problem Space



Unlike his previous task, Robert mostly identified causes closer to the event, although his problem space was slightly larger than Avery's. He also identified more causal interconnections than the previous task.

Figure 26

A Map of Ren's Task 1 (Part 1) Problem Space



As before, Ren identified causes at multiple scales of space and time. However, he identified more causal interconnections in this task compared to the previous.

Framing a Narrow, Agentic, and Highly Interconnected Problem Space (Avery)

As in the Pullman case (Task 1), Avery divided her initial brainstorm into two parts: "what I need to know," which included seven questions, and "what I know," which included two statements of fact (Figure 27).

Figure 27

Avery's Amazon Case (Task 2) Brainstorm

[Page 1: Initial Brainstorm]

What I need to know

- Did their wages increase or decrease or stay the same because of COVID?
- What types of injuries were the workers getting?
- How did workers get injured?
- Did Amazon make a much higher profit because of the increased demand?
- What were other workers most frustrated about?
- What were the "no union" workers reasoning for feeling that they didn't need a union?
- Did Amazon ever try to negotiate with the workers or vice-versa?

What I know

- I know injuries increased, threatening the workers' health
- I know Amazon was trying to convince workers against joining the union.

[Page 2: Additional Questions]

- How were prices of goods affected because of COVID?
- Was it harder to get jobs?
- What was the union trying to accomplish?
- Did the union have any strategies in mind to accomplish the workers goals?

As before, Avery framed a narrow problem space, focusing on short-term, proximate factors, such as the workers' wages, their frustration with Amazon, their "financial issues… at home," and the rate, type, and causes of workplace injuries. When asked which of her factors "would be most important to include in your report," Avery selected three short-term, proximate

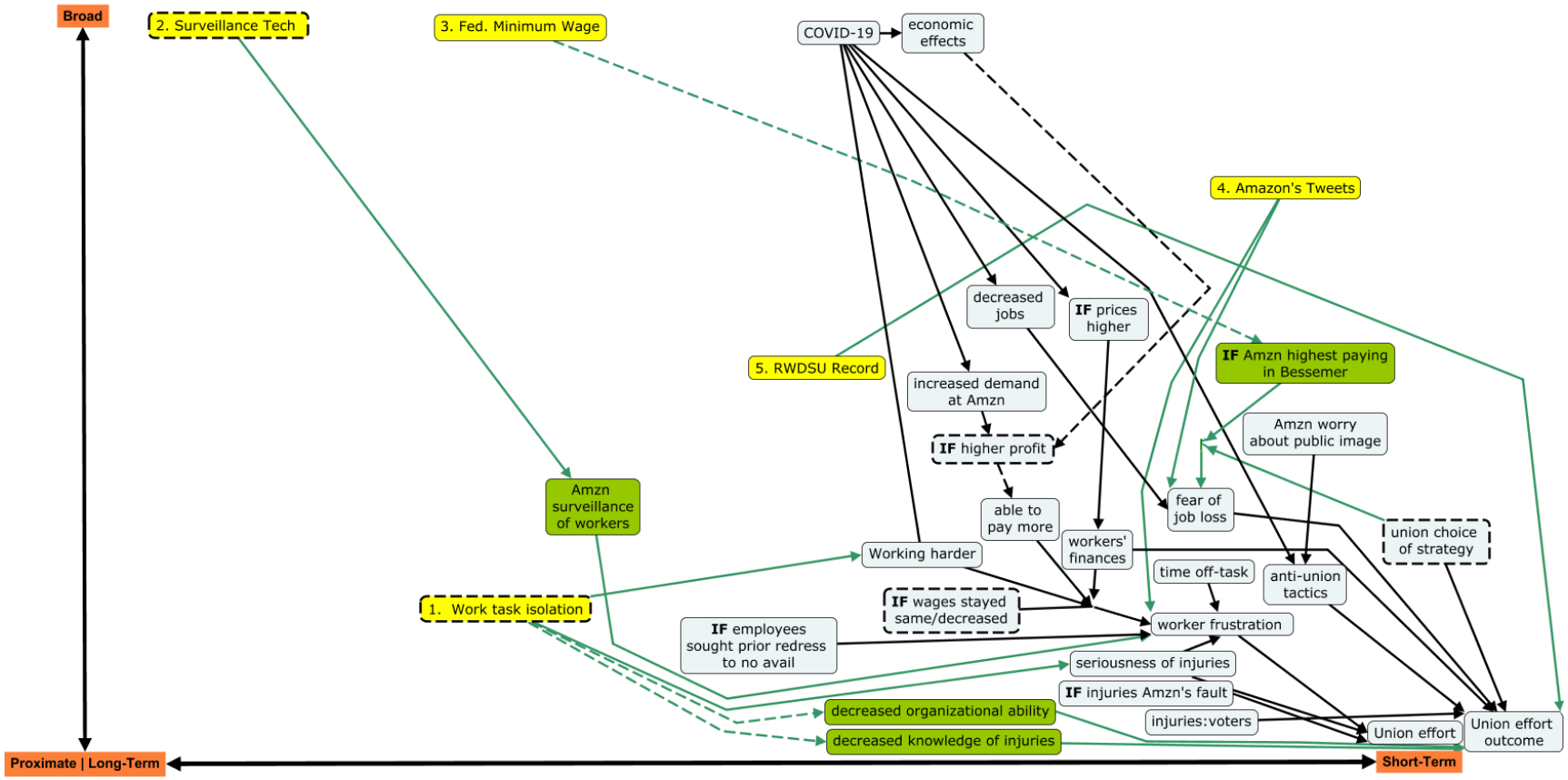
factors. However, in response to the provided factor about Amazon's Tweets (Factor 4), she considered the spatially distant factor of the "influence" of "politicians and celebrities."

Avery primarily discussed human-agentic properties, human-agentic action, and specific economic structures. Her agent-focused factors included workers' frustration with Amazon, the union organizers' goals, and the degree to which Amazon was being "selfish" or at fault for workplace injuries. She also considered specific economic structures, such as the economic conditions created by COVID-19 and workers' wages and standard of living. When explaining the significance of an economic structure, Avery often related it back to workers' subjectivity (e.g., "[I]f they [Amazon] were making a much higher profit … I think that would make the workers even more frustrated").

To see how Avery related these different causal factors, I constructed a diagram of her problem space (Figure 28).

Figure 28

Researcher-Created Map for Avery's Amazon Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

As in the Pullman task, Avery considered a wide variety of causal roles and used precise language, as compared to the other students in this study, to describe those roles. She discussed how wages, injuries, and the union's strategies might have *influenced* the workers to be "likely" or "less likely to join the union." Avery also raised a host of conditional roles, such as the conditional role of prices in mediating the relationship between wages and the union vote and the conditional role of the "strategy of the union" on workers' perceived risk of "losing their job." In the following exchange, Avery explained that the causal relationship of job conditions and workers' motivation to strike was conditional on how wages had changed during COVID-19.

> Avery: So, my first question [was] about if their wages increased, decreased, or stayed the same because of COVID….[T]hey're working harder, so did they get rewarded with like increased wages? Or did it just stay the same? Or did it decrease because the economy was not good with COVID?
>
> Researcher: And why would that matter for your task?
>
> Avery: … so they were getting paid a certain amount before COVID… and then they had to start working harder. So, they're working harder with the same result and they might get frustrated….
>
> Researcher: And that would have changed the outcome?
>
> Avery: Possibly, but also I think it might matter, like everyone's personal life, how their financial issues are at home.

Here Avery argued that the conditional variable of increased compensation likely mediated the effect of "working harder" on the outcome of the union vote. Then she identified workers' "financial issues" as another conditional, mediating factor on wages' effect on the vote.

Finally, Avery identified several factors that shaped Amazon's or workers' choices. In the following, she considered Amazon's conditional profitability as *enabling* or *constraining* Amazon's ability to pay workers more.

> So obviously there's an increased demand, so was Amazon making a much, much higher profit? Or were they even making a higher profit? Because I know COVID is definitely affecting the economy…[I]f they were making a much higher profit, wouldn't they be able to make the wages higher to reward the workers for working harder? Or are they not able to do that because they weren't making much higher profits?

Avery began with an initial conditional, that COVID-19's effect on the economy had some effect on Amazon's profit. She then argued that this conditional might have *enabled* or *constrained* them from paying workers more.

Avery's causal model looked similar to her model in the previous task. She connected multiple factors directly to the strike, situating these factors within an intricate web of indirect factors, some of which played multiple, often conditional or counteracting roles. For instance, she argued that a more aggressive union strategy might lead more workers to fear losing their jobs, which would reduce the likelihood of the union effort succeeding. Then she explained that this effect could have been exacerbated by COVID-19 which might have made it "harder to get a job."

As in the Pullman task, Avery tended to integrate the provided causes into her existing causal model. For example, she discussed how workers' isolation (Factor 1) might exacerbate the problem of work-place injuries—a factor she previously identified as driving the union effort.

Demonstrating a rather dynamic view of causation, she then considered how workers' isolation (Factor 1) might also *negatively* affect the unionization effort.

> Avery: And also, maybe [the workers] wouldn't be able to talk to other workers and see the common problems that everyone was facing…
>
> Researcher: And what's the implications of that?
>
> Avery: Because if you know what's affecting you is affecting everybody too and everybody's frustrated, you might be able to actually do something about it…

This type of contingency thinking about causal factors was common in Avery's response.

Avery used several reasoning processes in framing the problem. For example, to clarify the possible effect of worker isolation (Factor 1), she compared the Amazon and Pullman cases: "[I]t's harder [for Amazon workers] to organize something collectively like how the Pullman workers did because they're isolated from one another." In doing so, she underscored a structural constraint on Amazon employees that did not exist for Pullman's workers. She made two additional comparisons to Pullman: one to conjecture about how Amazon workers might react to the company's "selfish" behavior and one to justify a line of inquiry whether the economic conditions at the time made it difficult for workers to "provide for their families."

Avery also frequently identified changes and continuity over time (CCOT) to reason about causation. For instance, she questioned whether wages "increased, decreased, or stayed the same" during COVID-19 to determine the extent that increased work pressure drove workers' frustration with Amazon. She reasoned that if wages had stayed the same, the effects of the increased work pressure might have been greater than if wages had increased. Finally, Avery surfaced several personal experiences to identify or justify causes or causal roles. For example, she discussed an experience where Amazon asked her to review an Amazon delivery person on a

standard that she believed was "unfair." She used this anecdote to explain how workplace surveillance technology (Factor 2) might impact workers' feelings about the union effort.

Overall, as in the previous task, Avery framed a narrow, agency-focused problem space that was multicausal, highly interconnected, and contingent.

Framing a Narrow Problem Space Around a Central Agent (Robert)

In contrast to the Pullman case (Task 1), Robert divided his Amazon case (Task 2) brainstorm into two categories: "know," which included two statements, and "might need to know," which included four questions (Figure 29).

Figure 29

Robert's Amazon Case (Task 2) Brainstorm

[Page 1: Initial Brainstorm]
Know: Amazon/Bezos Hard to mess with Richest Man in world +
one of largest companies in world
Amazon cares ^deeply about robots/computers + efficiency as those shipments must be on time

Might need to know: What other tactics were used by Amazon to persuade union voters?
Why did workers feel a union wasn't necessary? Did demand die down?
Why was Amazon like what was the reason?
Against unions
so much?

[Page 2: Additional Questions]
Do workers still feel that a union isn't necessary today?
Did the unions have tactics they used to appeal to workers?
What about workers who still want a union?
Steel Unions? Influence Context ^ over the town they in?

In his verbal response, Robert framed a relatively narrow problem space (although still wider than Avery's). He mostly discussed short-term factors, such as workplace injuries, Amazon's policies, and Amazon's influence over Bessemer. He did consider a few factors that I

interpreted as long-term and/or broad scale, such as Amazon's "large amount of control over local governments." Of the factors he surfaced, Robert identified three proximate to intermediate factors as "most important" ("Amazon size [and] wealth," their desire for "efficiency," and their anti-union "tactics").

Robert primarily framed the problem as one of Amazon and workers' intentions. He established early on that "what the workers want is not necessarily what the company wants," explaining that Amazon is most interested in "efficiency and how much money they're making" and the workers "wanted to see change happening." Additionally, he discussed the outcome of unionization effort as a product of workers' agency, claiming "it was up to them to choose." However, Robert also recognized some structural constraints and unintended consequences. When discussing the constraints of worker isolation (Factor 1) on workers' ability to organize, Robert surmised, "I guess [this was] not intentional, because that's probably how [Amazon] designed the system, but [it was] one of their unintentional, yet coincidentally beneficial, ways that they would remove the spread of information." In this example, Robert described the lack of communication among workers as an unintentional outcome of a specific structure: "the system" Amazon designed to increase "efficiency."

Robert also mentioned several general, socio-political structures related to Amazon's ability to "use their wealth to maintain their interests," including their "influence over the town," their "large amount of control over local governments," and their ability to impede "the formation of workers into unions." On one occasion, Robert surfaced a history of corporate power stretching back to Carnegie to contextualize Amazon's practices.

> Robert: I had a connection that I was kind of building between steel unions…with Carnegie and stuff that was more brutal of a putdown, but a putdown, nonetheless.

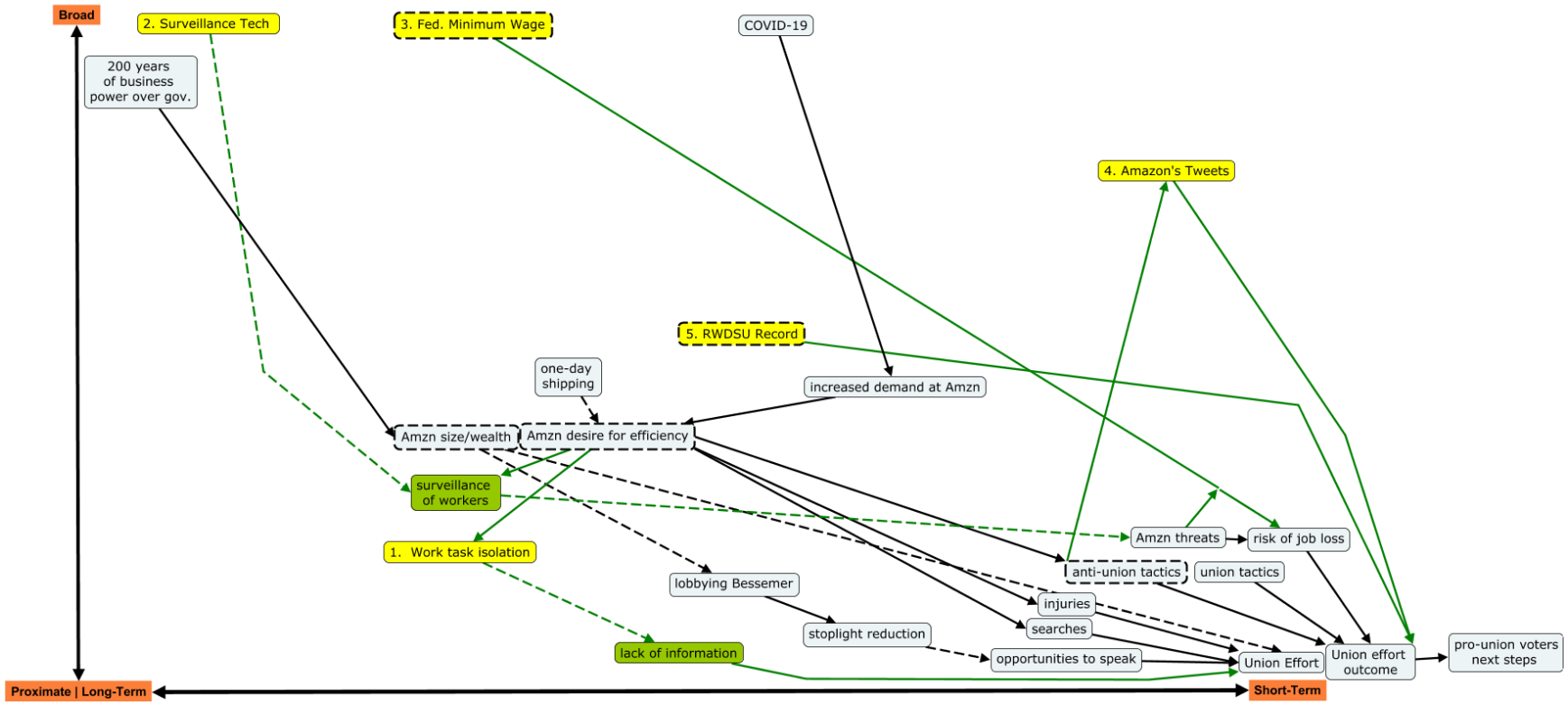
> And then the text we were reading last Thursday [about Pullman's] influence over the town that [the workers lived] in. It's not as big of a thing, because they [Pullman] literally owned the town, but Amazon was able to use their influence to persuade the town to do something for them…
>
> Researcher: You're comparing Pullman to Amazon. Why is that comparison important?
>
> Robert: Because it shows that even though it's way less upfront and brutal, it still shows that [Amazon's] playing the same games as [Pullman was] like 200 years ago, you know, the same tactics that are being used are still effective, so it shows like businesses still have this much control over a town or local government.

In general, this type of historical contextualization was relatively rare in Robert's response.

To see how Robert related these different causal factors, I constructed a diagram of his problem space (Figure 30).

Figure 30

Researcher-Created Map for Robert's Amazon Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

In contrast to the Pullman Task (Task 1), Robert identified a variety of causal roles in his response. He considered how the "union's…tactics…to appeal to workers" and Amazon's "influence" on workers impacted the vote. He surfaced several enabling causes, such as the fact that "[Amazon] *can* obviously use their wealth to maintain their interests" or "was *able* to use their influence to persuade the town to do something for them." He also identified constraints, such as the constraints of the "one-day shipping option" on Amazon's decisions on how to structure work or how the removal of stoplights "reduced" union members' "opportunities to speak" with workers.

In connecting his causes, Robert established a non-linear, moderately complex causal model. He considered multiple factors as positively or negatively influencing the union vote—including Amazon's and the union's tactics for appealing to workers, workers' desires for reform, and the threats of injury and job loss. Primarily, he framed his response around how Amazon's size and interests in efficiency drove their actions. Robert then used this framework to justify or interpret a number of causal factors. For instance, he identified the workers isolation (Factor 1) and the use of surveillance technology (Factor 2) as manifestations of Amazon's desire for "efficiency."

