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Competition and Beyond: Problems and Attention Allocation in the Organizational Rulemaking Process

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This study investigates how an organization allocates attention and generates solutions in response to new problems challenging existing routines, under the influences of different contexts surrounding problems and solutions. By examining the formation of airline safety rules by the Federal Aviation Administration, I show that although different types of problems compete for attention at the rule proposal stage when the organization searches for solutions to problems, at the rule finalization stage, attention is guided by "urgency" induced by the aggregate flow of new problems, which interacts with certain institutional factors and with an a priori "priority" given to different types of rules. The implications of the study on theories of organizational attention are discussed.

Key words: organizational attention; bounded rationality; organizational adaptation; organizational learning; rulemaking
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Attention in an organizational context can be understood as "the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers on both (a) issues: the available repertoire of categories for making sense of the environment: problems, opportunities, and threats; and (b) answers: the available repertoire of action alternatives: proposals, routines, projects, programs, and procedures" (Ocasio 1997, p. 189). The importance of attention in problem-solving and decision-making processes has long been noticed by organizational scholars. Studies from the Carnegie School (Simon 1957, March and Simon 1958, Cyert and March 1963) argued that organizational attention is a valuable and scarce resource in organizations. A logical consequence of attention being a valuable and scarce resource in organizations is that problems compete for the limited attention of decision makers. The premises of argument that attention is a scarce resource, however, have recently been challenged by some scholars (Weick and Sutcliffe 2006). Differing from the view that attention is a scarce resource, Weick and Sutcliffe (2006) contend that when the allocation of attention is done with discipline, such as with the mindfulness emphasized in Eastern thought, attention can be plentiful and sufficient and can enable decision makers to pay attention to different problems.

These varying ideas about organizational attention in the existing literature clearly suggest that theoretical and empirical examinations of the boundary conditions of attention allocation would be useful. Although studies have examined certain processes and mechanisms affecting organizational attention allocation (March and Simon 1958, Dutton and Duncan 1987, Ocasio 1997, Cho and Hambrick 2006), there are at least three limitations in the current literature on attention. First, there is a lack of theoretical and empirical examination of the context through which attention competition occurs. Arguments about the contextual impact of attention allocation have been mostly based on the presumption that attention is a scarce resource and attention allocation is inherently competitive (e.g., Ocasio 1997). Second, while scholars with the Carnegie School perspective have suggested that attention competition is related to context (Ocasio 1997), there is a lack of detailed investigation in the current literature about different attention allocation mechanisms constrained by the context's surrounding problems and solutions. In particular, few studies have paid attention to the impact of problems on attention allocation when the new problems are not directly linked to solutions solving old problems. To fill these gaps, building on the prior literature on organizational attention, in this study I develop theoretical arguments and empirically examine the contextual influences of problems on organizational attention allocation. Specifically, I address two key questions in this study: (1) How do different types of problems compete for organizational attention when an organization searches for solutions to the problems? (2) How does an organization allocate its attention under the influences of new problems while solving old problems? I first argue that whether attention is a limited resource and whether problems compete for attention in a problem-solving process are conditioned on the specific context. In a context where the attention capacity is relatively stable and the quality of the attention is not ensured to improve, competition for attention is likely to occur. Consistent with the notion of "situated attention" suggested by Ocasio (1997), I further argue and empirically demonstrate that competition for attention can be guided by different attention allocation rules, depending on the context that surrounds problems and solutions. In particular, I present evidence that shows how the "urgency effect" generated by problems affects an organization in allocating its attention when it faces new problems at the same time that it has to solve old problems.

I examine my research questions in a context where an organization faces problems and searches for and generates solutions in the form of rules. I demonstrate that attention allocation in the organizational rulemaking process is influenced by a constant influx of problems, related or not related to a particular search activity, constrained by attention capacity as defined by a particular organizational context. The choice of the rulemaking process as the empirical context indicates the importance of rules, which has been well documented in the organizational studies literature. Scholars have long argued that rules as well as rule-following behaviors are key features of modern organizations (Weber 1946, Merton 1957, Crozier 1964, Cyert and March 1963, Ocasio 1999). Rules have often been suggested as an important exogenous factor in explaining organizational behaviors. For instance, it has been argued that the thoughts and actions of people are guided by rules evolving in a social context (Ehrlich 2000). Formal and informal rules were found to be instrumental in CEO succession (Ocasio 1999). At an organizational level, organizations conform to government rules or regulations to acquire institutional legitimacy (Meyer and Rowan 1977, DiMaggio and Powell 1983, Scott 1998). Rules have been described as carriers of history, experience, and knowledge in organizations and populations (Zhou 1993, Miner and Haunschild 1995, Schulz 1998, March et al. 2000, Beck and Kieser 2003), and rules can be the result of an organization's intentions to solve problems (Schulz 1998, March et al. 2000).

Although the primary contribution of this study is to enrich our understanding of the contextual conditions under which problems may compete for attention and detailed attention allocation patterns exist, this study also contributes to our understanding of organizational rulemaking by showing that attention allocation is a key factor in understanding the process of organizational rulemaking. Further, this study broadens understanding of the role that new problems play in the process of organizational attention allocation not only by focusing on the impact of problems in the context where an organization searches for the solutions to those problems as done in the prior studies but also by examining how the influx of new problems influences the process of solving old problems, when the new problems may be not directly connected to a particular search activity.

The paper is structured as follows. Following a brief discussion of the empirical context of this study, I discuss what impact problems might have on solution generation, linking these ideas to a broader literature on problem solving and theories of attention. I then develop hypotheses about the effects of problems on organizational attention and thus the rate of rule generation. Finally, I present an empirical study of safety problems experienced by the U.S. airline industry and the impact of these problems on the rate of rulemaking by the Federal Aviation Administration (FAA). I conclude this paper with a discussion on the implications of these results for understanding attention allocation in decision making.