Robert used several reasoning moves in his response. He compared and contrasted the actions of Pullman and Amazon to clarify the nature of Amazon's influence over local government and to identify a historical continuity ("even though it's way less upfront and brutal…. it shows businesses still have this much control…"). Robert also raised two counterfactuals. When explaining why he though RWDSU's previous successes (Factor 5) were important, he said,

> Factor 5 is mainly there to show that it was a worker's choice to say no [to the union]…because obviously [the workers] invited [the union] in to have talks and the union has a great track record, so if [the workers] voted yes, they would have gotten their changes done, but yeah that just goes to show the workers mind was changed.

Here Robert entertained the counterfactual that if workers had voted to join the union, they would have gotten the reforms they wanted. Therefore, the company must have successfully convinced workers not to join the union. He also surmised that "if workers really didn't have any risk of losing their jobs, they probably would have voted yes." By hypothetically removing the threat of job loss variable, Robert was able to underscore its explanatory significance to the union vote.

Framing a Nested, Multi-Structural Problem Space (Ren)

As in the Pullman case (Task 1), Ren wrote thirteen questions in his initial brainstorm covering a wide variety of issues (Figure 31).

Figure 31

Ren's Amazon Case (Task 2) Brainstorm

[Page 1: Initial Brainstorm]
Why did this happen in Bessemer and not other warehouses
What has been the government interaction with Amazon been like before this
What is the RWDSU history in fighting for unions
How did amazon influence the town officials to reduce stoplights.
What is amazons record with unions and workplace safety orgs
Do other companies in this sector have to deal with unions
Has there ever been such a big company as amazon
What is amazons political hold locally and nationally
What did polling show about what Americans felt as a GP [general public]?
What were the workers conditions
What is pay per hour and how does it compare
What sort of tactics does amazon use with workers that may provoke them?
What is turnover rate @ amazon?
Alabama labor laws

[Page 2: Additional Questions]
What is amazons societal hold on the GP [general public]?
Was there pressure from outside groups to unionize? AOC?
Wage gap between CEO and workers
City development?

In his explanation of the brainstorm, Ren framed a nested problem space. He discussed wide-scale factors like Amazon's "influence…over political campaigns," and proximate, short-term causes, such as the "pay per hour" and the company's "tactics" and policies. He also inquired into several intermediate-scale factors like the "industry standard" and the "track record in this industry." Of the factors he identified, Ren selected two short- to medium-term, proximate factors ("Amazon's managerial tactics …on a normal basis" and "working conditions" in comparison to "pay") and one short-term, broad-scale factor ("external pressures") as "the most important."

Within his problem space, Ren primarily discussed economic and socio-political structures. Many were specific structures, such as local labor laws, workers' pay, and the ability of the government to regulate large businesses like Amazon. Others were more general, such as "Amazon's political hold locally and nationally," their "reach in everyone's life," "external public support," and "government sway." He did, however, speak about some agentic properties, including "workplace satisfaction," the federal government's desire "to keep a friendly relationship with Amazon," and the fact that "towns were fawning over Amazon officials."

As in the prior task, Ren sometimes attempted to contextualize the relationships between agents or structures within broader historical developments.

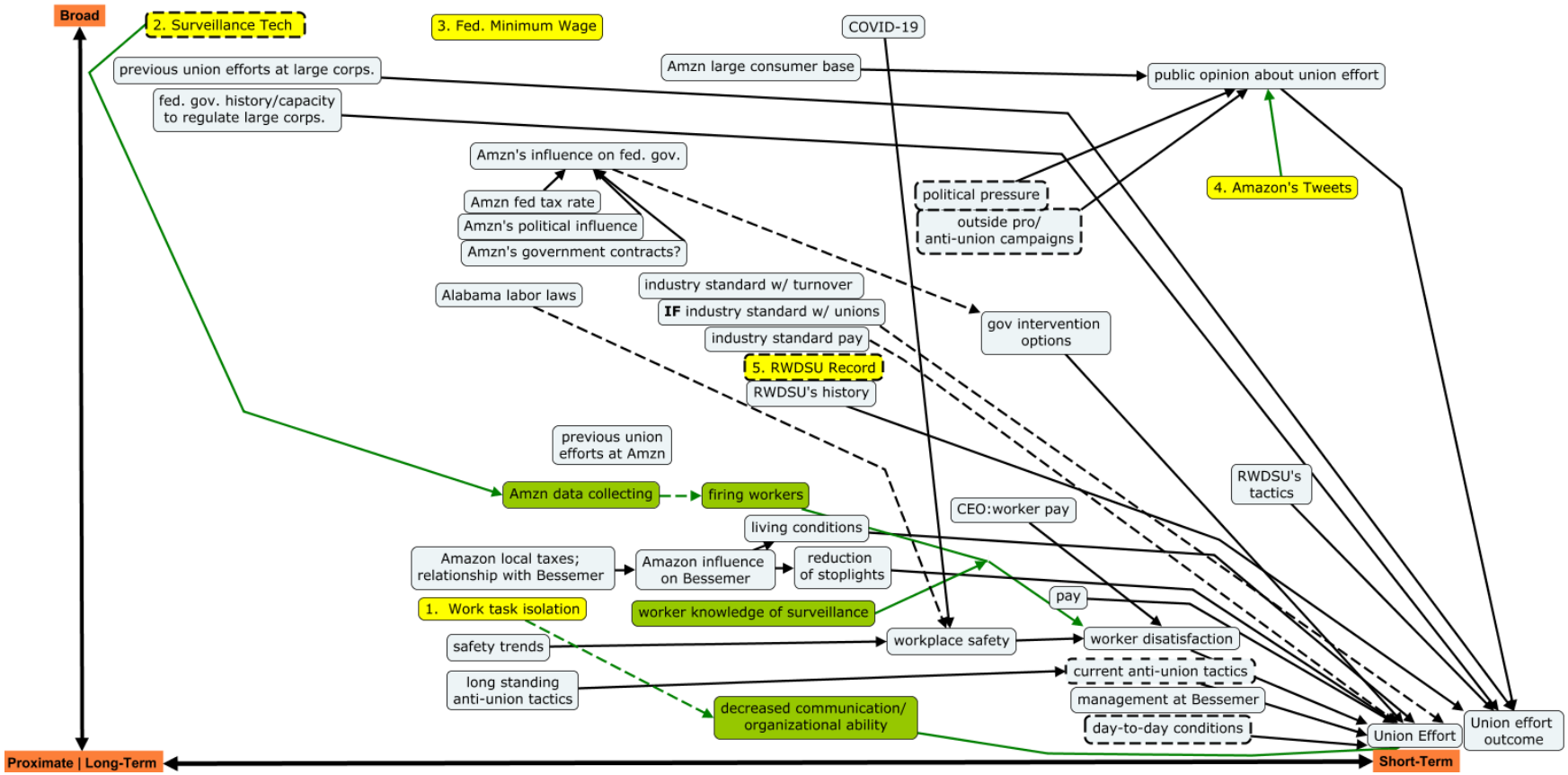
> Ren: [Paraphrasing from his brainstorm] "What was, sort of, government interaction with Amazon been like in the past?" I was thinking mostly about this on the federal level. You know, what kind of taxes does Amazon pay? And what kind of influence does it have over political campaigns? That sort of interaction with the government. Do they win government contracts? Etc…
>
> Researcher: Why would that matter?
>
> Ren: Because… like today, you know, the government closely watches a lot of labor disputes and union disputes. And, since obviously, you know, [President] Roosevelt, [the government] had become more interventional in labor disputes like that and there's a lot of labor laws regarding that, so I feel like any sort of government sway or government intervention that could be had in this scenario would be influenced by what interactions Amazon had with the government in the past. So, I thought that was important to investigate.

Here Ren identified the existence of historical and political structures ("labor laws" and "government intervention") that might constrain what Amazon can do. At the same time, he argued that Amazon's past and present influence over the government might mitigate those constraints.

To see how Ren related these different causal factors, I constructed a diagram of his problem space (Figure 32).

Figure 32

Researcher-Created Map for Ren's Amazon Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

In his response, Ren identified a variety of causal roles. He discussed *influencing* factors, such as the "impact" the town's stoplights and "external public support" on how workers voted. Ren also identified a *conditional* role, explaining that the existence or non-existence of unions in similar sectors may *enable* or *constrain* workers' choices.

> Ren: [Reading from his brainstorm] *"Do other companies in the sector have to deal with unions?"* Obviously Amazon is pretty unique in how large it is, but there are a lot of other arguably smaller fulfillment centers and other sort of facilities like that. Do those companies have unions? What's the sort of track record there and the standard in the industry? Is Amazon an exception to, like, not having unions before this vote? Are they, you know, the norm? That sort of thing was what I would want to investigate.
>
> Researcher: And would that have an impact on the union effort at Bessemer?
>
> Ren: Yeah I think if there was a track record in this industry of other companies having unions and Amazon was the one exception, you know, workers and employees [at Amazon] could…say, "Hey, you know, everyone around us has a union, why don't we have a union?" Or, in the opposite, if no one in this industry has a union, it'd be weird if we had one…sort of going with the status quo...

Here Ren started with a conditional ("if there was a track record…") to establish how an industry norm might *enable* or *constrain* workers in advocating for a union. He also hedged on the significance of this conditional by pointing out that Amazon is "unique in how large it is."

Finally, Ren asked a question about "labor laws" to try to determine constraints that might exist in other states but not in Alabama.

> Researcher: [Why did you write down] "*Alabama Labor laws*"?

> Ren: I was thinking maybe Alabama's labor laws are less strict than other places where Amazon has fulfillment centers, and so Amazon was exploiting that fact and maybe, you know, pressing their workers a little harder than they do in other states because of these labor laws, and that was causing the vote to happen here, and discontent to happen here in this factory rather than you know states around the nation.

In surfacing this potentially constraining structure, Ren attempted to answer a comparative causal question he wrote in his brainstorm: "*Why did this happen in Bessemer and not other warehouses[?]*" No other student seemed to address the "why here?" question of causation in this problem task.

In interconnecting all these different scaled causes, Ren framed a complex, non-linear causal model. He connected multiple causes directly to the unionization effort and contextualized those causes within larger socio-political structures, such as Amazon's political power and popularity, labor laws, the federal governments' history in dealing with large corporations, the industry standard for unionization, and taxes. Unlike Avery, who established multiple interconnections between relatively well-defined causes, Ren often sought to investigate more loosely defined historical contexts (e.g., "what was…government interaction with Amazon been like in the past?") that were not as highly interconnected. As in the previous task, Ren integrated many of the provided factors into his causal model. For instance, he established that Amazon's "hold" on society likely had an effect on the union vote and then later interpreted Amazon's Tweets (Factor 4) as "another tactic to dissuade the workers from unionizing, using that social—I guess social—hold on the society."

Ren engaged in several reasoning processes during his response. He made a *comparison* to Pullman's General Managers Association to elaborate on the ways that the business leaders today might try to undermine the union effort at Bessemer.

> Researcher: …is there anything else you're thinking of when you talk about "external pressure"?
>
> Ren: I'm thinking like…some sort of like shady organization that could have a mass media campaign to dissuade or, you know, convince Amazon workers…not to unionize…Sort of like the [General] Managers Association we talked about last time…where the kind of leaders of that industry joined together to stop unions from happening at one place [so] that they wouldn't happen as a wide scale thing across the industry. Possibly there's something like that going on here and I'd want to investigate that in relation to the vote that was happening.

Here Ren made a historical comparison to conjecture about what present-day industry leaders *might* have done in response to the unionization effort at Amazon. Similarly, he discussed the 1982 federally mandated breakup of AT&T to conjecture about what types of government actions "union organizers might advocate for." Ren also surfaced several contemporary comparisons. He questioned how unique Amazon is compared to "other companies in the sector" which, he explained, would help him to understand what Amazon workers might have known or expected from Amazon. He also compared Alabama's labor laws to other states to unearth a possible unique structural condition at the Bessemer fulfillment center.

Additionally, Ren identified or inquired into multiple *continuities* to contextualize enabling or constraining factors in the present, such as the government's "interaction" and "relationship with Amazon," "Amazon's interaction with [Bessemer]," "Amazon's record with

unions," the "trend" in workplace safety, and the government's past dealings with large corporations. Ren also argued that the RWDSU's previous successes (Factor 5) marked an important change in union power ("this factor would indicate that 20 years ago, compared to now, it's harder to unionize or at least it's harder to unionize at Amazon").

Ren identified several other indicators. For example, he explained, "if [Amazon] can change the stoplights in a small town, it's pretty obvious that they might be able to do things on a larger scale." Ren used this indicator to clarify how Amazon's size *enabled* them to exercise their power. Ren also discussed Amazon's high pay (Factor 3) as a potential indicator of the poor working conditions at the fulfillment center, explaining that "if the workers are still being unsatisfied with double the base pay, the work conditions must be extremely tiring or injury prone." Finally, Ren used a generalization to explain Amazon's intentionality behind isolating workers (Factor 1), stating, "I feel like when corporations—at least from what I've studied in the past—want to dissolve union kind of spirits, they isolate the workers."

Overall, Ren framed a nested problem space comprising a mix of general and specific structures that represented multiple structural classifications.

Discussion

The Features of Students' Amazon Unionization Problem Spaces

Avery and Ren framed the Amazon case (Task 2) in much the same way they framed the Pullman case (Task 1). Avery framed a narrow problem space comprising agentic actions and properties and specific, economic structures. She also identified a variety of causal roles, including conditional roles, to establish a highly interconnected and contingent causal model. In contrast, Ren framed a nested problem space comprised of economic and socio-political structures. He identified some, but not as many, conditional roles as Avery. Additionally, he

primarily inquired into less well-defined historical contexts whereas Avery tended to inquire into more well-defined causal factors. In contrast, Robert's framing of the Amazon case differed from his framing of the Pullman case. Overall, his framing of the Amazon case was akin to Avery's with several exceptions. Unlike Avery, Robert surfaced several general, socio-political factors and historical contexts. Furthermore, rather than establish a highly interconnected and contingent causal model, Robert filtered most of his causes or the provided causes through a framework he established about Amazon's desire for efficiency and profit. Table 12 summarizes these key dimensions of the students' problem spaces.

Table 12

Summary of Students' Framing of the Amazon Problem (Task 2)

	Focal Participants		
Dimension	Avery	Robert	Ren
Temporal Scale	Narrow	Narrow	Nested
Spatial Scale	Narrow	Narrow	Nested
Degree of agency/structure	Mostly agentic	Mostly agentic	Mostly structural
Degree of abstraction	Mostly specific	Both specific, general	Both specific, general
Use of Structural Classifications	Factors from mostly one classification	Factors from multiple classifications	Factors from multiple classifications
Organization of the problem space	Expository	Expository	Expository
Complexity of the problem space	Complex	Complex	Complex

Despite differences in their problem space framings, the students used similar reasoning processes to justify causal claims or lines of inquiry. For instance, all three used comparisons and identification of change and continuity over time to establish aspects of their problem spaces. The only major differences arose from Avery's use of personal experiences and Ren's heavy reliance on indicators

As in the previous task, *agentic causes* and *specific structures* seemed to play a clearer or more significant role in the narrower parts of students' problem spaces. Although students surfaced fewer *general structures* in the Amazon case (Task 2), those structures tended to be longer-term or broader-scale than the specific structures they identified. The students also seemed to identify more precise causal roles for agents and specific structures than for general structures. Lastly, the narrow parts of students' problem spaces often contained the highest concentration of causal interconnections. Overall, this suggests that there might be some tradeoffs in how students choose to focus their problem spaces. These findings may also call into question the appropriateness of constructing clear novice-to-expert progression in students' ill-structured causal problem framing. Further research is needed to demonstrate how generalizable these relationships are for different students or different kinds of problems. However, if these relationships are consistent in students' causal thinking, it may have important implications for teachers. Teachers might also support students by providing opportunities to explore multiple ways of framing a problem. For example, students could assess the affordances and constraints of a narrow-scale problem framing for being able to produce effective solutions to a problem.

Finally, the analysis revealed that Avery, Ren, and Robert used historical reasoning processes to establish or justify their problem spaces. This suggests that ill-structured problem researchers may want to consider adding these concepts to their analyses. Furthermore, teachers

may support students' problem-solving competencies by helping them to apply certain second-order historical concepts (e.g., comparison, CCOT, long-term causes) to framing ill-structured contemporary problems.

Students' Problem Spaces and Previous Studies

It is difficult to situate these students' responses to this task to prior research in ill-structured problem-solving, in part because this study, unlike most others, made problem framing the object of inquiry and not, as most others have done, the proposing a conclusion (e.g., Ertmer et al., 2008; Fernandes & Simon, 1999; Jones & Read, 2005; Voss et al., 1983). This activity treated the Amazon unionization question as an ill-structured problem that students needed to think about rather than a well-structured task calling for students to produce a solution.

Nevertheless, there are some elements of students' approaches that are comparable to prior research, such as students' thinking about scale, agency, structure, and causal mechanisms, and their organization of causal relationships. On these elements, we can see that Avery, Ren, and Robert both conformed to and defied expectations in a variety of ways. For example, research has found that novices tend to stick relatively closely to the problem statement (Chi et al., 1981; Voss et al., 1983), focusing mostly on proximate causes and effects (Grotzer & Basca, 2003; Grotzer et al., 2015). This seemed somewhat true for Robert and Avery who considered only a few long-term or broad scale factors not mentioned in the passage. This was decidedly not the case for Ren, who considered a host of factors at various scales, such as state laws, federal regulations, public opinion, industry norms, and labor trends at Amazon.

Research has also found that students tend to overlook indirect causal relationships (Grotzer & Basca, 2003; Grotzer et al., 2015) and often try to pin causality to agents where agents might not exist (Chi, 2005). This did not seem to be the case with any of the students'

responses. To varying degrees, all discussed structures that enabled or constrained actions or surfaced causes that mediated the effects of other causal relationships. Lastly, research pointed to students' tendencies to see complex, emergent phenomenon as controlled by a handful of central agents (Chi, 2005; Jacobson, 2001; Resnick & Wilensky, 1998; Yoon, 2008). On this front, the three focal students varied somewhat. Robert framed the majority of his response around the intentions and actions of Amazon. He did, however, surface the possibility that designed systems can produce "unintentional" outcomes, which suggests he may have applied some ideas about decentralization. Avery also focused much of her response on Amazon's actions but brought up a host of factors outside of Amazon's control, such as COVID-19 economic conditions, job availability, and workers' financial situations. Compared to Avery and Robert, Ren's explanation was exceedingly decentralized, involving multiple institutions ranging from state governments to lobbyists.

In the following chapter, I take these findings, along with findings from the previous two chapters, to propose a framework for researching students' ill-structured problem framing.

Chapter VIII

Conclusion: Towards a Framework and Implications

The first line of the College, Career, and Civic Life (C3) Framework reads: "Now more than ever, students need the intellectual power to recognize societal problems; ask good questions and develop robust investigations into them" (NCSS, 2013, p. 6). This rings as true today as it did nearly a decade ago. Graduating seniors find themselves in a world defined by pressing, complex problems. Deniers of the 2020 election results have started filling critical election administration positions. A leaked Supreme Court opinion augurs the end of abortion rights in at least half of the United States. Rising inflation levels keep hurting vulnerable communities while stymieing necessary social and environmental reform.

The C3 Framework outlines four core dimensions of inquiry in history and the social sciences: "1) developing questions and planning inquiries; 2) applying disciplinary tools and concepts; 3) evaluating sources and using evidence; and 4) communicating conclusions and taking informed action" (NCSS, 2013, p. 12). All four of these dimensions are critical for historical and civic reasoning. However, history education scholarship has predominantly focused on topics most relevant to the last three dimensions (e.g., Monte-Sano, 2010, 2011; Reisman, 2012; Wineburg, 1991). This work has inspired a host of frameworks, heuristics, and resources for evaluating historical sources (e.g., Britt et al., 2000; Hicks et al., 2004; Wineburg, 1991) and constructing historical explanations (e.g., Chapman, 2017; Saye & Brush, 2002; SHEG, n.d.).

Yet, history and social science education scholarship has paid little attention to what the C3 Framework defines as the first step of inquiry: "developing questions and planning inquiries" (p. 12). In addition, most inquiry activities in classes and assessments begin with a problem or a question that students must take at face value. Thus, neither the literature nor instructional interventions or assessments have given much time or attention to how students develop questions and plan inquiries nor how teachers help students develop more sophisticated ways to frame problems in advance of planning an inquiry.

If, as the C3 Framework asserts, "developing questions and planning inquiries" constitute crucial and necessary thinking practices in history and the social sciences, then teachers would benefit from explicit curricular activities focused on structuring or working on ill-structures problems. And, consequently, curriculum designers would benefit from more research on student problem framing as well as studies of frameworks to support such thinking. The exploratory studies in this dissertation are a first step to addressing this gap in scholarship.

While hardly comprehensive, my survey of existing research, exploratory studies of an experienced teacher's representation of causal problems, and of students' thinking while framing a historical and a contemporary problem are suggestive of features and intellectual processes essential to working in ill-structured or wicked problem spaces. Across these different studies, I identified a constellation of concepts and reasoning processes used in constructing causal explanations, including critical concepts such as *time, agency, structures, causal roles,* and *causal accounts* and intellectual processes, such as *counterfactual thinking* and *comparison*. Beyond, however, adding to the research on teaching and learning about problem framing, my findings also have implications for helping future researchers study student problem framing and for teachers to *explicitly* teach students to work with wicked or ill-structured problems. In what

follows, I explore three implications of this work for research, assessment, and teaching: (1) Constructing a framework for framing ill-structured causal problems; (2) Designing tasks to engage and assess students in problem framing; (3) Planning instructional interventions for rigorous problem framing.

Constructing A Framework for Ill-Structured Causal Problem Framing

Three fundamental, interrelated dimensions of ill-structured causal problem framing emerged for me through the exploratory research in this dissertation: *establishing the scale of the problem space, identifying the relevant agents and structures,* and *establishing the causal interaction of the problem space*. I have depicted this framework in two different, but overlapping ways.

First, as imagined in Table 13 below, I see these three distinctive dimensions of causal problem framing each consisting of key conceptual variables. For example, in working in an ill-structured problem space, whether historical or contemporary, people would benefit by thinking about the scale of the problem and this would require them to work with temporal and spatial concepts to reason about and make decisions about the breadth of the problem to investigate. Likewise, as Table 13 demonstrates, the other two dimensions each have critical conceptual variables necessary to frame, shape, and structure the problem.

Table 13

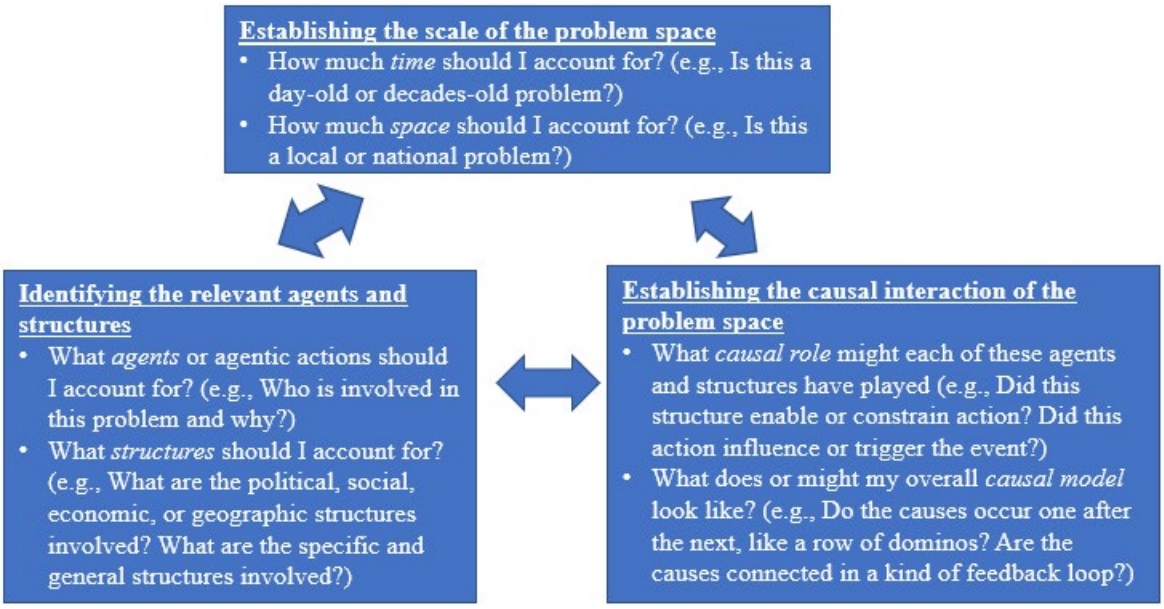
Dimensions of Causal Problem Framing and Key Concepts

Dimension of causal problem framing	Concepts
Establishing the scale of the problem space	• Time (e.g., long-term causes, short-term causes • Space (e.g., distant causes, proximate causes)
Identifying agents and structures	• Agents/agency (e.g., historical actors, intentionality) • Structures (specific and general; political, economic, social, geographic)
Causal interactions in the problem space	• Causal roles (enabling, influencing, triggering) • Causal model (simple and complex; linear and nonlinear)

The C3 Framework stimulated a second imaging of a framework for problem framing, this one grounded not simply on the dimensions of the intellectual task and the key conceptual variables, as Table 13 showed, but rather on the questioning processes that would invite students and teachers into the problem framing space. Similar to how curricula (e.g., SHEG, n.d.) have translated Wineburg's (1991) analytical heuristics of sourcing, contextualizing, and corroborating into a series of interconnected questions to scaffold sophisticated source analysis, I imagined in Figure 33 below the types of questions one might ask when reasoning about these different dimensions of the problem space as well as how these dimensions are interconnected.

Figure 33

Examples of Questions Within Framework for Causal Problem Framing



Establishing the Scale of the Problem Space

In analyzing data from all three studies and reviewing relevant scholarship (e.g. Chapman 2017; Christian, 2005; Gaddis, 2002; Voss et al., 1983), I came to see reasoning about *time* and *space* as part of a more fundamental dimension of problem framing: *establishing the scale of the problem space*. Establishing scale involves asking questions like: *How far out in time or space should I look for the causes of this event? (e.g., Is this a decade-old problem or day-old problem? A local or national problem?) What are the affordances and constraints of using one scale or another?* Such questions were explicitly and implicitly part of Mr. Owens' instruction. For instance, Mr. Owens implored students to consider multiple time scales when approaching a historical causal problem. He supported this type of thinking by providing students with scaffolds, such as a graphic organizer that distinguished between "long-term" and "short-term"

causes (Figure 11). Mr. Owens also discussed how widening the scale of one's inquiry can help reveal the "backstory" and "heart" of historical and current events.

In brainstorming what they "know or might need to know" to create a museum exhibit about the causes of the Pullman Strike or to write a report about the causes of the unionization effort at Amazon, students used time and space to define the boundaries and focus of their problem spaces. For instance, Avery wrote in her Pullman task brainstorm, "How long did the wage-cut last before workers decided to go on strike?" She considered this question to be essential in figuring out the role of another causal factor—the firing of the three workers. Ren wrote in his Amazon task brainstorm, "What is Amazon's political hold locally and nationally?" In asking this question, Ren broadened the scope of inquiry well beyond the small town discussed in the event description.

Analyses of Mr. Owens' instruction and students' responses also revealed ways that reasoning about scale might connect to reasoning about other dimensions of the problem space. For example, Mr. Owens frequently tied reasoning about time to identifying agents and structures, referring, for instance, to political and social structures as "big, long-term things." Similarly, when students identified larger-scale factors (e.g., "Amazon's political hold," "the Progressive Era," "corruption"), they tended to be abstract political and social structures, whereas students' more proximate factors (e.g., "workers' end goal," "wages," "tactics") tended to be agentic or specific structural factors. Students' framing of scale also related to how intricately they connected causal factors in their problem space. For example, within students' problem spaces, the highest concentration of causal interconnections existed closer to the event in time. Further out in the problem space, causal connections became fewer and less precise.

The relationships between scale and other dimensions of the problem space suggest that there might be tradeoffs between how students establish the scale of their problem spaces and how they frame the problem as a whole. For instance, in establishing a wide-scale problem space, students like Robert might have sacrificed consideration of agents and specific structures. In establishing a narrow problem space, students like Avery might have sacrificed consideration of more abstract structures. This does not mean that Robert's scale was more or less useful or sophisticated than Avery's. As Christian (2005) argues, the value of any scale is relative to its fundamental purpose. To illustrate this point, he likens historians' accounts to maps:

> Maps…are different from the objects they describe…Maps, like diagrams, compress information,…excluding most of the real world and including only what is important for their particular purpose. This process of choosing what is and what is not important forces mapmakers (and historians) to think carefully about the questions they are asking, and the sort of knowledge they want to convey (p. 64).

A world map, for instance, may provide information about national boundaries, but it cannot help one navigate the New York City subway system. Likewise, Christian's (2004) 14-billion year "big history" may offer interesting ways of thinking about humanity on a macro scale, but will probably offer little in terms of explaining the causes of the Pullman Strike. Consequently, this research begs the question of not just how students' establish the scale of their problem spaces, but for what purpose?

The review of existing literature and findings from the two student studies suggest the value in and some direction for further research into students' reasoning about scale when framing ill-structured problems. These studies raised unanswered questions about if or how

students consider the tradeoffs imbedded in their choices about scale. Furthermore, this work implies several ways teachers might support students' reasoning about scale that could also be the object of future study. For instance, teachers might explicitly ask questions that cue students to thinking about the different ways of framing scale and the tradeoffs imbedded in those choices.

Identifying Agents and Structures in the Problem Space

Analysis of previous literature (e.g., Grohs et al., 2018; Jonassen, 1997; Pomper, 1996), Mr. Owens instruction, and student thinking helped me to see the importance of identifying agents and structures in framing an ill-structured problem. This dimension of problem framing is represented by questions like, *Who or what is involved in this problem? To what extent is this a problem about people and choices? To what extent is this a problem about institutions, systems, and contexts?* Such questions were implicitly part of Mr. Owens' instruction. For instance, Mr. Owens asked students to inquire into historical actors and their intentions. He also pushed students to identify structures to contextualize agency, or what he called "biographical stuff."

Students also grappled with issues of agency and structure in response to both the Pullman and Amazon tasks. Students inquired into agents' subjectivity (e.g., how did the workers feel about the wage cuts?), character (e.g., was Pullman a good person or bad person?), and intentionality (e.g., why did Pullman cut the wages?). Students also identified and inquired into a wide range of political, economic, and social structures, some of which were specific structures (e.g., "the workers' wages") and some of which were abstract structures (e.g., "corruption"). The data is mostly silent on whether students had or used generalizable ideas about agency or structure, or the extent to which these ideas drove the focus of their problem spaces. One notable exception was during the Pullman task when Robert explicitly stated his

objective to "establish the context" of the event, in which he included important structures related to union movement in the late 1800s. Overall, students did not use generalizable agentic and structural language to the extent they did when discussing time (e.g., "long-term," "short-term").

Observations of students' responses suggest relationships between identifying agents and structures and other dimensions of problem framing. For instance, students tended to assign agentic causes and specific structural causes more precise causal roles and assigned abstract structural causes less precise causal roles. Consequently, in framing a mostly abstract, structural problem space, a student or historian may be less likely or able to make precise causal claims. Additionally, as mentioned in the previous section, students' agents and specific structures also tended to be closer to the event in time and space whereas abstract structures tended to be further out in the problem space. Finally, students who identified structures reflecting multiple structural classifications (e.g., political, social, geographic) tended to frame larger-scale problem spaces than students who mostly identified economic structures.

As with scale, there is no a priori way to determine whether a mostly agentic framing is more or less valuable than a structural framing of the same problem. There are affordances and constraints of both approaches. For instance, a structural framing of a problem might help one consider systemic solutions, whereas an agentic framing of a problem might help one consider solutions that focus on shaping perceptions or empowering individuals. Perhaps then, a goal for historians and students alike is to be aware of how they are framing agency and structure in the problem space and what that means for representing the past or proposing solutions to contemporary problems.

Including causal agents and contextual structures in the framework could and should serve as a both a compliment and counterweight to decisions students make about scale. As noted above, long temporal units of analysis often obscure individual human agency while allowing macro structures to come into view. In contrast, shorter temporal units typically privilege individual agency. Thus, adding causal agency and structures to the framework should sharpen students' attention to relative tradeoffs in their problem space and enable assessors to better understand students' approaches to problem framing.

Establishing the Interaction of the Problem Space

Finally, my analysis of prior scholarship (e.g. Chapman, 2017; Coffin, 2004, 2006; Jonassen & Ionas, 2008; Hexter, 1971; Meadows, 2008; Voss et al., 1994) and the three exploratory studies helped me to conceptualize how teachers or students might relate causes, both at the level of individual causal roles and overall causal models. This dimension of causal interaction encompasses questions like, *What role does this cause play? Does it constrain, enable, or influence the event? What do all these causes and effects look like when put together? Is it a chain of events? Is it a web of interactions or a feedback loop?* For instance, I observed Mr. Owens use causal role language like "trigger" and "spark," which he often tied to temporal concepts like "short-term causes." He also presented his students with two frameworks for thinking about and constructing multi-causal accounts. The first, which I called the "causal web," captures the intricate nature of causal reasoning and shares features of dynamic causal mapping (Jonassen, 1997; Meadows, 2008). The second, which Mr. Owens called "analytical storytelling," highlighted chronology as an organizing feature of historical causal accounts. These two models both reflected and added nuance to prior work on historical accounts (e.g., Lee, 2005; Lee & Shemilt, 2009; Voss et al., 1994)

Analyzing students' responses to the Pullman and Amazon tasks revealed additional causal roles and causal model organizations beyond those mentioned in historical thinking and history education scholarship (e.g., Chapman, 2017; Coffin, 2006; Voss et al., 1994). For instance, several students considered what I refer to as *conditional causal relationships* (e.g., "if the [workers'] end goal was to get like shorter workdays too, then you'd know that these problems started even before the wage cuts", Avery Task 1). Students' responses also reflected a range of different causal models. For example, Robert in the Pullman task situated a smaller-scale narrative of the strike within a larger-scale narrative of Progressive Era reforms. In the Amazon task, Ren situated the unionization effort within multiscale layers of social and political contexts. And, in the Pullman task, Avery interconnected multiple, short-term factors, often identifying mediating and contingent relationships. Though small-scale, this study suggests that there might be any number of ways for students to represent causal interactions when framing an ill-structured problem.

As discussed above, there appeared to be relationships or tradeoffs between how students framed the interaction of causes in their problem space and other dimensions of problem framing. For instance, students tended to use more precise causal role language for agentic and specific causes and short-term and proximate causes. This seemed especially true when students considered conditional roles. Students who constructed relatively intricate and dynamic causal models, like Avery, tended to focus on short-term, proximate events. In contrast, students who framed more expansive problem spaces (e.g., Robert in the Pullman task) seemed to establish less precise, less interconnected causal models.

As with all aspects of problem framing, different approaches have affordances and constraints. Representing as precisely as possible multiple interactions in the problem space may

force one to narrow the scope of the problem they are addressing. Widening the scope may sacrifice how precisely one can account for interactions. Such considerations should be taken into account when analyzing or assessing students' problem framing. Furthermore, explicit attention to questions of causal roles and causal accounts may support students in being more metacognitive about how they frame ill-structured problems.

Designing Tasks to Engage and Assess Students' Problem Framing

In this study, student-participants completed cognitive tasks that differed in focus and design from previous causal reasoning research. Whereas previous studies generally elicited students' causal explanations in response to well-structured tasks (e.g., Carretero et al., 1997; Jacott et al., 1998; Stoel et al., 2015, 2017; Voss et al., 1994), this study aimed to elicit students' problem spaces in response to ill-structured problems. For instance, rather than ask students to identify the causes of the Pullman Strike or the Amazon unionization effort, this study asked students to "brainstorm" what they "know or might need to know" to design a museum exhibit about the causes of the strike (Task 1) or to write a report about the causes of the unionization effort (Task 2). To help make students thinking visible, I asked students to "talk me through" their brainstorm to which I followed up with probing questions, such as "why did you say that?" "or could you explain further?"