Illustration of Research Issues in the Empirical Context

I explore the impact of problems in attention allocation and thus rule generation in the context of the FAA, which regulates and oversees aviation safety and security in the United States. The rulemaking process by the FAA is an ideal context to examine a key notion of this study that solution generation (rulemaking) as a response to problems is a dynamic process that is constantly under the influence of a continuous inflow of new problems. As described by members of the FAA rulemaking office, rulemaking at the FAA is organized on a team basis. The core of a team is composed of one or more team leaders who are subject experts, attorneys, economists, and writers/editors. In addition to the core of the team, policy analysts, whose tasks range from conducting public presentations to collecting or analyzing public comments, are assigned to different projects, depending on the needs of the project. Each team is responsible for all the tasks at different stages of rulemaking (e.g., proposing and finalizing stages, as elaborated later). Except for certain subject experts who are assigned to projects related to their particular expertise, other members in each rulemaking group can be assigned to any project because the skills required for making rules, such as collecting information from different parties, coordinating public meetings, analyzing economic data, editing, tabulating public comments, etc., are transferrable across different rules. This particular type of organizational arrangement suggests that rulemaking activities in the FAA share certain resource pools and that competition for attention resources could happen within the organization.

Based on information acquired from the FAA's financial budget office and conversations with various employees in different offices related to the rulemaking activities, it appears that the number of employees involved in the FAA rulemaking process is relatively stable over time. For instance, from 1995 to 2000, the Aviation Rulemaking (ARM) Office had 25, 24, 24, 25, 25, and 27 employees for each of the years. The FAA's regulation budget did increase during this period, but the increased budget for rulemaking offices largely reflected the increased salary levels of the employees. Overall, if the FAA's attention capacity is indicated by the number of employees involved in rulemaking, its attention capacity does not seem to vary dramatically over the years. This relatively stable attention capacity might provide another condition for possible competition for attention to occur in an organization.

Similar to other U.S. government agencies, the FAA follows two main stages in making rules: rule proposing and rule finalizing. The FAA issues rules when it encounters problems that are not sufficiently addressed by current rules. For instance, after the September 11, 2001, terrorist attacks, the FAA identified specific causes, such as problems surrounding airport security, the cockpit door design, keys to the cockpit doors, and crew responses to hijackers, and subsequently issued rules in response to these problems. The FAA normally issues a notice of proposed rulemaking (NPRM) to propose specific rule changes and to solicit public comments. The FAA might choose 30, 60, 90 or more days to solicit comments from the public, depending on whether the public requests extensions. After the public comment period, it may take months or years for the agency to analyze all the comments submitted. Once the FAA has incorporated all public comments, satisfied federal requirements, and obtained necessary Office of Management and Budget (OMB) and Office of Science and Technology (OST) clearances, the agency issues a final rule that has new or revised requirements and an effective date. A final rule normally identifies important substantive issues raised in the comments under the NPRM and the number of comments received by the agency varies for different rules. If more constituencies are involved and more comments are collected on a rule, then normally more negotiations among different parties are necessary and thus a higher degree of political complexity surrounds the rule.

There can be multiple sources of problems coming into the FAA that require the agency's attention. The FAA sometimes responds to congressional requests to investigate certain aspects of safety rules. In other words, problems can be directed to the FAA due to institutional pressures. This fact suggests the importance to control for important institutional factors while analyzing the influences of problems. The investigation of accidents and incidents by the National Transportation Safety Board (NTSB), however, tends to be the major source of problems. The mandatory process through which NTSB brings up problems and recommendations to the FAA based on its investigations requires the FAA to respond by indicating if it should or should not consider issuing new rules.

At the rule-proposing stage, the FAA evaluates alternative problems and proposes rules addressing particular problems. Therefore, this is the stage when alternative problems compete for organizational attention in a search activity directly linked to problems. Most new problems flowing into the agency at the rule-finalizing stage, however, are not substantively linked to the rules being finalized. For instance, in 1995, the FAA proposed to regulate crew flight hours after pilot fatigue was identified as an obvious cause in some aviation accidents. In the interval after the rules on flight hours were proposed, there were numerous other types of problems reported, such as engine failures, communication problems, and terrorist attacks, and the aviation industry did not experience any significant accidents or incidents associated with human fatigue. The interesting issue raised in this example is how problems not related to human fatigue affected how long it took to finalize the human fatigue rules. The rule-finalizing stage, therefore, provides an ideal setting for us to examine the second theoretical question of this study: How does an organization allocate its attention under the influences of new problems while solving old problems? Following prior studies on rules (Zhou 1993, Schulz 1998), the dependent variables in this study are the rate of proposing and finalizing rules, meaning how fast the FAA proposes or finalizes a rule. From a learning perspective, the speed at which the FAA proposes or finalizes a rule reflects how the FAA allocates its attention, though the slow or fast response does not necessarily indicate the effectiveness of the learning outcomes (rules) (Lounamaa and March 1987). If the FAA gives more attention to certain problems or rules, it is more likely that it will propose or finalize rules on those problems.

Problems in this study are defined as the *causes* of airline accidents and incidents experienced by members of the U.S. airline industry and identified by the NTSB. The FAA's knowledge of the safety problems in the airline industry mainly comes from the NTSB's problem diagnoses and recommendations based on its accident and incident investigations (GAO 2001).

In this study, problems are divided into two types: (1) those associated primarily with human factors, such as pilot and crew errors, and (2) those associated primarily with nonhuman factors, such as engine failures. This division is used for multiple reasons. First, in the literature on errors and accidents, human factor problems have been given primary attention (see Reason 1990). It is also likely that human and nonhuman problems have different impacts on the search for solutions to problems (Morris et al. 1999, Reason 1990, Perrow 1984). Finally, this division of problems makes practical sense in the current study because the categorization of human and nonhuman errors has been routinely used by government agencies, such as the NTSB and the FAA, when analyzing accidents and making policy recommendations (e.g., Baron 2002). As with problems, rules can be sorted into two distinct categories: (1) those related to human factors, such as rules stipulating the number of hours a pilot may fly, and (2) those related to nonhuman factors, such as regulations on engine maintenance. Apparently, with relatively stable attention capacity, the variation in the number of problems (or the problem load) can generate the variation in the competition for attention to problems.

Theory and Hypotheses

The current study is fundamentally about how organizations allocate attention resources to solve problems. Studies of problem solving and decision making have long viewed problems as a driver of the search for solutions. Organizational search activities for solutions are often triggered by problems (March and Simon 1958, Thompson 1967, Minzberg et al. 1976, Nutt 1984). Because of bounded rationality, however, organizations tend to look for satisfactory rather than optimized solutions (Simon 1957, March and Simon 1958). Organizational decision-makers search locally for solutions to problems around the problem area, consequently resulting in organizational actions (Cyert and March 1963, Lindblom and Braybrooke 1963, Etzioni 1967, Winter et al. 2007). In the process of looking for solutions to solve problems, organizational attention is the key driver as decision makers allocate relevant resources to problem areas where their attention resides (March and Simon 1958).