While I constructed the tasks and the procedures to surface students thinking in the ill-structured problem space, it occurred to me that these tasks also gave students practice working on framing problems, rather than quickly jumping into analyzing a set of documents to "solve" the given question. Again, if we consider, as the C3 Framework does, that forming research questions and planning an investigations are essential dimensions of preparing educated citizens, then it seems we should have tasks that elicit and give students the chance to practice such

thinking. Based on task design and procedures I employed in Chapters Six and Seven, I offer the following design principles to guide teachers, assessment design, and future research:

Problem framing tasks should…

- be open-ended in the sense that are many defensible ways to frame the problem,
- provide enough background information to help students generate ideas about the problem, but not so much information that the problem is already framed for students,
- focus students on the process of generating questions and initial lines of inquiry rather than conclusions or solutions,
- give students ample time to generate questions and initial lines of inquiry,
- support students in verbalizing their reasoning.

Ogle's (1986) popular K-W-L activity ("What we *know* – What we *want* to find out – What we *learned* and still need to learn," p. 565) and Rothstein and Santana's (2011) question formulation technique (QFT) embody several of these principles. Teachers might ensure that K-W-L and QFT activities are generative by selecting open-ended problems, devoting sufficient time to the activity, providing students an appropriate amount of background information, and prompting to students to share their reasoning (e.g., "you say you know X; *how* do you think X is related to the problem?", "*why* do you want to know X?").

Since there is never one correct problem space or even one best way to frame an ill-structured problem, analyzing students' work in these tasks makes conventional assessment challenging. Avery, Ren, and Robert, for instance, each established sophisticated, yet distinct problem spaces. Simply awarding points for students who establish a wide problem space, identify structural causes, or build an intricate causal model ignores the tradeoffs one makes when approaching an ill-structure problem. Instead, researchers and teachers might assess how

students understand and articulate the tradeoffs in their problem framing. For starters, does the student recognize other ways to frame the problem? Can they identify the affordances and constraints of their problem framing as well as those of alternative problem framings? Can they justify why they chose to frame the problem the way they did in light of other ways to frame the problem?

The data in this study is insufficient to provide a rubric or learning progression for problem framing processes. To create such a rubric or learning progression, researchers will likely need to elicit a range of students' approaches to framing an ill-structured problem, focusing specifically on their metacognitive processes rather than the specific size or content of their problem spaces. It may also be useful to compare students' metacognitive problem framing processes to experts in various domains.

Planning Instructional Interventions for Rigorous Problem Framing

As part of this dissertation, I observed how Mr. Owens, an experienced history teacher, taught his students to reason about causes in history. I did not and cannot comment on whether his instruction had any impact on how his students approach ill-structured causal problems. However, using the data and existing literature, I can make some suggestions for instructional interventions that *may* support students in engaging in this type of thinking.

One of the first steps in solving an ill-structured problem is recognizing the ill-structured features of the problem (King, 1992; King & Kitchener, 1994). Teachers might help students to recognize these features by asking them to analyze a familiar ill-structured problem. For instance, Mr. Owens engaged students in thinking about the multiple causes of a wildfire in California. Similarly, Chapman (2003) provided his students with an allegory about the death of a camel and prompted students to consider the possible causes of the camel's death. Teachers

and students can use examples like these to help students infer key attributes of ill-structured causal problems. These may include the fact that such problems:

1) have no definite scale (e.g., causes can be traced back in time or out in space indefinitely),

2) implicate a wide range of agents and structures,

3) can be represented using multiple causal relationships and models.

Teachers can also present students with evidence or questions that destabilizes their previously well-structured conception of a topic (Bain, 2005). For instance, if students were taught four primary causes of World War I (e.g., militarism, alliances, imperialism, and nationalism), a teacher might problematize that framing by asking students to try to combine two of the causes, divide the causes into smaller grain sizes, or identify a cause that predates the four given causes. Such an activity might help communicate the ill-structured nature of representing causation.

Teachers might also explicitly teach concepts related to identifying causes and developing an effective causal problem space. These will likely be concepts related to *scale* (e.g., short-term, long-term) *agency* and *structure* (e.g., abstract, specific, political, social), and *causal roles* (e.g., triggering, influencing) and *causal models* (e.g., narrative, systems map). For example, education scholars in fields outside of history, such as ecology and systems thinking, have helped students to nuance their causal explanations by explicitly using complex causal and systems thinking language, such as "domino," "cyclic," and "mutual causality" (Grotzer & Basca, 2003, p. 16) or "homeostasis" (Jacobson, 2001, p. 42). Teachers might elicit and nuance students' thinking about these different causal concepts through dialogue. For instance, during class discussions, Mr. Owens frequently pushed students to identify causes at multiple time scales. He also surfaced causal framings that privileged either agents or structures.

Finally, teachers might provide students with scaffolds to shape their approaches to establishing or reflecting on their causal problem spaces. Mr. Owens for instance provided graphic organizers to help students identify different types of causes or distinguish causes from event details. Teachers could also provide students with reflection prompts like: "How far back in time do your causes go?"; "Would it be useful to identify causes even further back in time? Why or why not?"; "Did you mostly talk about agents or structures?"; "What might you gain or lose by focusing more on agents or more on structures?"

Future research should investigate how such interventions might affect how students establish problem spaces in response to ill-structured problems and how they reflect on their own reasoning processes. Intervention studies about students' causal explanations (e.g., Stoel et al. 2015, 2017) can serve as a template for conducting this research.

The Virtues of Mapping the Problem Space Along Temporal and Spatial Axes

Previous research has used causal mapping to represent students' historical explanations (e.g., Voss et al., 1994). Likewise, scholars have proposed or studied mapping tools to help students develop more sophisticated causal accounts (e.g., Chapman, 2017; Jonassen & Ionas, 2008; Masterman & Sharples, 2002). However, this study is the only one that I am aware of that mapped students' thinking along temporal and spatial axes. Doing so helped me to not only see the boundaries of students' problem spaces, but also where in their problem spaces they established causal interconnections. I believe this tool could be useful for future researchers exploring the relationship between scale and other dimensions of students' problem spaces. I also see the two-axes map as a potentially useful instructional tool. Teachers, for instance, might map out for students two different historical accounts to show them how the authors' organized their causal claims in relation to time and space. Additionally, assigning students to create their own

maps might promote metacognition around framing a problem space. A student might look at a map they created and identify connections they had not previously considered or decide to seek out additional causal factors representing different temporal or spatial scales. Future scholarship should explore the potential design and efficacy of such interventions.

Limitations of These Exploratory Studies and The Proposed Framework

Though the studies I conducted were exploratory and I am making no claims to their generalizability, I want to point out several limitations in my design. First, I used purposive sampling (Silverman, 2000) to highlight the value of framing historical causal reasoning problems as ill-structured problems. The sample included a veteran history teacher and a handful of his ostensibly high achieving, secondary students. Therefore, I cannot and am not generalizing the individual findings of Mr. Owens' instruction or students' reasoning. Furthermore, the student data in this study primarily comprised students' verbal responses to an open-ended protocol. As a result, the approach used in this study may not be as valuable in evaluating students' written work, especially shorter-form responses or more close-ended inquiries.

Additionally, I designed the two cognitive tasks to elicit students' initial causal problem framing. It is unclear, then, if the approach presented here is useful for describing a more complete set of students' inquiry or problem-solving practices. For instance, there is no data to show how students' framing of the scale of the problem might have shaped their final historical account or solution. Furthermore, to elicit students' thinking, I used a probing-question protocol rather than a less intrusive think-aloud protocol (Ericsson & Simon, 1993). This enabled me to unearth a great deal of nuance in students' thinking. However, as discussed in Chapter Four, there were moments in the data where it was difficult to determine if a student was elaborating on previous thinking or generating new thoughts in response to a probing question. Additionally,

this study did not assess students' background knowledge of the two events. What students knew or felt about the two events likely impacted the way they framed the problem. However, any instrument used to assess students' background knowledge might also influence how students frame the problem.

Further, students sometimes used imprecise language when identifying causes and causal roles. As a result, I had to make decisions about how to categorize students' utterances. This might have led to some interpretative errors. As discussed previously, I tried to mitigate these errors by looking at the broader context of students' utterances. I also consulted with an intercoder to help reify code definitions and applications. Nonetheless, there are bound to be some differences between other readers' interpretations and my interpretations.

Finally, as discussed in the literature review and in the data analysis, historians and students engage in a host of reasoning processes related to causal problems, such as *counterfactual thinking, comparing,* and *reasoning about change and continuity over time*. Although these are likely important for how students frame problems, I have left them out of the framework because they do not appear to be necessary attributes for problem framing. For instance, one might engage in *counterfactual thinking* to reason about a causal relationship or to identify an agent or structure, but such *counterfactual thinking* is not a requirement for such reasoning. Nevertheless, future research may provide further insight into how or why students use these or other reasoning processes in relation to the different dimensions of problem framing.

Conclusion

The past may be *the past*, but historical inquiry is ever present and thus remains an open-ended and ill-structured project. When approaching a new topic, a historian may not know how they will frame their question or establish the scale of their problem space. They may not know

what source material they might find or what new information might reshape their understanding of the topic. These kinds of messy problem-solving processes are not always observable in historians' published accounts (e.g., a history book or journal article). This lack of visibility can give teachers and students the impression that the past is "settled history"—that it is their job to simply teach or learn those facts which historians have previously uncovered. To break students and educators out of this notion of "settled history," I've argued for including ideas and frameworks from ill-structured or wicked problem-solving fields (e.g., policy, ecology). Experts in these fields tend to grapple more openly with issues of uncertainty, contingency, and problem framing in ways we often do not get to observe in historical accounts. Ironically then, teaching historical inquiry as akin to a policy or design problem may help students better understand the true nature of historical inquiry.

Therefore, rather than provide students with heavily bounded activities assessed along isolated content objectives, teachers should provide students with more opportunities to frame their own questions, consider what they don't know or need to know, test hypotheses, and raise counterfactuals. Opening up the sandbox of history is not without risks, however. Coherence may lose out to complexity, and consensus ideas may be rejected for more idiosyncratic ones. Students will be wrong more often. Nevertheless, to develop students into critical consumers of news and history, we must provide them the tools and space to take on ill-structured historical and contemporary problems. In doing so, I think we'll find that students' approaches to history and contemporary problems are not as "novice" as we once thought.

References

Bain, R. B. (2000). Into the breach: Using research and theory to shape history instruction. In P. N. Stearns & P. C. Seixas (Eds.), *Knowing, Teaching and Learning History* (pp. 331–352). New York University Press.

Bain, R. B. (2005). They thought the world was flat? Applying the principles of how people learn in teaching high school history. In M. S. Donovan & J. D. Bransford (Eds.), *How students learn: History, mathematics, and science in the classroom* (pp. 179–213). National Academic Press.

Balint, P. J., Stewart, R. E., Desai, A., & Walters, L. C. (2011). *Wicked environmental problems: Managing uncertainty and conflict*. Island Press.

Barton, K. C. (2012). Agency, choice and historical action: How history teaching can help students think about democratic decision making. *Citizenship Teaching & Learning*, *7*(2), 131–142. https://doi.org/10.1386/ctl.7.2.131_1

Barton, K. C., & Levstik, L. S. (2004). *Teaching history for the common good*. Lawrence Erlbaum Associates.

Bassett, J. (1997). The Pullman Strike of 1894. *OAH Magazine of History*, *11*(2), 34–41.

Blow, F. (2011). "Everything flows and nothing stays": How students make sense of the historical concepts of change, continuity and development. *Teaching History*.

Boix-Mansilla, V. (2000). Historical understanding: Beyond the past and into the present. In P.N. Stearns, S. Wineburg, & P. Seixas (Eds.), *Knowing, teaching and learning history: National and international perspectives* (pp. 390–414). New York University Press.

Breuning, M. (2007). *Foreign policy analysis: A comparative introduction*. Springer.

Brien, J. (2013). The role of causation in history. *History in the Making*, *2*(1), 72–81.

Britt, M. A., Perfetti, C. A., Van Dyke, J., & Gabrys, G. (2000). The Sourcer's Apprentice: A tool for document-supported history instruction. In P. N. Stearns, P. Seixas, & S. S. Wineburg (Eds.), *Knowing, teaching and learning history: National and international perspectives* (pp. 437–470). New York University Press.

Brooks, S. (2014). Connecting the past to the present in the middle-level classroom: A comparative case study. *Theory & Research in Social Education*, *42*(1), 65–95. https://doi.org/10.1080/00933104.2013.860068

Carlsnaes, W. (1992). The agency-structure problem in foreign policy analysis. *International Studies Quarterly*, *36*(3), 245–270. https://doi.org/10.2307/2600772

Carr, E. H. (1961). *What is history?* Palgrave Macmillan.

Carretero, M., Asensio, M., & Pozo, J. I. (1991). Cognitive development, historical time representation, and causal explanations in adolescence. In M. Carretero, M. Pope, R.-J. Simons, & J. I. Pozo (Eds.), *Learning and instruction: European research in an international context* (Vol. 3, pp. 27–48). Pergamon Press.

Carretero, M., Jacott, L., Limón, M., Lopez-Manjon, A., & Leon, J. (1994). Historical knowledge: Cognitive and instructional implications. In M. Carretero & J. F. Voss (Eds.), *Cognitive and instructional processes in history and the social Sciences* (pp. 357–376). Psychology Press.

Carretero, M., López-Manjón, A., & Jacott, L. (1997). Explaining historical events. *International Journal of Educational Research*, *27*(3), 245–253. https://doi.org/10.1016/S0883-0355(97)89732-7

Carroll, J. E. (2018). Couching counterfactuals in knowledge when explaining the Salem Witch Trials with Year 13. *Teaching History*, 172, 18–29.

Casti, J. L. (1994). *Complexification: Explaining a paradoxical world through the science of surprise*. Harper Collins.

Cercadillo, L., Chapman, A., & Lee, P. (2017). Organizing the past: Historical accounts, significance and unknown ontologies. In M. Carretero, S. Berger, & M. Grever (Eds.), *Palgrave handbook of research in historical culture and education* (pp. 529–552). Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-52908-4_28

Chapman, A. (2003). Camels, diamonds and counterfactuals: A model for teaching causal reasoning. *Teaching History*, *112*, 46–53.

Chapman, A. (2017). Causal explanation. In I. Davies (Ed.), *Debates in history teaching* (2nd edition, pp. 130–143). Routledge.

Cheng, P. W. (1997). From covariation to causation: A causal power theory. *Psychological Review*, *104*(2), 367–405. https://doi.org/10.1037/0033-295X.104.2.367

Chi, M. T. H. (2005). Commonsense conceptions of emergent processes: Why some misconceptions are robust. *Journal of the Learning Sciences*, *14*(2), 161–199. https://doi.org/10.1207/s15327809jls1402_1

Chi, M. T. H., Feltovich, P. J., & Glaser, R. (1981). Categorization and representation of physics problems by experts and novices. *Cognitive Science*, *5*(2), 121–152. https://doi.org/10.1207/s15516709cog0502_2

Chi, M. T. H., & Glaser, R. (1985). Problem solving ability. In R. J. Sternberg (Ed.), *Human abilities: An information-processing approach* (pp. 227–257). W. H. Freeman & Co.

Chi, M. T. H., Roscoe, R. D., Slotta, J. D., Roy, M., & Chase, C. C. (2012). Misconceived causal explanations for emergent processes. *Cognitive Science*, *36*(1), 1–61. https://doi.org/10.1111/j.1551-6709.2011.01207.x

Christian, D. (2004). *Maps of time. An introduction to big history*: University of California Press.

Christian, D. (2005). Scales. In M. Hughes-Warrington (Ed.), *Palgrave advances in world histories* (pp. 64–89). Palgrave Macmillan UK. https://doi.org/10.1057/9780230523401_4

Coffin, C. (2004). Learning to write history: The role of causality. *Written Communication*, *21*(3), 261–289. https://doi.org/10.1177/0741088304265476

Coffin, C. (2006). *Historical discourse: The language of time, cause and evaluation*. Continuum.

College Board. (2020). *AP U.S. History: Course and exam description*. College Board.

Collingwood, R. G. (1956). *The idea of history*. Oxford University Press.

Conklin, J. (2006). *Dialogue mapping: Building shared understanding of wicked problems*. Wiley.

Corkery, M., & Weise, K. (2021, January 25). Amazon union drive takes hold in unlikely place. *The New York Times*. https://www.nytimes.com/2021/01/25/business/amazon-union-alabama.html

Counsell, C. (2011). What do we want students to do with historical change and continuity? In I. Davies (Ed.), *Debates in history teaching* (1st ed., pp. 109–123). Routledge.

Counsell, C. (2017). Historical change and continuity: How history teachers are advancing the field. In I. Davies (Ed.), *Debates in history teaching,* (2nd ed., pp. 113–129). Routledge.

den Heyer, K. (2012). Mapping the shadow: Bringing scholarship and teachers together to explore agency's shape and content in social change. *Theory & Research in Social Education*, *40*(3), 292–323. https://doi.org/10.1080/00933104.2012.705680

Duquette, C. (2015). Relating historical consciousness to historical thinking through assessment. In K. Ercikan and P. Seixas (Eds.), *New directions in assessing historical thinking* (pp. 51–63). Routledge.

Eilam, B. (2012). System thinking and feeding relations: Learning with a live ecosystem model. *Instructional Science*, *40*(2), 213–239. https://doi.org/10.1007/s11251-011-9175-4

Einhorn, H. J., & Hogarth, R. M. (1986). Judging probable cause. *Psychological Bulletin*, *99*(1), 3–19. https://doi.org/10.1037/0033-2909.99.1.3

Epstein, T. (1998). Deconstructing differences in African-American and European-American adolescents' perspectives on U.S. history. *Curriculum Inquiry*, *28*(4), 397–423. https://doi.org/10.1111/0362-6784.00100

Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data (revised edition)*. MIT Press.

Ertmer, P. A., Stepich, D. A., York, C. S., Stickman, A., Wu, X., Zurek, S., & Goktas, Y. (2008). How instructional design experts use knowledge and experience to solve ill-structured problems. *Performance Improvement Quarterly*, 21(1), 17–42.