A well-established and influential perspective on organizational attention in the process of generating solutions to problems is the Carnegie School perspective, which suggests that decision makers have limited attention capacity, and, consequently, organizations do not attend to problems indiscriminately (Simon 1957, March and Simon 1958, Cyert and March 1963). Organizations or decision makers in organizations need to allocate their attention alternatively to different types of problems (Cyert and March 1963). The gain of attention to one problem area is accompanied by the loss of attention to other problem areas, and solutions are more likely to be generated in problem domains that have gained more attention. In other words, different types of problems compete for organizational attention.

The notion that attention is a scarce resource for an organization has been well described not only in the organization studies literature but also in the economics literature. Economists in recent years have argued that attention as a scarce resource has a major impact on economic choices, such as consumption dynamics and equity premium payments (Lynch 1996, Rogers 2001), monetary transmission mechanisms (Mankiw and Reis 2002, Sims 2003), and asset pricing (D'Avolio and Nierenberg 2003, Peng and Xiong 2003, Pollet 2003). Organization studies have explored the impact of attention as a scarce resource on firm behaviors, such as decision making (March and Simon 1958, Ocasio 1997), strategic change (Dutton and Duncan 1987, Cho and Hambrick 2006), and knowledge dissemination (Hansen and Haas 2001). In particular, building on the premises of the Carnegie School, Ocasio (1997) theoretically extends the theories of organizational attention by identifying three principles: the focus of attention, suggesting that decision makers act according to the issues and answers on which they focus their attention; situated attention, suggesting that the particular context can affect the focus of attention and actions of decision makers; and the structural distribution of attention, suggesting that organizational rules, resources, and social relationships can channel the attention focus of decision makers.

This notion of "limited attention," however, was recently challenged by some scholars (Weick and Sutcliffe 2006). Weick and Sutcliffe (2006) suggest that different problems do not necessarily compete for attention because decision makers can simultaneously pay attention to distinctive problem categories if attention allocation is disciplined in a certain way (i.e., using Eastern ideas of mindfulness). If we consider the fact that problem solving is affected by both problem load and attention capacity (Cohen et al. 1972), the two views might be compatible, with the Carnegie School perspective emphasizing the problem overload that can happen given a certain capacity for attention and the Weick-Sutcliffe approach emphasizing the elasticity of attention capacity. The contrast in the two perspectives does lead us to see a possible gap in the literature on attention; that is, studies have paid little attention to whether problems' competition for attention can be affected by contexts that affect the dynamics of attention capacity and the problem load. Organizational design might be important not only for attention allocation under the principle of attention scarcity (Ocasio 1997) but also for the occurrence of competition for attention. In a context where organizations were designed to enrich attention capacity, problems might be less likely to compete for attention. In a context such as the current research setting, however, the conditions for achieving "Eastern-style mindfulness," such as direct perceptions of problems that happened in an event and a low degree of coordination among the participants (Weick and Sutcliffe 2006), might not be effectively fulfilled given the nature of the government agency. Under such circumstances, it is then less likely for this attention allocation with mindfulness to happen and attention capacity is less likely to be enhanced. Problems are likely to compete for attention in the later context.

In addition to the scarcity of attention, in order for problems to compete for attention, certain types of problems should be distinctively different by their natures, making it more difficult for organizational attention to be "contagious" among alternative problems (March et al.

2000). In this study, human factor problems are distinctive from other problems. The line between human and environmental (or nonhuman) factors has been clearly drawn in the literature on error studies, in which an enormous volume of research focuses on analysis of human errors as well as on practices by organizations (e.g., the FAA) that are engaged in preventing accidents or errors (Perrow 1984, Reason 1990, Baron 2002). This may reflect common knowledge that solving a human factor problem is quite different from solving a nonhuman factor problem although the two categories could be intertwined in important ways (Reason 1990, 1997). For the FAA, because the human factor involves pilots and crews (including ground crews), the distinction between the two categories can be readily drawn once the errors are identified by NTSB.

Therefore, in the process of searching for solutions to problems at the rule-proposing stage at the FAA, different problems of distinctive natures, human and nonhuman factor problems, are likely to compete for organization attention. Whereas a greater number of problems in one problem area would lead to more attention allocated to that type of problem because decision makers tend to pay more attention to more frequent events (Bazerman 2001), less attention would be given to other types of problems during the same time period. Therefore, I posit the following:

Hypothesis 1 (H1). *An increase in the number of problems in one distinctive domain (e.g., human factors) increases the rate of proposing rules in the same domain (e.g., human factors) but decreases the rate of proposing rules in the different domain (e.g., nonhuman factors).*

The above hypothesis is developed to test the "competition for attention" argument in a rulemaking process. The current literature on problems and solution generation, however, tends to focus on the scenario when an organization looks for particular solutions to specific problems. It does not address the fact that each ongoing problem-solving process is subject to the influences of new problems, which may have no substantive connections to the current solutions being considered. As illustrated in the FAA example, at the time of finalizing particular rules, new problems continue to arise, but in most cases they are not connected to the rule the FAA is finalizing. This "disconnectedness" is especially true in the short time window following when the rules are proposed, as illustrated by the example of the FAA rules on human fatigue and flight hours I mentioned above. The question raised in the FAA fatigue rule example is how problems not related to human fatigue affected how long it took to finalize the human fatigue rules. While organizational attention was more stimulated by problems at the proposing stage, organizational attention could be shifted more to the solution when the decision makers tried to finalize solution. In the stage of finalizing rules, new problems can exert important impact more as a situational factor that channels organizational attention allocation to finalizing rules (Ocasio 1997).