Eseryel, D. (2006). *Expert conceptualizations of the domain of instructional design: An investigative study on the deep assessment methodology for complex problem-solving outcomes* (Publication No. 3241853) [Doctoral dissertation, Syracuse University]. http://surface.syr.edu/idde_etd/5/

Evans, R. J. (1987). *Death in Hamburg: Society and politics in the cholera years, 1830-1910*. Clarendon Press.

Evans, R. J. (1997). *In defense of history*. Granta.

Ferguson, N. (2000). *Virtual history: Alternatives and counterfactuals*. Basic Books.

Fernandes, R., & Simon, H. A. (1999). A study of how individuals solve complex and ill-structured problems. *Policy Sciences*, *32*(3), 225–245. https://doi.org/10.1023/A:1004668303848

Fertig, G. (2008). Using biography to help young learners understand the causes of historical change and continuity. *The Social Studies*, *99*(4), 147–154. https://doi.org/10.3200/TSSS.99.4.147-154

Fischer, D. H. (1970). *Historians' fallacies: Toward a logic of historical thought*. Harper Perennial.

Fitzgerald, J. C. (2014). An analysis of causal asyndetic constructions in United States history textbooks. *Functional Linguistics*, *1*(1), 5. https://doi.org/10.1186/2196-419X-1-5

Foster, R. (2008). Speed cameras, dead ends, drivers and diversions: Year 9 use a "road map" to problematise change and continuity. *Teaching History, London*, *131*, 4–7.

Foster, S., Ashby, R., & Lee, P. (2008). *Usable historical pasts: A study of students' frameworks of the past*. ESRC.

Froeyman, A. (2009). Concepts of causation in historiography. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, *42*(3), 116–128. https://doi.org/10.3200/HMTS.42.3.116-128

Funke, J. (1991). *Complex problem solving: Principles and mechanisms* (R. J. Sternberg & P. A. Frensch, Eds.). Psychology Press.

Gaddis, J. L. (2002). *The landscape of history: How historians map the past*. Oxford University Press.

Gay, P. (1976). *Art and act: On causes in history: Manet, Gropius, Mondrian*. Harper & Row.

Ge, X., & Land, S. M. (2003). Scaffolding students' problem-solving processes in an ill-structured task using question prompts and peer interactions. *Educational Technology Research and Development*, *51*(1), 21–38. https://doi.org/10.1007/BF02504515

Ge, X., & Land, S. M. (2004). A conceptual framework for scaffolding III-structured problem-solving processes using question prompts and peer interactions. *Educational Technology Research and Development*, *52*(2), 5–22. https://doi.org/10.1007/BF02504836

Ghilani, D., Luminet, O., Erb, H.-P., Flassbeck, C., Rosoux, V., Tames, I., & Klein, O. (2017). Looking forward to the past: An interdisciplinary discussion on the use of historical analogies and their effects. *Memory Studies*, *10*(3), 274–285. https://doi.org/10.1177/1750698017701609

Gick, M. L. (1986). Problem-solving strategies. *Educational Psychologist*, *21*(1–2), 99–120. https://doi.org/10.1080/00461520.1986.9653026

Gick, M. L., & Holyoak, K. J. (1980). Analogical problem solving. *Cognitive Psychology*, *12*(3), 306–355. https://doi.org/10.1016/0010-0285(80)90013-4

Gick, M. L., & Holyoak, K. J. (1983). Schema induction and analogical transfer. *Cognitive Psychology*, *15*(1), 1–38. https://doi.org/10.1016/0010-0285(83)90002-6

Giddens, A. (1979). *Central problems in social theory: Action, structure, and contradiction in social analysis*. University of California Press. (Original work published in 1950).

Gottschalk, L. R. (1963). *Understanding history: A primer of historical method*. Knopf. (Work originally published in 1950).

Grohs, J. R., Kirk, G. R., Soledad, M. M., & Knight, D. B. (2018). Assessing systems thinking: A tool to measure complex reasoning through ill-structured problems. *Thinking Skills and Creativity*, *28*, 110–130. https://doi.org/10.1016/j.tsc.2018.03.003

Grotzer, T. A., & Basca, B. B. (2003). How does grasping the underlying causal structures of ecosystems impact students' understanding? *Journal of Biological Education*, *38*(1), 16–29. https://doi.org/10.1080/00219266.2003.9655891

Grotzer, T. A., Kamarainen, A. M., Tutwiler, M. S., Metcalf, S., & Dede, C. (2013). Learning to reason about ecosystems dynamics over time: The challenges of an event-based causal focus. *BioScience*, *63*(4), 288–296. https://doi.org/10.1525/bio.2013.63.4.9

Grotzer, T. A., Powell, M. M., M. Derbiszewska, K., Courter, C. J., Kamarainen, A. M., Metcalf, S. J., & Dede, C. J. (2015). Turning transfer inside out: The affordances of virtual worlds and mobile devices in real world contexts for teaching about causality across time and distance in ecosystems. *Technology, Knowledge and Learning*, *20*(1), 43–69. https://doi.org/10.1007/s10758-014-9241-5

Halldén, O. (1986). Learning history. *Oxford Review of Education*, *12*(1), 53–66. https://doi.org/10.1080/0305498860120105

Halldén, O. (1993). Learners' conceptions of the subject matter being taught: A case from learning history. *International Journal of Educational Research*, *19*(3), 317–325.

Halldén, O. (1997). Conceptual change and the learning of history. *International Journal of Educational Research*, *27*(3), 201–210. https://doi.org/10.1016/S0883-0355(97)89728-5

Halldén, O. (1998). Personalization in historical descriptions and explanations. *Learning and Instruction*, *8*(2), 131–139. https://doi.org/10.1016/S0959-4752(97)00012-1

Hart, H. L. A., & Honoré, T. (1985). *Causation in the Law* (2nd ed.). Oxford University Press. (Original work published in 1959).

Healey, P., & Barrett, S. M. (1990). Structure and agency in land and property development processes: Some ideas for research. *Urban Studies*, *27*(1), 89–103. https://doi.org/10.1080/00420989020080051

Henríquez, R., & Ruiz, M. (2014). Chilean students learn to think historically: Construction of historical causation through the use of evidence in writing. *Linguistics and Education*, *25*, 145–157. https://doi.org/10.1016/j.linged.2013.10.003

Hexter, J. H. (1971). *The history primer*. New York: Basic Books.

Hicks, D., Doolittle, P., & Ewing, T. (2004). The SCIM-C strategy: Expert historians, historical inquiry, and multmedia. *Social Education*, 68(3), 221–225.

Hmelo-Silver, C. E., Marathe, S., & Liu, L. (2007). Fish swim, rocks sit, and lungs breathe: Expert-novice understanding of complex systems. *Journal of the Learning Sciences*, *16*(3), 307–331. https://doi.org/10.1080/10508400701413401

Holyoak, K. J., & Thagard, P. (1996). *Mental leaps: Analogy in creative thought*. MIT Press.

Horiguchi, T., & Kashihara, A. (2016). Pseudo-haptics presentation for promoting historical understanding. In P. Zaphiris & A. Ioannou (Eds.), *Learning and collaboration technologies* (pp. 156–164). Springer International Publishing. https://doi.org/10.1007/978-3-319-39483-1_15

Houghton, D. P. (1998a). Analogical reasoning and policymaking: Where and when is it used? *Policy Sciences*, *31*(3), 151–176. JSTOR.

Houghton, D. P. (1998b). Historical analogies and the cognitive dimension of domestic policymaking. *Political Psychology*, *19*(2), 279–303. https://doi.org/10.1111/0162-895X.00105

Hung, W. (2016). All PBL starts here: The problem. *Interdisciplinary Journal of Problem-Based Learning*, *10*(2). https://doi.org/10.7771/1541-5015.1604

Hung, W., Mehl, K., & Holen, J. B. (2013). The relationships between problem design and learning process in problem-based learning environments: Two cases. *The Asia-Pacific Education Researcher*, *22*(4), 635–645. https://doi.org/10.1007/s40299-013-0066-0

Hwang, G. J., Kuo, F. R., Chen, N. S., & Ho, H. J. (2014). Effects of an integrated concept mapping and web-based problem-solving approach on students' learning achievements, perceptions and cognitive loads. *Computers & Education*, *71*, 77–86. https://doi.org/10.1016/j.compedu.2013.09.013

Jackson, K. T. (1987). *Crabgrass frontier: The suburbanization of the United States.* Oxford University Press.

Jacobson, M. J. (2001). Problem solving, cognition, and complex systems: Differences between experts and novices. *Complexity*, *6*(3), 41–49. https://doi.org/10.1002/cplx.1027

Jacott, L., López-Manjón, A., & Carretero, M. (1998). Generating explanations in history. In M. Carretero & J. Voss (Eds.), *International Review of History Education: International Review of History Education* (Vol. 2, pp. 294–306). Routledge.

Janis, I. L. (1989). *Crucial decisions: Leadership in policymaking and crisis management*. Simon and Schuster.

Jonassen, D. H. (1997). Instructional design models for well-structured and ill-structured problem-solving learning outcomes. *Educational Technology Research and Development*, *45*(1), 65–94.

Jonassen, D. H., & Ionas, I. G. (2008). Designing effective supports for causal reasoning. *Educational Technology Research and Development*, *56*(3), 287–308. https://doi.org/10.1007/s11423-006-9021-6

Jones, D. K., & Read, S. J. (2005). Expert-novice differences in the understanding and explanation of complex political conflicts. *Discourse Processes*, *39*(1), 45–80. https://doi.org/10.1207/s15326950dp3901_2

Jordan, R. C., Brooks, W. R., Hmelo-Silver, C., Eberbach, C., & Sinha, S. (2014). Balancing broad ideas with context: An evaluation of student accuracy in describing ecosystem processes after a system-level intervention. *Journal of Biological Education*, *48*(2), 57–62. https://doi.org/10.1080/00219266.2013.821080

Kahneman, D. (1995). Varieties of counterfactual thinking. In N. J. Roese & J. M. Olson (Eds.), *What might have been: The social psychology of counterfactual thinking* (pp. 375–396). Taylor & Francis.

Kemp, S. G., & Sadoski, M. (1991). The effects of instruction in forming generalizations on high school students' critical thinking in world history. *Reading Research and Instruction*, *31*(1), 33–42. https://doi.org/10.1080/19388079109558069

Khong, Y. F. (1992). *Analogies at war: Korea, Munich, Dien Bien Phu, and the Vietnam decisions of 1965*. Princeton University Press.

King, P. M. (1992). How do we know? Why do we believe? Learning to make reflective judgments. *Liberal Education*, 78(1), 2–9.

King, P. M., & Kitchener, K. S. (1994). *Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults.* Jossey-Bass.

Lamberti, D. M., & Newsome, S. L. (1989). Presenting abstract versus concrete information in expert systems: What is the impact on user performance? *International Journal of Man-Machine Studies*, *31*(1), 27–45. https://doi.org/10.1016/0020-7373(89)90031-X

Le Roy Ladurie, E. (1978). *Montaillou: The promised land of error and Cathars and Catholics in a French village* (B. Bray, Trans.). Braziller.

Lee, P. (2004). "Walking backwards into tomorrow": Historical consciousness and understanding history. *International Journal of Historical Teaching, Learning, and Research*, *4(1), 1–46.* https://doi.org/10.18546/HERJ.10.2.07

Lee, P. (2005). Putting principles into practice: Understanding history. In M. S. Donovan & J. D. Bransford (Eds.), *How students learn: History in the classroom* (pp. 31- 78). Washington, DC: National Academies Press.

Lee, P. (2014). Fused horizons? UK research into students' second-order ideas in history – A perspective from London. In M. Köster, H. Thünemann, & M. Zülsdorf-Kersting (Eds.), *Researching history education: International perspectives and disciplinary traditions*. Wochenschau.

Lee, P., & Ashby, R. (2000). Progression in historical understanding among students ages 7-14. In P. N. Stearns, P. C. Seixas, & S. S. Wineburg (Eds.), *Knowing, teaching, and learning history: National and international perspectives*. New York University Press.

Lee, P. J., & Ashby, R. (2001). Empathy, perspective taking and rational understanding. In O. L. Davis, E. A. Yeager, & S. J. Foster (Eds.), *Historical empathy and perspective taking in*

the social studies (pp. 21–50). Rowman & Littlefield.

Lee, P., Ashby, R., & Dickinson, A. (1996). Progression in children's ideas about history. In M. Hughes (Ed.), *Progression in learning* (pp. 50–81). Multilingual Matters.

Lee, P., & Shemilt, D. (2009). Is any explanation better than none?: Over-determined narratives, senseless agencies and one-way streets in students' learning about cause and consequence in history. *Teaching History*, *137*, 42–49.

Lévesque, S., & Clark, P. (2018). Historical thinking: Definitions and educational applications. In *The Wiley international handbook of history teaching and learning* (pp. 117–148). John Wiley & Sons. https://doi.org/10.1002/9781119100812.ch5

Lloyd, C. (1993). *The structures of history*. Wiley.

Marx, K. (1926). *The Eighteenth Brumaire of Louis Bonaparte*. International Publishers. (Original work published in 1852).

Masterman, L. (2005). A knowledge-based coach for reasoning about historical causation. In C. K. Looi, G. McCalla, & B. Bredeweg (Eds.), *Artificial intelligence in education: supporting learning through intelligent and socially informed technology* (pp. 435–442). IOS Press.

Masterman, L., & Sharples, M. (2002). A theory-informed framework for designing software to support reasoning about causation in history. *Computers & Education*, *38*(1–3), 165–185. https://doi.org/10.1016/S0360-1315(01)00072-0

Meadows, D. H. (2008). *Thinking in systems: A primer* (D. Wright, Ed.). Chelsea Green Publishing.

Megill, A. (1994). Jörn Rüsen's theory of historiography between modernism and rhetoric of inquiry. *History and Theory*, *33*(1), 39–60. https://doi.org/10.2307/2505651

Megill, A. (2007). *Historical knowledge, historical error: A contemporary guide to practice*. University of Chicago Press.

Metcalf, S. J., Krajcik, J., & Soloway, E. (2000). Model-It: A design retrospective. In M. J. Jacobson & R. B. Kozma (Eds.), *Innovations in science and mathematics education* (pp. 77–115). Lawrence Erlbaum.

Montanero, M., & Lucero, M. (2011). Causal discourse and the teaching of history. How do teachers explain historical causality? *Instructional Science*, *39*(2), 109–136. https://doi.org/10.1007/s11251-009-9112-y

Monte-Sano, C. (2010). Disciplinary literacy in history: An exploration of the historical nature of adolescents' writing. *Journal of the Learning Sciences*, 19(4), 539–568. https://doi.org/10.1080/10508406.2010.481014

Monte-Sano, C. (2011). Beyond reading comprehension and summary: Learning to read and write in history by focusing on evidence, perspective, and interpretation. *Curriculum Inquiry*, 41(2), 212–249.

National Council for the Social Studies (NCSS), *The college, career, and civic life (C3) framework for social studies state standards: Guidance for enhancing the rigor of K-12 civics, economics, geography, and history*. NCSS.

Needham, A. (2014). *Power Lines: Phoenix and the making of the modern southwest*. Princeton University Press.

Nersäter, A. (2018). Student understanding of causation in History in relation to specific subject matter: Causes behind the scramble for Africa. *Historical Encounters, 5*(1), 76–89.

Neustadt, R. E., & May, E. R. (1988). *Thinking in time: The uses of history for decision-makers*. Free Press.

Newell, A., & Simon, H. A. (1972). *Human problem solving*. Prentice-Hall.

Ogle, D. M. (1986). K-W-L: A teaching model that develops active reading of expository text. *The Reading Teacher*, 39(6), 564–570.

Orfield, G. (1988). Separate societies: Have the Kerner warnings come true? In R. W. Wilkins & F. R. Harris (Eds.), *Quiet riots: Race and poverty in the United States: The Kerner Report twenty years later* (pp. 100–122). Pantheon Books.

Parker, W. C. (1988). Thinking to learn concepts. *The Social Studies*, *79*(2), 70–73. https://doi.org/10.1080/00220973.1944.11019892

Penuel, W. R., & Wertsch, J. V. (1998). Historical representation as mediated action: Official history as a tool. In M. Carretero & J. Voss (Eds.), *International review of history education* (Vol. 2, pp. 23–38). Woburn.

Petri, J., & Niedderer, H. (1998). A learning pathway in high-school level quantum atomic physics. *International Journal of Science Education*, *20*(9), 1075–1088. https://doi.org/10.1080/0950069980200905

Pomper, P. (1996). Historians and individual agency. *History and Theory*, *35*(3), 281–308. https://doi.org/10.2307/2505451

Reed, S. K. (2016). The structure of ill-structured (and well-structured) problems revisited. *Educational Psychology Review*, 28(4), 691–716. https://doi.org/10.1007/s10648-015-9343-1

Reimann, P., & Chi, M. T. H. (1989). Human expertise. In K. J. Gilhooly (Ed.), *Human and machine problem solving* (pp. 161–191). Springer US. https://doi.org/10.1007/978-1-4684-8015-3_7

Reisman, A. (2009). Teaching the historical principle of contextual causation: A study of transfer in historical reading. In M. Martens, U. Hartmann, M. Sauer, & M. Hasselhorn (Eds.), *Interpersonal understanding in historical context* (pp. 43–60). Sense Publishers.

Reisman, A. (2012). Reading like a historian: A document-based history curriculum intervention in urban high schools. *Cognition and Instruction*, 30(1), 86–112.

Resnick, M. (1994). *Turtles, termites, and traffic jams: Explorations in massively parallel microworlds*. MIT Press.

Resnick, M., & Wilensky, U. (1998). Diving into complexity: Developing probabilistic decentralized thinking through role-playing activities. *Journal of the Learning Sciences*, *7*(2), 153–172. https://doi.org/10.1207/s15327809jls0702_1

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155–169. https://doi.org/10.1007/BF01405730

Roese, N. (1999). Counterfactual thinking and decision making. *Psychonomic Bulletin & Review*, *6*(4), 570–578. https://doi.org/10.3758/BF03212965

Rondinone, T. (2009). Guarding the switch: Cultivating nationalism during the Pullman Strike. *The Journal of the Gilded Age and Progressive Era*, *8*(1), 83–109. https://doi.org/10.1017/S1537781400001018

Ross, J. I. (1993). Structural causes of oppositional political terrorism: Towards a causal model. *Journal of Peace Research*, *30*(3), 317–329. https://doi.org/10.1177/0022343393030003006

Rothstein, D., & Santana, L. (2011). *Make just one change: Teach students to ask their own questions*. Harvard Education Press.

Rowland, G. (1992). What do instructional designers actually do? An initial investigation of expert practice. *Performance Improvement Quarterly*, *5*(2), 65–86. https://doi.org/10.1111/j.1937-8327.1992.tb00546.x

Rüsen, J. (1990). *Zeit und sinn strategien historischen denkens*. Fischer Wissenschaft.

Rüsen, J. (2004). Historical consciousness: Narrative structure, moral function, and ontogenetic development. In P. Seixas (Ed.), *Theorizing historical consciousness*. University of Toronto Press. https://www.jstor.org/stable/10.3138/9781442682610

Salvatore, N. (1982). *Eugene V. Debs: Citizen and socialist*. University of Illinois Press.

Saye, J. W., & Brush, T. (2002). Scaffolding critical reasoning about history and social issues in multimedia-supported learning environments. *Educational Technology Research and Development*, *50*(3), 77–96. https://doi.org/10.1007/BF02505026

Saye, J. W., & Brush, T. (2006). Comparing teachers' strategies for supporting student inquiry in a problem-based multimedia-enhanced history unit. *Theory & Research in Social Education*, *34*(2), 183–212. https://doi.org/10.1080/00933104.2006.10473304

Segrue, T. J. (1996). *The origins of the urban crisis: Race and inequality in postwar Detroit*. Princeton University Press.

Seixas, P. (2017). A model of historical thinking. *Educational Philosophy and Theory*, *49*(6), 593–605. https://doi.org/10.1080/00131857.2015.1101363

Seixas, P. C., & Morton, T. (2013). *The big Six historical thinking concepts*. Nelson.

Selyukh, A. (2021, March 29). Historic Amazon union vote count begins this week for Alabama warehouse. *National Public Radio*. https://www.npr.org/2021/03/29/981573228/historic-amazon-union-vote-count-begins-this-week-for-alabama-warehouse

Shah, N. (2001). *Contagious divides: Epidemics and race in San Francisco's Chinatown*. University of California Press.

Shemilt, D. (1983). The devil's locomotive. *History and Theory*, *22*(4), 1–18. JSTOR. https://doi.org/10.2307/2505213

Shreiner, T. L. (2014). Using historical knowledge to reason about contemporary political issues: An expert–novice study. *Cognition and Instruction*, *32*(4), 313–352. https://doi.org/10.1080/07370008.2014.948680

Shreiner, T. L. (2017). Helping students use world historical knowledge to take a stand on a contemporary issue: The case of genocide. *The History Teacher*, *50*(3), 359–380.

Silverman, D. (2000). *Doing qualitative research: A practical handbook*. SAGE Publications.

Simon, H. A. (1973). The structure of ill structured problems. *Artificial Intelligence*, *4*(3), 181–201. https://doi.org/10.1016/0004-3702(73)90011-8

Sinatra, G. M., Brem, S. K., & Evans, E. M. (2008). Changing minds? Implications of conceptual change for teaching and learning about biological evolution. *Evolution: Education and Outreach*, *1*(2), 189–195. https://doi.org/10.1007/s12052-008-0037-8

Smith, S. M., Ward, T. B., & Schumacher, J. S. (1993). Constraining effects of examples in a creative generation task. *Memory & Cognition*, *21*(6), 837–845. https://doi.org/10.3758/BF03202751

Stanford History Education Group (SHEG) (n.d.). *Reading Like a Historian*. Retrieved from http://sheg.stanford.edu/rlh

Stanford History Education Group (SHEG) (n.d.b.). Salem Witch Trials. *Reading Like a Historian*. Retrieved from https://sheg.stanford.edu/history-lessons/salem-witch-trials

Stearns, P. N. (2000). Getting specific about training in historical analysis: A case study in world history. In P. N. Stearns, P. C. Seixas, & S. S. Wineburg (Eds.), *Knowing, teaching and learning history* (pp. 419–436). New York University Press.

Stoel, G. L., van Drie, J. P., & van Boxtel, C. A. M. (2015). Teaching towards historical expertise: Developing a pedagogy for fostering causal reasoning in history. *Journal of Curriculum Studies*, *47*(1), 49–76. https://doi.org/10.1080/00220272.2014.968212

Stoel, G. L., van Drie, J. P., & van Boxtel, C. A. M. (2017). The effects of explicit teaching of strategies, second-order concepts, and epistemological underpinnings on students' ability to reason causally in history. *Journal of Educational Psychology*, *109*(3), 321–337. https://doi.org/10.1037/edu0000143

Straub, J. (Ed.). (2005). *Narration, identity, and historical consciousness*. Berghahn Books.

Taber, K. S. (2008). Exploring conceptual integration in student thinking: Evidence from a case study. *International Journal of Science Education*, *30*(14), 1915–1943. https://doi.org/10.1080/09500690701589404

Tapp, E. J. (1952). Some aspects of causation in history. *The Journal of Philosophy*, *49*(3), 67–79. JSTOR. https://doi.org/10.2307/2020913

Texas Essential Knowledge and Skills for Social Studies: Subchapter C. High School. (2018). Texas Education Agency. https://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=19&pt=2&ch=113&sch=C&rl=Y

Twyman, T., Mccleery, J., & Tindal, G. (2006). Using concepts to frame history content. *The Journal of Experimental Education*, *74*(4), 329–350. https://doi.org/10.3200/JEXE.74.4.329-350

U.S. News Best High Schools Rankings. (n.d.). U.S. News & World Report. Retrieved February 14, 2021, from https://www.usnews.com/education/best-high-schools/rankings-overview

van Boxtel, C., Grever, M., & Klein, S. (2015). Heritage as a resource for enhancing and assessing historical thinking: Reflections from the Netherlands. In K. Ercikan & P. C. Seixas (Eds.), *New Directions in Assessing Historical Thinking* (pp. 40–50). Routledge.

van Boxtel, C., & van Drie, J. (2018). Historical reasoning: Conceptualizations and educational applications. In S. A. Metzger & L. M. Harris (Eds.), *The Wiley international handbook of history teaching and learning* (pp. 149–176). John Wiley & Sons. https://doi.org/10.1002/9781119100812.ch6

von Ranke, Leopold (1824). *Geschichten der romanischen und germanischen Völker von 1494 bis 1535*. Reimer.

Voss, J. F., Blais, J., Means, M. L., Greene, T. R., & Ahwesh, E. (1986). Informal reasoning and subject matter knowledge in the solving of economics problems by naive and novice individuals. *Cognition and Instruction*, *3*(3), 269–302. https://doi.org/10.1207/s1532690xci0303_7

Voss, J. F., Carretero, M., Kennet, J., & Silfies, L. N. (1994). The collapse of the Soviet Union: A case study in causal reasoning. In M. Carretero & J. F. Voss (Eds.), *Cognitive and instructional processes in history and the social sciences* (pp. 403-429). Lawrence Erlbaum.

Voss, J. F., Greene, T. R., Post, T. A., & Penner, B. C. (1983). Problem-solving skill in the social sciences. In G. H. Bower (Ed.), *Psychology of learning and motivation* (Vol. 17, pp. 165–213). Academic Press. https://doi.org/10.1016/S0079-7421(08)60099-7

Voss, J. F., & Post, T. A. (1988). On the solving of ill-structured problems. In M. H. Chi, R.

Glaser, & M. J. Farr (Eds.), *The nature of expertise* (pp. 261–285). Lawrence Erlbaum.

Voss, J. F., & Wiley, J. (2006). Expertise in history. In K. A. Ericsson, N. Charness, P. J. Feltovich, & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 569–584). Cambridge University Press. https://doi.org/10.1017/CBO9780511816796.033

Voss, J. F., Wolfe, C. R., Lawrence, J. A., & Engle, R. A. (1991). From representation to decision: An analysis of problem solving in international relations. In *Complex problem solving: Principles and mechanisms* (pp. 119–158). Lawrence Erlbaum.

Ward, T. B., Patterson, M. J., & Sifonis, C. M. (2004). The role of specificity and abstraction in creative idea generation. *Creativity Research Journal*, *16*(1), 1–9. https://doi.org/10.1207/s15326934crj1601_1

Weber, M. (2012). *The Protestant ethic and the spirit of capitalism*. Courier Corporation. (Work originally published in 1905).

Wendell, J. (2018). Explaining the Third Reich: Swedish students' causal reasoning about the Nazi seizure of power in Germany. *The Curriculum Journal*, *29*(1), 60–76. https://doi.org/10.1080/09585176.2017.1398098

Wendell, J. (2020). Qualifying counterfactuals: Students' use of counterfactuals for evaluating historical explanations. *History Education Research Journal*, *17*(1), 50–67. https://doi.org/10.18546/HERJ.17.1.05

Wilkerson-Jerde, M. H., & Wilensky, U. J. (2015). Patterns, probabilities, and people: Making sense of quantitative change in complex systems. *Journal of the Learning Sciences*, *24*(2), 204–251. https://doi.org/10.1080/10508406.2014.976647

Wills, J. S. (2011). Misremembering as mediated action: Schematic narrative templates and elementary students' narration of the past. *Theory & Research in Social Education*, *39*(1), 115–144. https://doi.org/10.1080/00933104.2011.10473449

Wineburg, S. S. (1991). On the reading of historical texts: Notes on the breach between school and academy. *American Educational Research Journal*, 28(3), 495–519. https://doi.org/10.3102/00028312028003495

Woodcock, J. (2005). Does the linguistic release the conceptual? Helping Year 10 to improve their causal reasoning. *Teaching History*, *119*, 5–14.

Yetiv, S. (2011). History, international relations, and integrated approaches: Thinking about greater interdisciplinarity: History, international relations, and integrated approaches. *International Studies Perspectives*, *12*(2), 94–118. https://doi.org/10.1111/j.1528-3585.2011.00422.x

Yoon, S. A. (2008). An evolutionary approach to harnessing complex systems thinking in the science and technology classroom. *International Journal of Science Education*, *30*(1), 1–32. https://doi.org/10.1080/09500690601101672

Zakharenko, R. (2016). Self-driving cars will change cities. *Regional Science and Urban Economics*, 61, 26–37.

Zydney, J. M. (2008). Cognitive tools for scaffolding students defining an ill-structured problem. *Journal of Educational Computing Research*, *38*(4), 353–385.

Appendix A

Task 1 & 2 Protocol

Intro: Thank you for agreeing to participate in this activity. The purpose of this activity is for me to see how you reason about a particular [historical event OR current event] that you may or may not be familiar with. This activity will be one part of the big paper I have to write for my graduate program. I am going to record this activity so I can make accurate transcripts of the things you talk about. I will never share the recording or your name with anyone.

The only thing you will need is your computer, a piece of paper, and something to write with. Take a second to get a piece of paper if you need one.

To start, you will read an activity scenario and then a short passage about a [historical event OR current event]. This may be the first time you've heard about this event and that's totally fine. After you read, I'm going to ask you to do a brainstorming activity.

I'm going to put the link to the activity scenario and event description into the chat.

So the first thing I want you to do is to read the activity scenario.

On the next two pages, you'll see a description of the [historical event or current event]. Please read the description and let me know when you are done.

Table 14

Task 1 & 2 Passages

Task 1 *Historical: Pullman Strike*	***Task 2*** *Current: Amazon Unionization Efforts*
Activity Scenario *You have been hired by the Chicago History Museum to create an exhibit about the causes of the Pullman Strike in 1894. The exhibit should also help viewers understand why the strike happened when it did and why it unfolded the way that it did.* *Before you create the exhibit, you will brainstorm all the possible factors that you might include in the exhibit as well as any additional information you might need to know.* ***Event Description*** *In 1867, George Pullman founded the Pullman Palace Car Company which manufactured luxury train cars.* *Towards the end of the 1800s, most of the workers at the Pullman company lived in a company town (Pullman, Chicago) where the company owned and operated houses and stores and heavily regulated life inside the town.* *During the economic Panic of 1893, the demand for luxury train cars decreased. As a result, Pullman decided to lay off ⅔ of its workforce and cut wages by as much as half. However, the company refused to lower rent or prices in the company town. Many workers ended up owing more to live in the town of Pullman than they were making at the company.*	***Activity Scenario*** *You have been hired by a workers' rights organization to write a report about the causes of the unionization effort at the Amazon warehouse in Bessemer, Alabama. The report should also help the organization understand why the unionization effort happened when it did and why it unfolded the way that it did.* *Before you write your report, you will brainstorm all the possible factors you might include in the report as well as any additional information you might need to know.* ***Event Description*** *In 1994, Jeff Bezos founded Amazon, an online marketplace for consumer goods and services.* *Today, Amazon has over a million workers, many of whom work in large fulfillment warehouses. Amazon uses tracking programs to closely monitor these warehouse workers' levels of productivity.* *When COVID hit in 2020, the demand for home delivered goods increased. As a result, Amazon increased pressure on its warehouse workers to quickly package and ship millions more products than usual. In 2020, Amazon workers reported workplace injuries at a rate 50% higher than the average for all warehouse workers in the country.* *In mid August, 2021, Jennifer Bates, a warehouse worker in Bessemer, Alabama was*

In mid May, 1894, several frustrated Pullman workers formed a committee and presented a list of grievances to the Vice President of the company. Although these committee members were assured that there would be no retributions for stating their grievances, 3 of the members were immediately fired. *Upon hearing the news of the firings, Pullman workers went on strike. The striking workers sought help from the American Railway Union (ARU) (a **union** is a group of workers that engages in collective bargaining with employers for better wages or working conditions). Headed by labor activist Eugene V. Debs, the ARU supported the strike at Pullman by refusing to operate trains that used Pullman Cars. This created a massive slowdown in train transportation from Chicago to the west coast.* *After refusing to negotiate with the striking workers, Pullman joined forces with 24 other railroad companies, forming a group called the General Managers Association (GMA). The GMA used their political connections to lobby the business-friendly president, Grover Cleveland, to put a stop to the strike.* *In July of 1894. Cleveland sent in federal troops to end the strike. Many of the workers involved in the strike were fired and put on a blacklist which prevented them from getting jobs at other related companies. Eugene Debs was put in prison for six months for his role in the strike.*	*called in for a routine search of stolen goods. According to Bates, the computer system counted the time she was being searched as "time off task." Workers are not paid for time off task. Amazon can use too much time off task as a reason to fire a worker.* *Bates said that the search was the final straw. She decided to organize other frustrated workers at the warehouse. Together, they sought help from the Retail, Wholesale and Department Store Union (RWDSU) (a **union** is a group of workers that engages in collective bargaining with employers for better wages or working conditions). Headed by union president, Stuart Appelbaum, the RWDSU agreed to help organize a union vote among the warehouse employees.* *Prior to the vote, managers at the Bessemer warehouse held mandatory meetings where they tried to dissuade their workers from joining the union. The company also persuaded the town of Bessemer to reduce the number of redlights near the warehouse which made it harder for union representatives to talk to employees after work.* *In April of 2021, 71% voted against the union. In interviews, many of the "no union" voters argued that there was no need for a union because of Amazon's relatively high $15/hour pay and healthcare benefits.*

Before I tell you what you are about to do next, are there any questions about what you read?

Table 15

Task 1 & 2 Brainstorming Tasks

Historical	Current
The first thing I want you to do is to brainstorm about *what you know or might need to know* before creating your exhibit. Please take out a blank piece of paper. On this paper, I want you to put down anything you know or might need to know in order to make your exhibit. You can organize your brainstorm any way you want, but please don't look anything up.	The first thing I want you to do is to brainstorm about *what you know or might need to know* before writing your report. Please take out a blank piece of paper. On this paper, I want you to put down anything you know or might need to know in order to write your report. You can organize your brainstorm any way you want, but please don't look anything up.

I'm going to put these directions in the chat so you can access them.

I will give you 8 minutes to do this independent thinking activity. After 8 minutes, I'm going to ask you to hold up your brainstorm to the camera so I can take a screenshot. Any questions about what you're doing? **You can turn your camera off if you want. You can also tell me if you finish early.**

Take a look at your brainstorm. I want you to take a few minutes to consider any additional questions that you might want to investigate further before **creating your exhibit** OR writing your report]. If you come up with any additional questions, write them on the backside of your brainstorm. When you run out of questions, just give me a thumbs up to let me know you're ready to move on.

Initial Brainstorms discussion: I'm going to ask you to talk me through your brainstorm and I might interject to ask you questions about it. So tell me about what you wrote down here.

[If applicable] Now flip to the backside, what questions did you write down? Why?

Three most important factors:

Table 16

Task 1 & 2 Part 2 Scenario

Task 1	**Task 2**
You have a meeting with the board of the museum. They want you to identify three factors that you think would be most important to include in your exhibit. Which three would you choose?	You have a meeting with the board of the workers' rights group. They want you to identify only three factors that you think would be most important to include in your report. Which three would you choose?

I'll drop those directions in the chat so you have them. Take a minute to think about it.

So tell me, which three would you choose? Why those?

***Additional factors explanation*:** You have another meeting with the board of the [**museum** OR workers' rights group]**.** They provide you with five additional factors they want you to consider.

Go to the last slide. Please remove the red box from the first factor and tell me how you think the factor might be connected to your task of [**designing the museum exhibit** OR writing your report].

Table 17

Task 1 & 2 Provided Factors

Factor type (hidden from students)	***Task 1 Factors*** *Historical: Pullman Strike*	***Task 2 Factors*** *Current: Amazon Unionization Efforts*
Proximate structure	The town of Pullman and its workers were largely isolated from the rest of the city of Chicago.	Most of the work tasks at Amazon's Bessemer warehouse are done individually. Workers are often isolated from one another.
Remote structure	American cities industrialized rapidly after the Civil War with very few government rules or regulations on businesses.	Modern computer technology enables companies to monitor workers' behavior in very detailed ways.
Proximate structure	Major newspapers at the time often associated worker strikes with Eastern and Southern European immigrants and political radicals.	The federal minimum wage is $7.25 an hour, which is almost half of the starting wage of $15.30 an hour at Amazon's Bessemer warehouse.
Proximate agent	In a statement to the *New York Tribune*, George Pullman accused the labor organizers of acting like dictators and opposing freedom of business.	Top Amazon officials used the company's Twitter account to criticize politicians and celebrities who supported the unionization effort at the warehouse in Bessemer.
Remote agent	There was a successful strike against the Great Northern Railroad (GNR) one year before the Pullman strike. Led by Eugene Debs and the American Railroad Union, the GNR strike led to an increase in wages for workers at the GNR.	In the 20 years before the Bessemer warehouse union vote, The Retail, Wholesale and Department Store Union (RWDSU) successfully unionized 3 poultry plants in Alabama, leading to increased wages and working conditions in those plants.