To answer the question of how new problems affect the attention given to solving old problems, we need to go back to the framework of bounded rationality and limited attention capacity for organizations (Simon 1957, March and Simon 1958, Cyert and March 1963). As argued by Kieser and Koch (2002), solution finalization is also subject to the bounded rationality of an organization. That is, as Kieser and Koch (2002) found in their field work, a proposed rule can be enacted through experimentation and recombination of the experiential knowledge of organizational members. In our study context, the effect of new incoming problems on the finalization of rules can reflect the influences of the organization's bounded rationality in a different way. Given limited capacity and attention resources, there are two possible scenarios for when an organization faces new problems while finalizing the solutions to old problems. The first possible scenario is that an organization is distracted by the new problems and consequently shifts a certain amount of attention from finalizing old solutions to searching for solutions to new problems. The second scenario is that an organization speeds up the finalization process for certain rules and uses its freed capacity to address new problems. In other words, there can be a trade-off between attending to new problems and finalizing solutions solving old problems. These two scenarios imply different attention allocation principles for the organization. Whereas the first scenario suggests a more typical "distraction effect" resulting from constrained attention resources, the second scenario suggests that an organization could be pushed to take action because of the general sense of urgency (or the "urgency effect") induced by the new problems. That is, the new problems create a sense of pressure compelling an organization to attend to certain old issues within a constrained time period.

When facing problems, organizations could experience urgency from worries that problems could worsen if their solutions are not attended to, from overload of responsibilities, or from insufficient time to search for adequate solutions (Billings et al. 1980). Accumulated complaints or dissatisfaction associated with problems could lead to crises, a distinctive feature of which is time pressure or urgency (Nutt 1984).

Further, individual and organizational behaviors are affected by urgency. For instance, settlement decisions are reached faster under time pressure (Yukl et al. 1976), the level of generalization and dimensional weight distribution are affected by deadlines (Lamberts 1995), and faster decisions can arise from a crisis (Smart and Vertinsky 1977).

In this study, whereas the "distraction" scenario suggests that the incoming new problems might slow down the speed of finalizing rules at the FAA, the "urgency" scenario suggests that the FAA will finalize more rules when facing new problems. There are two reasons leading us to predict that the urgency induced by new problems would have an overall dominant effect in the process of rule finalization at the FAA. First, the production pressure faced by the FAA is likely to lead the FAA to be more responsive to the urgency effect. As a public agency, the agency is under constant pressure to show the public that it is producing something that is beneficial to the public. To formalize certain rules is a very useful way to show the public that the FAA is doing its work. Second, searching for new solutions to solve new problems is a long and complex process for the FAA. The search itself is not sufficient for the FAA to demonstrate its performance. Thus, we can expect that when the number of new problems increases, the FAA is more likely to finalize proposed rules due to the dominance of the urgency effect. It is possible for this speeding up of the finalization of rules to occur in the agency because of two additional reasons. First, the flexible structure designed for rulemaking in the agency as explained earlier makes it possible for the organization to shift resources as necessary when it faces pressure. Second, as I will elaborate later, under the urgency effect, the agency can allocate more attention to finalizing "easier rules" and thus speed up the finalization of rules. Therefore, I hypothesize the following:

HYPOTHESIS 2 (H2). *The number of overall new problems increases the rate of finalizing rules by the FAA.*

The urgency induced by problems can be moderated by certain external institutional factors because organizational attention can be channeled by the external environment (Ocasio 1997, Hoffman and Ocasio 2001, Cho and Hambrick 2006). External rhetoric was found to affect decision makers' attention areas (Bouquet and Birkinshaw 2008) and influence organizational outcomes by interacting with problems (Greve et al. 2006). One important factor in the FAA rulemaking process is industry performance. The literature on performance feedback can help us to understand how the rate of rulemaking for the airline industry is influenced by the performance of the airline industry. The performance feedback-based learning model suggests that decision makers take risks and make changes based on the performance feedback they receive in relation to their aspiration level, which is the performance level desired by decision makers (Bowman 1982; Bromiley 1991; Chen 2008; Cyert and March 1963; Greve 1998, 2003; Kahneman and Tversky 1979; Lant and Montgomery 1987). This line of literature suggests that individuals or organizations tend to be risk seeking (more likely to change) when facing losses and risk averse (less likely to change) when facing gains. There is sufficient empirical evidence to show that decision makers are more likely to make changes when they face poor performance (see Greve 2003 for a review), though some have also pointed out certain contingent factors (Audia and Greve 2006, Desai 2008). As government rules regulating industries are closely linked to industry performance (Magat et al. 1986) and agencies do careful economic performance evaluations during rulemaking processes, it is possible that the agency adjusts its rules based on industry performance feedback. The performance feedback theory would suggest that if the industry is performing well, the agency might feel less pressure to change, adjust, or enact any rules; if the industry is not performing well, the agency might sense a greater need to finalize certain rules to relieve the cost pressure on the airlines or to boost public confidence in airline safety. It is thus possible that the agency engages in more rulemaking activities (or a higher rate of rulemaking) when the industry has a lower performance level. Given the fact that more safety problems in the airlines often accompany lower industry performance averages (Rose 1990), the urgency effect created by new problems can be highlighted because there is an even greater need to ensure the public that the agency is working hard to make the public safer when the industry performance level is low. The need to make changes when facing low performance can validate the urgency effect created by problems. Therefore, I predict that the positive effect of new problems on rule finalization is stronger when the industry's performance is low.

HYPOTHESIS 3 (H3). *The positive effect of new problems on the rate of finalizing rules is stronger if the industry has a low performance level.*

The nature of solutions can also interfere with the attention allocation of decision makers (Ocasio 1997). This would be especially the case when decision-makers finalize the solutions as their attention is primarily on the solutions. The urgency effect due to new problems is likely to accentuate the attention disparity between high- and low-priority activities in terms of solution "easiness." A priority order defined by the ease of the solution exists even without urgency, as illustrated by Gresham's Law of Planning, which states that individuals and organizations tend to give priority to highly programmed and highly structured activities (March and Simon 1958). Evidence of Gresham's Law of Planning is found in the activities of administrators in an educational institution (Cohen and March 1974), the unquestioned rule-following in NASA's disastrous launch of the Challenger (Vaughan 1998), and priority management in the process of developing new products (Repenning 2001).

Urgency induced by problems can lead the organization *further* to favor "easier" solutions, increasing the difference in attention paid to easier and harder solutions. For instance, in a study of new project development in a manufacturing company, Repenning (2002) showed that the priority order between the project design/testing phase and the conceptual development phase was differentiated because of the urgency generated by the new product launch, with more attention paid to project design and testing, which has more attainable goals.