Additional Factor Selection: If you had to choose 2 of these factors to include in the [**exhibit** OR report], which would you choose?

Appendix B

Avery, Ren, and Robert's Task Brainstorms

Avery Task 1 Brainstorm Transcript

(Page 1)
What I need to know

- Were the wages fair before they were cut in half?
- Did the company have justifications or reasoning for firing the specific 3 workers?
- Was it mathematically possible for the works to pay rent and buy necessities for life? (food, water, etc.)
- How hard was the workers jobs and how long were their workdays?
- How long did the wage-cut last before workers decided to go on strike?

What I know

- I know how drastic the wage cut was (50% lower)
- I know 2 possible trigger events
    1. The wage-cut
    2. The firing of the 3 workers
- I know they kept the rent prices the same

(Page 2)

- How did the Panic affect the workers besides the wage cuts? (were prices of goods higher or lower)?
- What were the workers' end goal for the strike?
- Was there any other way the company could have saved money besides cutting wages?

Ren Task 1 Brainstorm Transcript

(Page 1)

- What was the Panic of 1893[V What overall trend did this represent economically]
- What conditions before the strike/cutting of wages, did the workers complain about
- Using what sort of business practices did Pullman use to come to power? (i.e. Taylorism?)
- What was a day to day operation/life like for a worker?
- What was the list of grievances?
- Did Cleveland ever use his authority in a similar way before?[^or after]

- What was Eugene Debs charged with and how did the court rule?
- How was this event covered in the press?
- Did Pullman give any anecdotal rationale for not meeting with the workers?
- How did the strike impact labor laws in the future?
- How did Pullman's operations/ hiring change after the incident?
- Did similar strike happen during this time period?
- How did this impact other unions at the time?

(Page 2)
- What economic conditions led to a place where LUXURY car were being produced?
- How did GMA effect future strikes?

Robert Task 1 Brainstorm

(page 1)
Before: - 1800's America had seen failed attempts at unions before (steel ind. Carnegie as Focus)
- Federal resistance due to political ties

During: - Economic panic had caused layoffs + lower wages
- Many workers unable to afford rent
- Created unions to Battle unfairness, saw workers coming together
- Put down by Feds

After: - Unions seen gaining more traction as more + more appeared
- Feds sought to protect workers after Progressive Era left distaste w/ large businesses
- Now businesses have to abide by unions + other laws that improve working conditions

(Page 2)
<u>Questions:</u>
We often saw the Federal Government side with large businesses. Why was this?
What was the cause of the Panic of 1893?
Were any Pre-Progressive Era unions successful?

Avery Task 2 Brainstorm Transcript

(Page 1)
<u>What I need to know</u>
- Did their wages increase or decrease or stay the same because of COVID?
- What types of injuries were the workers getting?
- How did workers get injured?
- Did Amazon make a much higher profit because of the increased demand?

- What were other workers most frustrated about?
- What were the "no union" workers reasoning for feeling that they didn't need a union?
- Did Amazon ever try to negotiate with the workers or vice-versa?

What I know

- I know injuries increased, threatening the workers' health
- I know Amazon was trying to convince workers against joining the union.

(Page 2)

Additional Questions

- How were prices of goods affected because of COVID?
- Was it harder to get jobs?
- What was the union trying to accomplish?
- Did the union have any strategies in mind to accomplish the workers goals?

Ren Task 2 Brainstorm Transcript

(Page 1)
Why did this happen in Bessemer and not other warehouses
What has been the government interaction with Amazon been like before this
What is the RWDSU history in fighting for unions
How did amazon influence the town officials to reduce stoplights.
What is amazons record with unions and workplace safety orgs
Do other companies in this sector have to deal with unions
Has there ever been such a big company as amazon
What is amazons political hold locally and nationally
What did polling show about what americans felt as a GP [general public]?
What were the workers conditions
What is pay per hour and how does it compare
What sort of tactics does amazon use with workers that may provoke them?
What is turnover rate @ amazon?
Alabama labor laws

(Page 2)
What is amazons societal hold on the GP [general public]?
Was there pressure from outside groups to unionize? AOC?
Wage gap between CEO and workers
City development?

Robert Task 2 Brainstorm Transcript

(page 1)

Know: Amazon/Bezos [Hard to mess with] Richest Man in world + one of largest companies in world
Amazon cares [^deeply] about robots/computers + efficiency as those shipments must be on time

Might need to know: What other tactics were used by Amazon to persuade union voters?
Why did workers feel a union wasn't necessary? Did demand die down?
Why was Amazon Against unions so much?
like what was the reason?

(page 2)

Do workers [still] feel that a union isn't necessary today?
Did the unions have tactics they used to appeal to workers?
What about workers who still want a union?
Steel Unions? Influence [Context ^] over the town they in?

Appendix C

Codebook

Table 18

Codebook

Subdimension	Code	Code Definition	Example
Temporal Proximity	short-term	A causal factor that originated no earlier than the Panic of 1893 (Task 1) or the onset of COVID-19 (Task 2)	For short term causes: So just details on how like the labor workers were treated in terms of wages and not just wages, just like treatment, working conditions and stuff like that. And then all that just like leads to the pullman strike. (Dakini, T1)
	medium-term	A causal factor that originated between 0 and 10 years before Panic of 1893 (Task 1) or the onset of COVID-19 (Task 2)	What is Amazon's record with unions? From what I understand this [Bessemer] was the first union vote in Amazon but was there are similar struggles in the past in other warehouses or just this warehouse in particular? (Ren, T2)
	long-term	A causal factor that originated more than 10 years back from before Panic of 1893 (Task 1) or the onset of COVID-19 (Task 2)	so you could say like if the Federal Government was definitely like a lot more corrupt back then, as larger businesses had that much power over what happened (Robert, T1)
Spatial Proximity	proximate	A causal factor confined to the company and its workers or the town the company is located in	Was it mathematically possible for [Pullman's] workers to pay rent and buy necessities for life? So I thought this was important because the more like life threatening the situation is, I think it would affect their need for a strike (Avery, T2)

	intermediate	A causal factor confined to the region (e.g., county, state) or to other related entities in the industry that are not the company	I think if there was a track record in this industry of other companies having unions and Amazon was the one exception, you know, workers and employees there could point, if they were in support of the union movement, say hey you know everyone around us has a Union, why don't we have a Union? Or, in the opposite, you know, no one in this industry has a Union it'd be weird (Ren, T2)
	broad	A causal factor that exists at the national level or within different industries	But back then, there was like little to no regulation, so the businesses could be like selfish, I guess, and make as much profit for themselves and just not like care for workers. ...they can create unfair conditions and wages and like long workdays, which makes it harder and harder to work and pay for things so then eventually it's like too much. (Avery, T2)
Human Agent Event/Property	agentic action	an action that can plausibly attributed to an agent or a collective of agents acting with intent.	[Pullman] cut down wages, and he also refused to lower down the cost of the rent which a lot of workers thought was unfair. And then that obviously led to the workers reacting (Eshe, T1)
	agent subjectivity/intent	how an agent perceives or feels about an event/structure, the knowledge or beliefs an agent consults, or an agent's rationale for action	[Pullman] also refused to lower down the cost of the rent which a lot of workers thought was unfair (Eshe, T1); if [Pullman] already decided to like lower the wages, then like he must have known that the workers would have trouble paying off their rent and like he, like, I feel like he would he must have known that he wouldn't just get away with treating them poorly at the workplace and paying them low wages, kinda like this strike would be expected to happen. (Falak, T1)
	agent character	a piece of information about or an interpretation of the agent's personality or background	For long term causes, I thought something that would be important to know about would be George Pullman's background, like how he grew up, like where he grew up, and stuff because I think that could influence the decisions that he makes for that company. (Dakini, T1)
Structure	**Specific Structure**	a relatively well-defined physical, social or political entity/reality that	even simple things like stop lights do have an impact on the union vote apparently, so that interaction with the town,

		can influence or enable actions and outcomes	which I assume is where a lot of the workers of this facility live (Ren, T2)
	General Structure	a relatively ill-defined social or political entity that can influence or enable actions and outcomes	Well, [Cleveland] probably could use his **power** to a regulate Pullman's company and say that you have to make the minimum wage (Falak, T1)
	Political Structure	A structure related to government	lobbying efforts would have a larger effect on how things got done. (Robert, T1)
	Economic Structure	A structure related to business and the distribution of goods	I think because of the economy at the time. It's all of these like capitalists and like businesses booming and the way that they were mass producing and all that, like the economy was on this really big high and like going up and increasing, and it was really helping the country overall, that the government would do anything to protect those businesses, even if it is like ruling against workers (Eshe, T1)
	Social Structure	A structure related to non-governmental norms or institutions	I remember that we were learning in class that there were a lot of strikes at this time period, like this is the time period where the Labor unions are popping up and stuff like that. So just learning about how like the whole country was just like becoming a part of this whole movement for like better working conditions and like more unions and strikes and stuff like that. I think it would be important. And, like relating back to the pullman strike, it'd be like a reason on why like---other places might have been an inspiration for the Pullman Strike. (Dakini, T1)
	Geographic Structure	A structure related to physical infrastructure or natural features of the world	even simple things like stop lights do have an impact on the union vote apparently, so that interaction with the town, which I assume is where a lot of the workers of this facility live (Ren, T2)

Causal Role	enabler/ constrainer	an event, action or condition that widens or restricts the possible set of actions or outcomes OR makes another causal relationship possible/impossible. By themselves **may be** necessary conditions of event.	…[I]f [Amazon] were making a much higher profit, wouldn't they be able to make the wages higher to reward the workers for working harder? Or are they not able to do that because they weren't making much higher profits?
	influencer	an event, action or condition that either directly or indirectly effects an outcome (e.g., magnitude or direction of effect). These factors may be "piled on" to explain the causes of an event, but individually would usually not be considered a necessary condition of event.	Alex Honold: You wrote "what sort of business practices did Pullman use to come to power?". Tell me a little bit about that one. Ren: I was thinking you know Gilded Age stuff, like the effects of you know kind of Taylorism that scientific manipulation of workers and making them more efficient, because sometimes that led to business practices that were not the most ethical and puts stress and strain on the workers themselves (Ren, T1)
	catalyst	an event or action that that sets off a causal chain of events when necessary conditions are present.	the Panic of 1893 feels like a catalyst to Pullman, you know, cutting the salaries which is obviously the short term cause of the strike, so it feels like it's important to know sort of the context behind why Pullman was A) making cars in the first place, like that, and then B) the reason that it led to that strike was sort of this panic (Ren, T1)
	trigger	an event or action that directly leads to the explicandum when necessary conditions are present.	I'm leaning towards the workers being fired is the main trigger event because the wage cut had happened and they didn't automatically decide on a strike, they decided to just go to the business about their problems (Avery, T1)
	*conditional	(*should be applied with another role) a causal factor that could have different impacts on the outcome because of some unknown entity. Often in the form of an "If...then" statement.	I don't know that much about business, but like if there was another way that the company could have effectively saved money, besides cutting wages, that might like frustrate the workers, I guess, because, they might think the company's being selfish, because they just take away [the workers'] money instead. (Avery, T1)

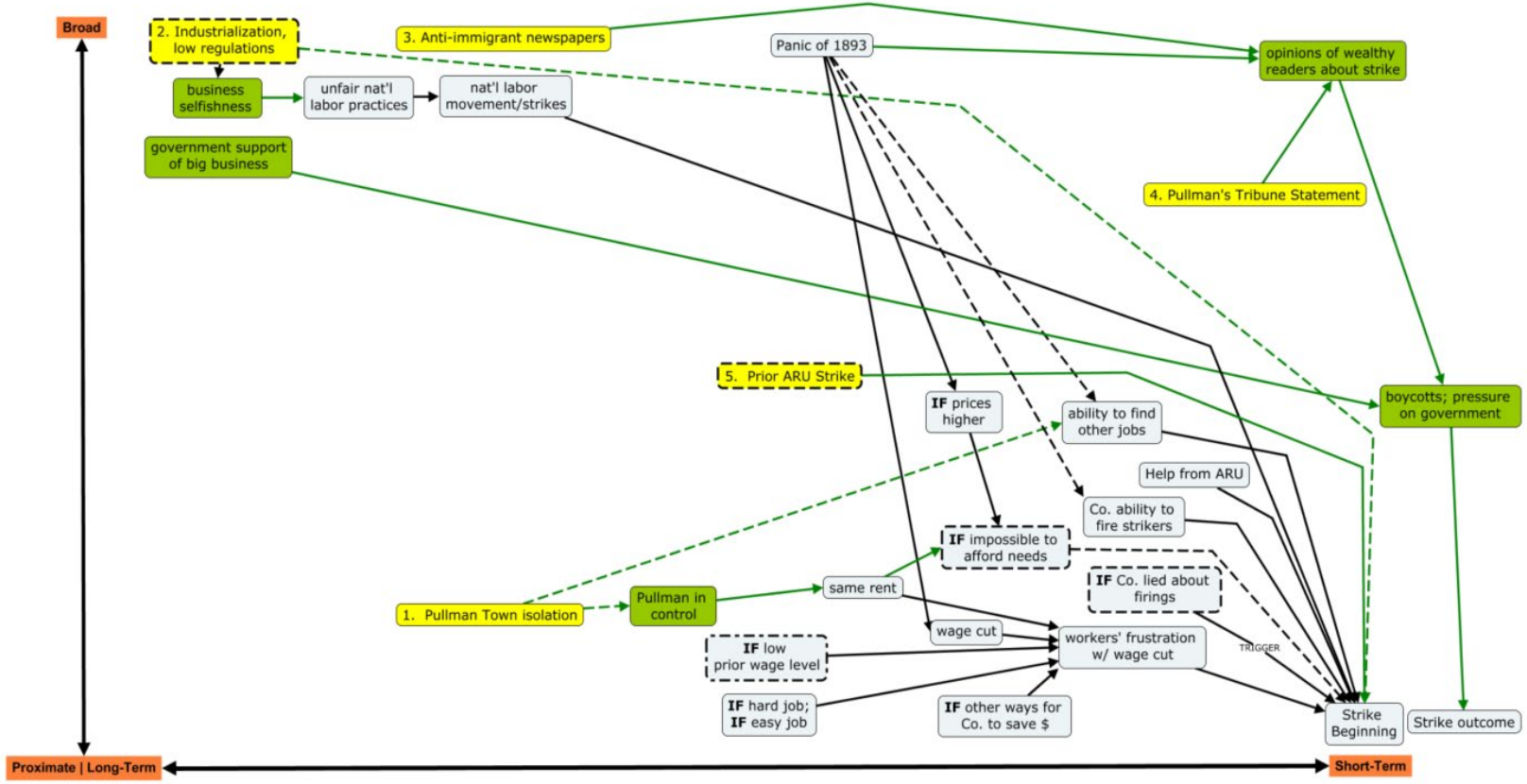
Additional reasoning processes	comparison	Student compares/contrasts an event, action, or structure to another in history or the present	Robert: And then I had like a connection that I was kind of building between steel unions…with like Carnegie and stuff that was more brutal of a putdown, but a putdown, nonetheless. And then the last text we were reading last Thursday [about Pullman's] influence over the town that [the workers were] in. It's not as big of a thing, because they [Pullman] literally owned the town, but Amazon was able to use their influence to persuade the town to do something for them…
	CCOT	Student raises a change or continuity to reason about causation	Did their [workers'] wages increase or decrease or stay the same? (Avery, T2)
	Generalization	Student applies a generalizable principle or pattern when considering a cause or effect (the generalization or pattern is not itself a cause).	often when times are tough or something tragic happens in history, we tended to sort of blame that on a specific immigrant class or a specific type of person. (Ren, T1)
	indicator	Student references information as being indicative of or evidence for the existence of a causal factor.	I see that Pullman incident and I see that Pullman factory and the town where he controlled everything as sort of…what could have happened if the government eventually didn't step in and at least regulate a little bit… I see the Pullman town as an indicator, maybe it was then, maybe there's some you know messaging that would say that hey you know if we keep allowing this and we don't strike you know all cities in the United States are going to become like this pullman town where the [business] sort of owns everything. (Ren, T1)
	counterfactual*	Student considers how events in the past could have played out differently.	Would the Pullman strike still have ended up with the workers fired if the president supported federal intervention (like FDR)? (Falak, T1)
	Personal experience/ opinion	Student discusses personal experience or opinion related to causal factor	Personally I feel like maybe I would be much less likely to join the Union if it was a strike or like even violence or something, but if it was like negotiation, I probably would. (Avery T2)