The "easier" solutions for the FAA to finalize are likely to be the rules with less complexity. This complexity can be both political and technical, with the former emphasizing the negotiation process among different rulemaking parties and the latter referring to the composition of rules, such as the different areas covered by a rule. If a rule that is being finalized involves many interest groups, or many aspects that need to be addressed, it would be much more complex or difficult for the FAA to finalize the rule. From a technical point of view, more complex rules would require more time from the agency for analysis and response. For instance, if a rule received many comments from the public, then the agency would have to spend more time to address the comments. In addition to this longer time requirement for more complex rules from a technical point of view, Gresham's Law of Planning also suggests that rules of low complexity will gain more attention and thus would be more likely to be finalized.

Further, the attention allocation mechanism described above suggests that with increased urgency generated by new problems, those "easier" (or less complex) solutions would be given even more attention. In other words, the "urgency effect" induced by new problems should be stronger for rules of low complexity.

Hypothesis 4 (H4). *The positive effect from new problems on the rate of rule finalization is stronger for rules of low complexity.*

Method

Data

The data consist of problems experienced by the U.S. airline industry from 1983 to 2000 and FAA regulations[1] proposed or made final during this period. Information on FAA rules from 1983 to 2000 was collected from the *Federal Register* publication of rules. FAA rules finalized prior to 1983 were collected from the FAA annual publication of rules and were used as a measure for accumulated rule density back to the date when the FAA was first established. When the FAA issues a rule, either a proposed rule or a finalized rule, it states the date of the rule being proposed or finalized. Each proposed rule has a unique docket number, and the FAA refers to that number if any future documents have anything to do with that proposed rule. Therefore, we can trace when a proposed rule is finalized. Based on the FAA's system of categorization, I sort rules into eight categories or domains. There are rules dealing with administrative procedures (combination of subchapters B and K), aircraft, airmen, airspace, air traffic control and general operating systems, air carriers, training schools, and airports. Rules associated with operating personnel and schools are regarded as human factor rules, and the other rules are treated as nonhuman factor rules. Because the abandonment of any rules has not been clearly recorded by the *Federal Register*, this study is limited to the general aspect of rulemaking or rule changes, including setting out new rules and making amendments to existing rules. At the stage of finalizing rules, rules that are finalized were regarded as events in this analysis, coded as "1." If a rule is regarded by the agency as a rule that should not be finalized (or in the FAA terminology, being "withdrawn"), it is coded as "0."[2] Rules that were still in process of finalization in the year 2000 were treated as right censored.

Problems in this data set were coded based on the NTSB reports of accidents and incidents experienced by all U.S.-based commercial airlines during 1983–2000. I used the 1983–2000 period because the NTSB created an improved database on accidents and incidents in 1983. During this eighteen-year period, about 310 commercial airline companies existed, and these companies experienced a total of 810 accidents and 834 incidents. The NTSB reports give narratives about each accident or incident, and they also give cause diagnoses for most of the accidents and incidents. With the procedure described by Haunschild and Sullivan (2002), 23 causes were identified by two independent coders (see Table 1). Although the NTSB-generated causes were used for those reports with NTSB diagnoses, causes were directly coded from the narratives for those reports without NTSB diagnoses. Among the causes, pilot error, flight crew error, flight attendant error, ground crew error, air traffic controller error, inadequate group coordination, error of pilots on other airplanes, and passenger errors were categorized as problems associated with human factors. Equipment malfunction, maintenance error, manufacturer error, inadequate FAA supervision and procedures, inadequate airline supervision and procedures, inadequate weather assistance, improper maintenance of the runway, terrain conditions, and weather turbulences were categorized as nonhuman factor problems. According to Baron (2002), the NTSB views human errors as mostly equivalent to pilot/crew errors. That is why the maintenance errors and procedure errors are categorized into the nonhuman factor group. A few causes, such as weather, birds, and passenger error, were excluded from analyses because they are unlikely to affect FAA rulemaking.

Table 1 Codes for Problems in Accidents and Incidents

Human problems
1. Pilot error
2. Flight crew error
3. Flight attendant error
4. Ground crew error
5. Air traffic control error
6. Pilot of other aircraft—error
7. Inadequate group coordination
8. Passenger error

Nonhuman problems[a]
9. Problematic ground conditions (not under control of facilities)
10. Equipment malfunction
11. Maintenance error
12. Manufacturer error
13. FAA supervision/procedures inadequate
14. Airline supervision/procedures inadequate
15. Airline failure to incorporate correction
16. Inadequate weather assistance
17. Facilities problem (e.g., runway maintenance)
18. Terrain condition
19. Weather—Turbulence
20. Weather—Other
21. Birds

Other problems[b]
22. Unknown, undetermined
23. Other—Nonclassifiable

Note. The same 23 causes were identified by Haunschild and Sullivan (2002).

[a]According to Baron (2002), the NTSB views human errors as mostly equivalent to pilot/crew errors classified by the NTSB. That is why the maintenance error and procedure errors were categorized into the nonhuman problem group.

[b]These problems were excluded from the analyses because they are unlikely to influence the FAA to make rules.

Dependent Variables

The rate of proposing rules is the dependent variable for models testing the "competition for attention" argument during the rule proposal stage (Hypotheses 1 and 2). A monthly event count was used for estimation in order to capture detailed information on variables over time. An event count model is appropriate because the FAA sometimes issues more than one rule on the same date and we do not know the history of the rules before they were proposed. *The hazard rate of rule finalization* is the dependent variable for hypotheses testing the "urgency effect" argument (Hypotheses 3–6). In this study, the hazard rate is the transition rate of a proposed rule being finalized. A rule enters into a risk set for estimation of the hazard rate at the time when it is proposed and exits the risk set until it is finalized or withdrawn.

Independent Variables

The independent variables include *the number of all problems*, *the number of human factor problems*, and *the number of nonhuman factor problems*. To test the competition for attention hypotheses, the number of human and nonhuman factor problems was the accumulated number in the prior two years up to the last month in order to capture the fact that there is variation in the amount of time it takes for the FAA to respond to different problems. It is also based on the consideration that the average time for the FAA to draft a proposal and get it published is about one year and there is some time needed for the FAA to respond and analyze problems before it drafts the proposal (GAO 2001). Following conventional practices, the independent variable was lagged by one month ($t-1$) to eliminate causal concerns. To test the urgency effect hypotheses, the number of all problems was updated monthly with a one-month time window because a short time window can capture the presence of urgency faced by the agency. For instance, unrelated problems that happened a year ago are very unlikely to generate urgency that compels the agency to accelerate its current action to finalize a particular rule.

One moderating variable is industry performance, which is measured by t*he average ROE of the airline industry*, i.e., the average return on equity for all airlines. It was collected from the Financial Statistics published by the Air Transport Association and updated quarterly.

Another moderating variable is *the complexity of rules*. A rule can be more complex and thus difficult to finalize if it has more parties involved in the rulemaking process, has more comments were given by different commentators, or covers more areas for consideration. I collected the number of parties, such as associations, governments, government agencies, airlines, individual citizens, etc., involved in the rule finalization process for any particular rule. If there were multiple airlines or multiple individuals, I grouped them together as one party of airlines or citizens to indicate the two different interest groups. I also collected the total number of comments from all participants and the total number of different areas of a particular rule that the comments are addressed to. The number of different areas of a rule considered by the commentators is obviously correlated with the total number of areas covered by a rule. It is a better measure than the number of areas covered by a rule for this particular study because it directly indicates the rule areas the FAA needs to pay attention to in its responses to the comments. The complexity of rules was measured by a linear composite combination of the three variables mentioned (the factor loading coefficients for the number of comments, the number of parties, and the number of concerned rule areas by the commentators are 0.79, 0.8, and 0.58, respectively). The number of comments was logged for this calculation because this variable is highly skewed.

To test Hypothesis 4, I divided the rules into two groups: rules of high and low complexity. Rules of high complexity have complexity scores above the mean of the rule complexity score and rules of low complexity have complexity scores below the mean. There are two reasons for me to use this approach of analyzing the two groups separately. First, exploratory analysis showed that the urgency effect did not seem to be linearly affected by rule complexity and thus it is better to reveal the differences in the urgency effect in different groups of rules. Second, to compare the different effects in different groups, it is more informative and reliable to run models separately for each group because the models for separate groups do not constrain the variance of residuals and coefficients to be the same as does a pooled model.

Control Variables

In addition to problems, many other factors may affect the making of FAA rules. In order to demonstrate the independent role of industry problems in the process of FAA rulemaking, both coercive and normative institutional factors were controlled for because government agencies are under the direct influence of many institutions, such as the U.S. Congress, the courts, political parties, and interest groups. Several noninstitutional factors that may interfere with the agency's diagnosis of problems were also controlled for.

Variables for Coercive Institutional Influences. The number of Congressional bills was collected from THOMAS legislative information published by the Library of Congress. This number also includes proposed bills because politicians might have an informal impact on agency decision making. *Court cases* in which the FAA was the defendant were collected from the Lexis-Nexis legal database. Both federal and supreme court cases were included. *The political party affiliation of an administration* was also included in the models, with the Democratic Party coded as "0" and the Republican Party coded as "1." Prior research suggests that the nature of a bureaucracy and the background of top managers can influence attention distribution in organizations (Ocasio 1997, Gavetti 2005). The top administrators of the FAA appointed by a Republican president might pay attention to different problems and rules than might an administrator appointed by a Democratic president.

Variables for Normative Institutional Influences. In addition to industry performance described above, I also included *the total number of firms and the negative media exposure of airline safety* to control for the overall power of the business group and for the pressure from public opinion. The total number of firms was updated quarterly. The negative media exposure to airline safety was indicated by the number of articles with negative comments on airline safety and the role of the FAA that were published in the top 50 newspapers and business magazines in the United States. All articles containing key words "airline safety" or "FAA" (or "Federal Aviation Administration") were downloaded from the Dow Jones newspaper and magazine database and the number of the articles holding a negative view toward airline safety and the role of the FAA was counted for a particular time period. Two coders worked on the coding and any disagreement was resolved by further discussion.

Other Control Variables. The total flight hours for the commercial airlines was collected from the annual report published by the Air Transport Association. This variable is included to control for other possible problems that may acquire FAA's attention for rulemaking or changing. *The industry accident and incident rate* was calculated by dividing the total number of accidents and incidents by the total flight hours, which indicates how the industry as a whole learns from its experience. To include this variable can also show that detailed problems, rather than the sheer existence of accidents and incidents, affect FAA rulemaking activity. *Rule density* in a particular time has been found to affect the rate of organizational rulemaking (Schulz 1998). Rule density was measured by the accumulated number of all rules in one domain existing prior to the focal rule. This variable also controls for the possible rulemaking capacity acquired by FAA through its learning from past rulemaking experiences. Because the FAA does not have records on the exact number of employees involved in the rulemaking over the sampled years, I included *the total number of the FAA employees in the office of Aviation Regulation and Certification* as a proxy for FAA's rulemaking capacity. *Calendar time* was included in the models estimating the rate of proposing and finalizing rules to control for other environmental changes over time in the models for the first and second stage. *Quarter dummies* were included to control for possible "seasonal variation" in agency rulemaking activity. *The number of proposed rules*, as an indicator for the rulemaking capacity, was included in models estimating the rate of finalizing rules. The *percentage of fatal accidents,* calculated based on the accidents and incidents data collected from the NTSB, was also included to control for any attention effect from particular problems of a certain nature because organizations tend to respond to salient events (Hoffman and Ocasio 2001).

As suggested by the notion of "normal accidents," accidents can be caused by multiple factors (Perrow 1984). The FAA, however, appears to address specific problems. For instance, the problem of pilot fatigue was identified in two accidents that had other associated causes. Nonetheless, fatigue was identified as a major cause by the NTSB, and the FAA proposed rules on pilot flying time. As shown in the example above describing the FAA's rulemaking activity in response to the September 11, 2001, terrorist attacks, the FAA also responds to multiple causes in one accident. The agency, however, might have a difficult time distinguishing between different types of problems and therefore might overlook the effects of problems if different types of problems exist in a complex format. Therefore, *problem heterogeneity* (*used as measured for problem complexity*) was included in models to control for the fact that some causes may appear in a "bundle" to cause accidents. This variable is used to control for the FAA's response to more complex problems. It is possible that the FAA is making a few rules simply because the problems have become more complex (Miner et al. 2003). This variable was constructed as follows. All errors were coded from NTSB data as described above and then indexed using the following entropy-based measure:

$$-(\text{sum}(P_i(\ln P_i))) \quad \text{for } i = 1, \ldots, n,$$

where i is each of the 23 cause categories coded from the accident reports and P_i is the proportion of the occurrence of i over the total number of the problems for accidents or incidents during a particular time period. This entropy-based measure of complexity has been used in prior studies (Ancona and Caldwell 1992, Jehn et al. 1999, Haunschild and Sullivan 2002). In this study, because the agency looks into many errors from multiple events, the complexity scores were calculated across all accidents and incidents experienced by all airlines for a given time period. Problem i can be from multiple accidents or incidents, and P_i is the proportion of problem i that occurred in all accidents and incidents for a given time period over the total number of problems involved in all accidents and incidents in the same time period. A higher score suggests a higher degree of complexity of the problems.