Appendix D

Researcher-Created Causal Maps for Student-Participants' Responses

Figure 34

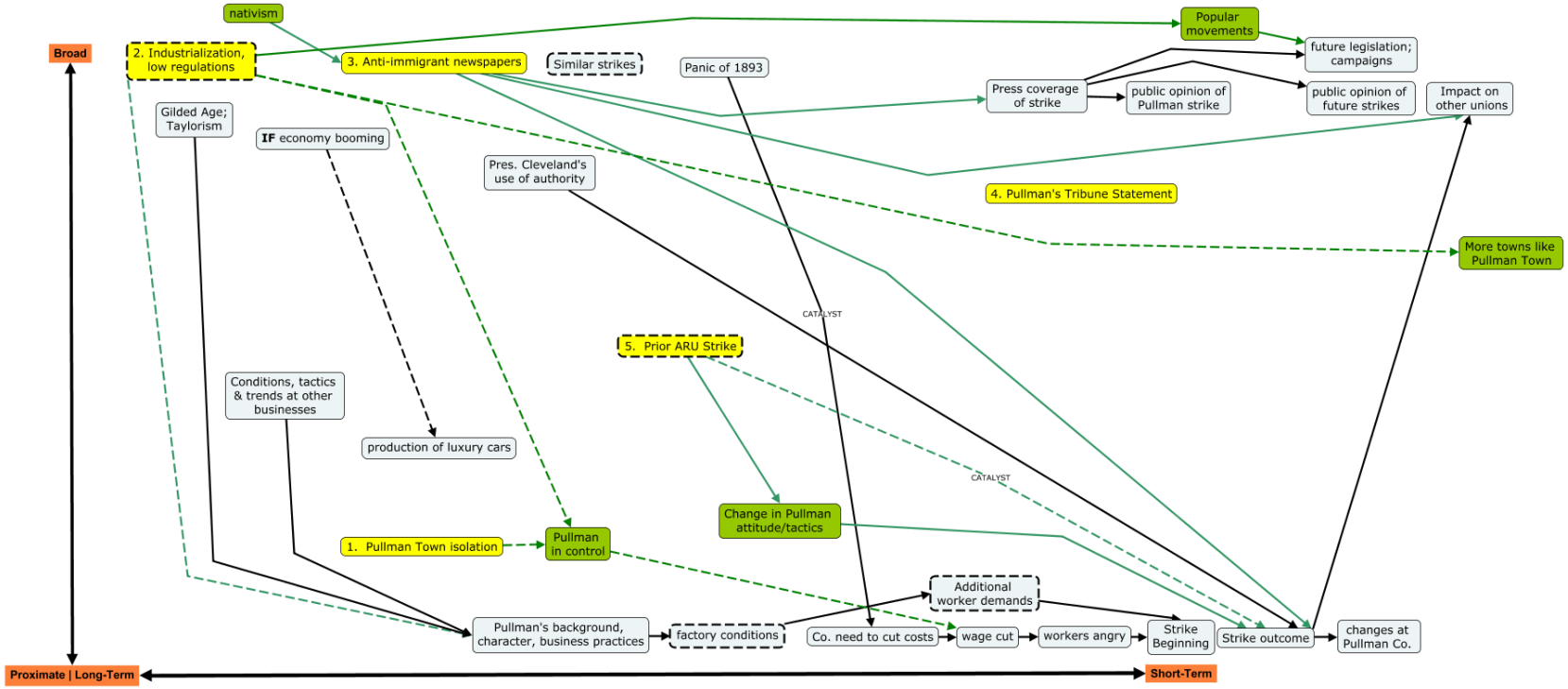
Researcher-Created Map for Avery's Pullman Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

Figure 35

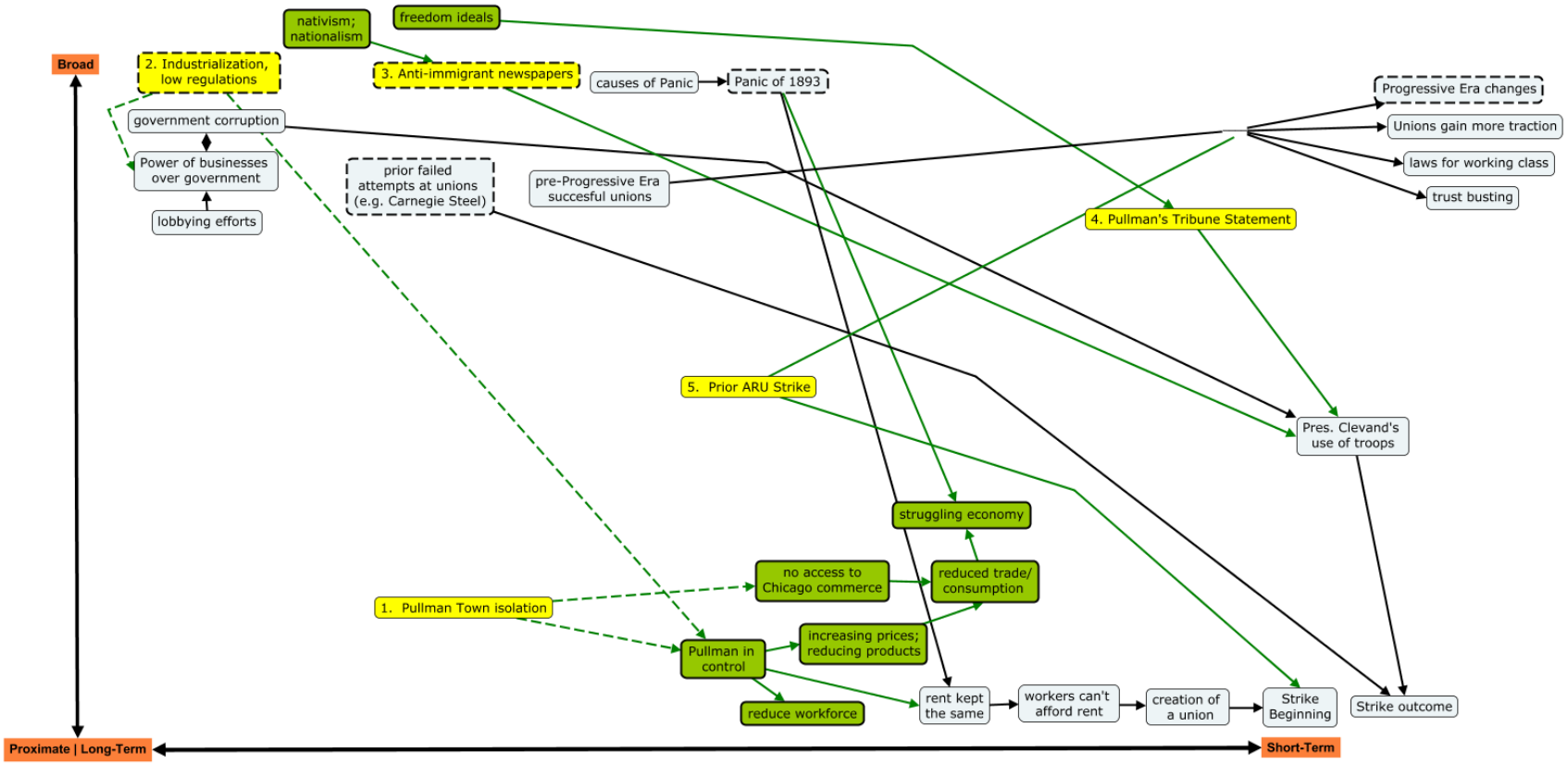
Researcher-Created Map for Ren's Pullman Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

Figure 36

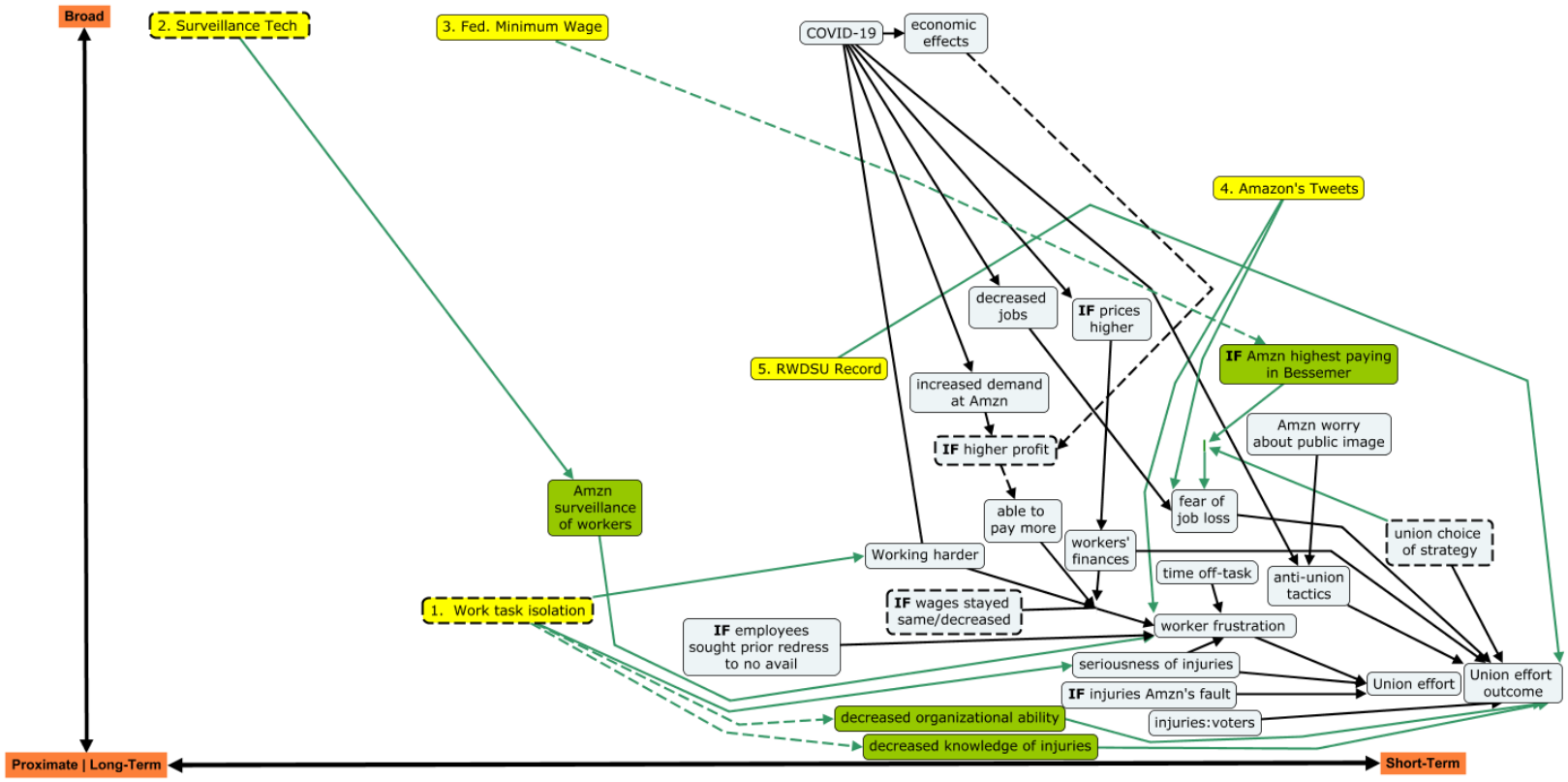
Researcher-Created Map for Robert's Pullman Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role.

Figure 37

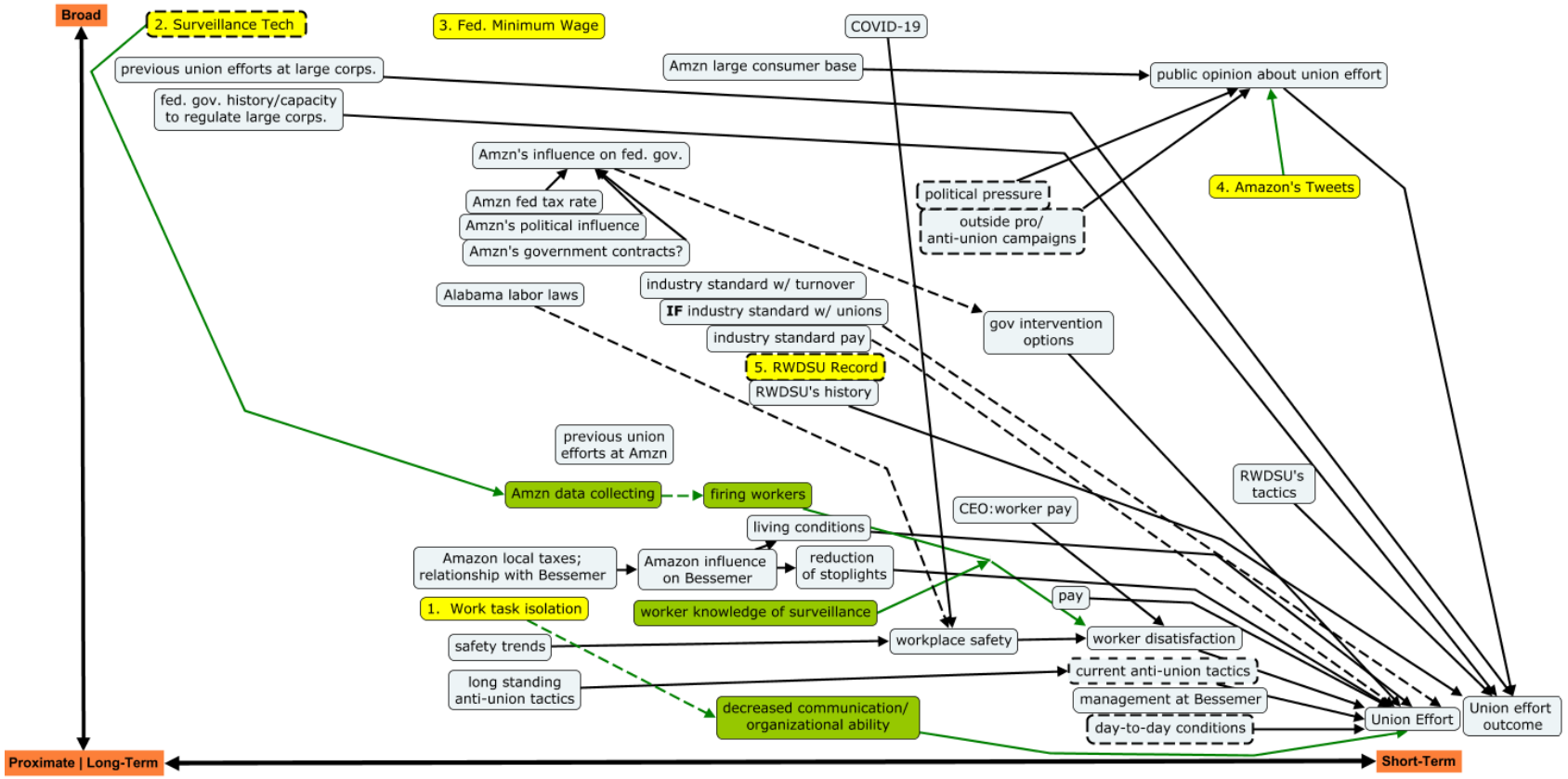
Researcher-Created Map for Avery's Amazon Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

Figure 38

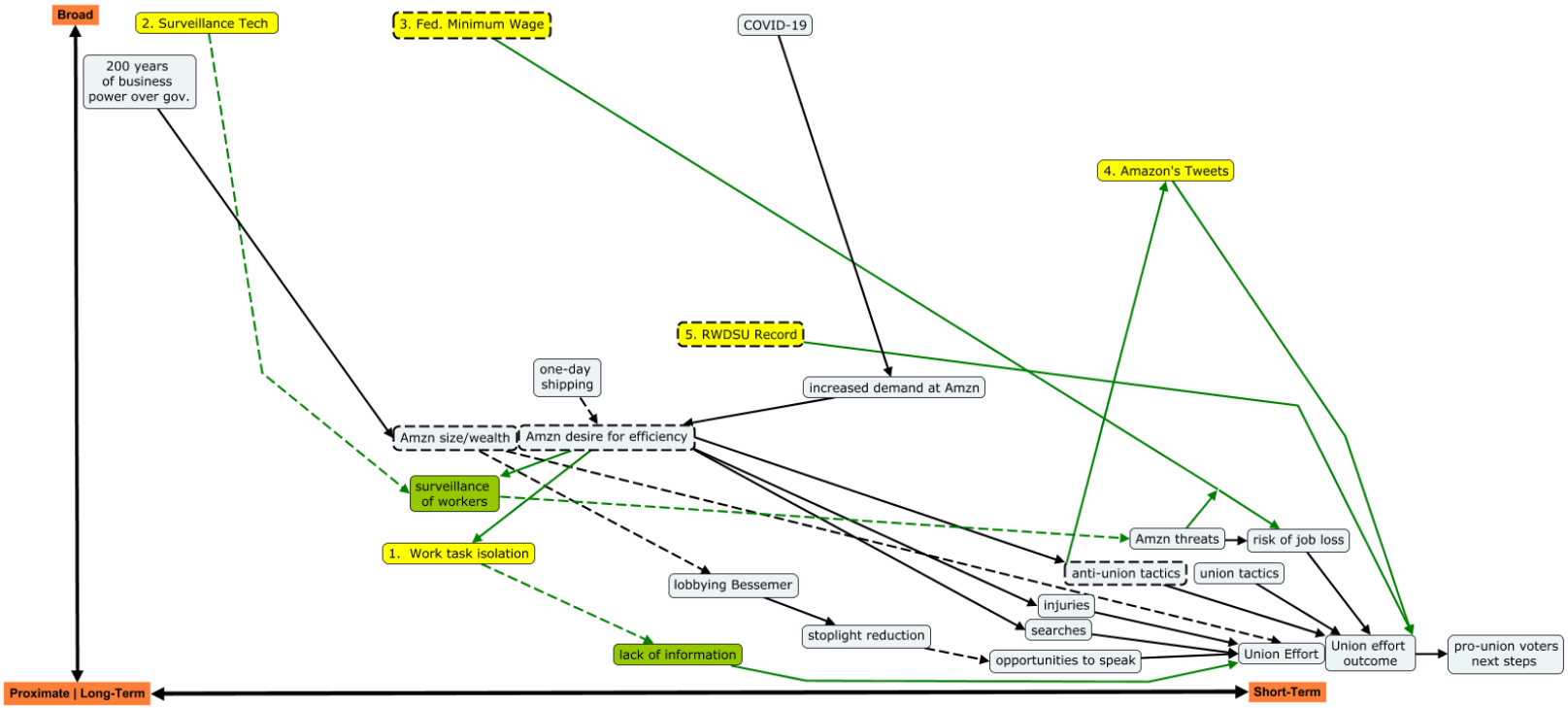
Researcher-Created Map for Ren's Amazon Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role

Figure 39

Researcher-Created Map for Robert's Amazon Task Problem Space



Key: light blue boxes = student identified causes in Part 1; green boxes = student identified causes in Part 2; yellow boxes = provided causes in Part 2; dashed border boxes = factors in Part 1 and Part 2 selected as "most important"; black colored arrow = student identified causal roles in Part 1; green colored arrow = student identified causal roles in Part 2; solid arrow = influencing cause; dashed arrow = enabling causes; "IF" = conditional role.