I also controlled for *the importance of rules* in models estimating the finalization of rules because the agency assigns an importance level to different rules and it might also intervene with other variables. Regulations issued by the FAA are prioritized by the agency in terms of importance or significance. A rule is regarded as significant if it has important economic impact, is controversial, or is of substantial public interest under the Department of Transportation's Regulatory Policies and Procedures. Regulations are regarded as nonsignificant if they are issued routinely and frequently as a part of an established body of technical requirements. "1" was coded for rules regarded by the agency as significant, and "0" was coded for those labeled as nonsignificant. This information was collected from the Department Regulations Agenda published in the *Federal Register*. Finally, *the lagged monthly event count variable* was included in order to control for unobserved heterogeneity (Heckman and Borjas 1980).[3]

Models

To model the rule production rate for the stage of proposal development, a zero-inflated, fixed-effect, negative binomial model was used. Because the dependent variable is a count of the number of rules with a significant amount of zero entries, a zero-inflated Poisson model should be used. This model assumes that both zero and positive counts can be generated by a Poisson process, but zero counts occur with probability ψ from a separate process. This binary process can be specified as follows:

$$\Pr(y_t = 0 \mid x_t) = \psi_t + (1 - \psi_t)\exp(-\mu_t),$$

where $\mu_t = \exp(x\beta)$ and ψ is determined by a logit model estimated by x.

By combining this binary model with the Poisson count model, we then have

$$\Pr(y_t \mid x_t) = (1 - \psi_t)\frac{\exp(-\mu_t)\mu_t^{y_t}}{y_t!} \quad (y_t > 0).$$

In other words, I first estimate the probability of the occurrence of zero counts based on certain parameters and then, in a full model, estimate the rate of proposing rules with the Poisson count model while taking the probability of occurrence of zero counts into consideration. For this study, I used the negative binomial variant, which does not assume equality of the conditional mean and variance of the underlying distribution as does the Poisson model (Barron 1992). There are two reasons for using a fixed-effects model. First, population heterogeneity should be controlled for. One strategy is to "disaggregate the population into sub-populations and to allow parameters to vary across subpopulations" (March et al. 2000, p. 128). Using the approach by March et al. (2000), I pooled the time-series data for all eight subcategories of the FAA rules (that is, it is a panel data set comprising rule domains with months) and used an unconditional fixed-effect model with rule domains as dummy variables in corresponding models. This approach basically looks at how, in one particular domain, the rate of proposing rules changes over the time. Thus, it also effectively eliminates the concern that rules in the same domain are interdependent. Second, this approach allows for the updating of covariates in a more time-detailed fashion. In this case, I could update both the dependent variables and the covariates on a monthly basis.

To model the hazard rate of rule finalization, I used the Cox event history model because each rule proposal has information on the specific date of being proposed, whether it was finalized, and when it was finalized. The Cox proportional model is specified as the following:

$$h(t) = h_0(t)e^{\beta_1 x_1 + \cdots + \beta_k x_k},$$

where $h(t)$ is the hazard rate and h_0 is the baseline hazard, which is not estimated. Initial tests using Schoenfeld residuals show evidence of possible violations of the proportional assumption in the Cox models where the dependent variable is the hazard rate of finalizing all rules or nonhuman rules. The Cox models stratified by rule domains and the number of total accidents and incidents, two covariates that showed significant violation of the proportionality assumption, were then used.

Split spells were used to update the covariates monthly. The final data for this part included 432 proposed rules with more than 15,100 rule-month observations. Due to missing values, the number of rule-month observations used in the analyses was 10,283. In this case, the unique aspects of each domain, which may influence the rate of rule finalization, can be controlled through the domain dummies attached to each proposal during its existing time period. The time variable is the number of days after a rule has been proposed.

Results

From 1983 to 2000, the total number of proposed major FAA rules in the sample was 432: 12% of these rules are categorized as rules dealing with human factors, whereas the remaining 88% deal with nonhuman factors. During the same time period, the total number of problems was 2,248. Among these problems, 33% were human factor problems and 67% were nonhuman factor problems. Table 2 presents the descriptive statistics and correlations for the key study variables. It shows that the correlation between human and nonhuman problems is not too high. To check if there is a multicollinearity issue, each variable was entered separately and no evidence of multicollinearity was found.

Table 3 reports the results of zero-inflated negative binomial regressions in which the dependent variable is the number of proposed rules for a specific rule domain in a given month. The dependent variable for Model 1 of Table 3 is the number of rules across all domains. The model includes the control variables and the total number of problems. The number of problems does not have a significant effect on the overall rate of proposing rules. This result suggests that the agency's capacity to make rules was limited. Different rule domains (categories) do appear to have significant differences in terms of their rates of rule proposal development. It appears that rules were most likely to be proposed in the domain of "aircraft." Rule density has a negative but nonsignificant impact on the overall rate of rule proposing. The number of negative media comments seems to slow down the rate of proposing rules ($p < 0.01$), suggesting that negative public opinions might add burdens to the agency and distract the agency's attention from rulemaking activities.

Models 2 and 3 differentiate rules dealing with human factors from rules dealing with nonhuman factors. The results from these two models support Hypothesis 1, which states that an increase in human factor problems increases the rule-proposing rate in the human factor category but decreases the rate in the nonhuman factor category, whereas an increase in nonhuman factor problems

Table 2 Descriptive Statistics and Correlations for Key Study Variables in Models for Proposing Rules ($N = 1{,}536$)

Variables	Mean	SD	Min.	Max.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Number of proposed rules (monthly)	0.2	0.6	0.0	5.0	1.00															
2. Number of proposed rules (lag)	0.2	0.6	0.0	5.0	0.13	1.00														
3. Rule density (domain specific)	346.54	558.76	29.0	2,101.0	0.25	0.25	1.00													
4. Number of firms	76.2	15.3	51.0	102.0	0.03	0.04	0.02	1.00												
5. Avg. ROE	−1.0	1.6	−7.3	3.1	0.05	0.03	0.07	0.17	1.00											
6. Number of court cases	15.2	9.0	4.0	39.0	−0.02	−0.03	−0.05	0.07	0.04	1.00										
7. Number of proposed Congress bills	27.9	9.3	14.0	51.0	−0.03	−0.02	−0.04	−0.29	−0.16	0.55	1.00									
8. Number of negative media articles	28.8	25.3	5.0	102.0	0.06	0.07	0.05	0.28	0.15	−0.05	−0.15	1.00								
9. If a Republican administration (yes = 1)	0.6	0.5	0.0	1.0	−0.08	−0.08	−0.08	−0.35	−0.18	0.36	0.50	−0.56	1.00							
10. Calendar time	9.1	5.4	1.0	18.0	0.06	0.06	0.09	0.16	0.18	−0.51	−0.44	0.46	−0.86	1.00						
11. Total number of FAA AVS employees (ln)	8.6	0.1	8.3	8.7	0.01	0.03	0.04	−0.05	0.10	0.05	0.24	0.25	−0.02	0.35	1.00					
12. Problem complexity	0.3	0.1	0.1	0.9	−0.05	−0.05	−0.09	−0.17	−0.19	0.45	0.40	−0.28	0.76	−0.86	−0.13	1				
13. Industry flying hours (ln)	9.3	0.2	8.8	9.7	0.05	0.05	0.09	0.03	0.11	−0.45	−0.27	0.43	−0.77	0.97	0.42	−0.88	1.00			
14. Industry accident/incident rate	0.0	0.0	0.0	0.0	−0.03	−0.03	−0.06	0.10	0.06	0.60	0.35	−0.22	0.52	−0.66	0.04	0.49	−0.68	1.00		
15. Number of all problems (two-year window; $t-1$)	254.3	41.1	179.0	367.0	−0.05	−0.03	−0.06	−0.06	−0.04	0.72	0.57	−0.07	0.57	−0.65	0.17	0.60	−0.57	0.78	1.00	
16. Nonhuman problems (two-year window; $t-1$)	169.1	19.8	129.0	216.0	0.01	0.04	0.01	0.10	0.12	0.40	0.31	0.38	−0.05	0.08	0.56	−0.09	0.14	0.44	0.68	1.00
17. Human problems (two-year window; $t-1$)	85.2	31.2	28.0	151.0	−0.07	−0.06	−0.09	−0.14	−0.13	0.70	0.56	−0.33	0.78	−0.82	−0.14	0.85	−0.83	0.75	0.89	0.26

Table 3 Zero-Inflated Negative Bionomial Models for Rate of Proposing Rules

	Models		
Variables	1. All rules	2. Human rules	3. Nonhuman rules
Domain 1 (procedure)	−1.412** (0.546)		−0.324 (0.309)
Domain 2 (aircraft)	4.077*** (1.224)		4.746*** (1.086)
Domain 3 (airmen)	−0.611 (0.523)	2.031 (0.787)	
Domain 4 (airspace)	−1.022* (0.533)		0.061 (0.278)
Domain 5 (ATC, gen. op.)	0.388 (0.522)		1.460*** (0.242)
Domain 6 (air carrier)	0.522 (0.604)		1.508*** (0.361)
Domain 7 (schools)	−2.187*** (0.599)		
Domain 8 (airport)			
Lagged dependent variable	−0.015*** (0.081)	−0.700* (0.787)	−0.054 (0.084)
Rule density	−0.002 (0.001)	−0.030 (0.401)	−0.002*** (0.001)
Number of firms	−0.005 (0.009)	−0.010 (0.015)	−0.005 (0.009)
Industry average ROE	0.036 (0.120)	−0.179 (0.023)	0.091 (0.129)
Number of court cases	0.004 (0.014)	−0.015 (0.135)	0.020 (0.014)
Number of proposed Congress bills	0.008 (0.012)	−0.035 (0.043)	0.009 (0.013)
Number of negative media articles	−0.003** (0.004)	0.010 (0.040)	−0.007* (0.004)
If a Republican administration (yes = 1)	−1.153** (0.529)	0.688* (0.012)	−1.974** (0.603)
Calendar time	0.061* (0.168)	0.633** (0.228)	−0.163 (0.188)
Total number of FAA employees	2.205 (1.270)	1.151 (0.577)	3.484** (1.377)
Problem complexity	2.475 (2.455)	−1.105 (3.975)	4.889* (2.708)
Industry flying hours (ln)	−1.952 (3.113)	−0.254 (8.865)	−1.549 (3.308)
Industry accident/incident rate	−5.842 (65.292)	99.397 (9.340)	−52.075 (69.007)
Number of all problems	−0.006 (0.004)		
Nonhuman problems		**−0.059***** **(0.022)**	**0.012*** **(0.007)**
Human problems		**0.060*** **(0.032)**	**−0.030**** **(0.009)**
Intercept	−3.430 (31.880)	−13.230 (95.920)	−16.490** (34.120)
Observation	1,536	384	1,152
Log likelihood	−846.72	−115.77	−699.99
Chi-square	175.06**	35.56**	159.76**

Notes. Nonhuman rules = rules in domains 1–8; human rules = rules in domain 3, and domain 7; dummy variables of quarters are included in all models; parameters estimating zero inflation include rule density, quarter, and calendar time. Standard errors are in parentheses.

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$, two-tailed tests.

increases the rule-proposing rate in the nonhuman factor category but decreases the rate in the human factor category. Model 2 shows that human factor problems have a positive and marginally significant ($p < 0.1$) effect, and nonhuman factors have a negative and significant ($p < 0.01$) effect on the rate of proposing human factor rules. The coefficients of human and nonhuman factor problems are 0.06 and −0.059, respectively. In other words, with one additional human factor problem, the number of human factor rules increased by 6%, and with one additional nonhuman factor problem, the number of human factor rules decreased by about 6.1%. Model 3 supports Hypothesis 1, showing that nonhuman factor problems have a positive and significant ($p < 0.1$) effect, and human factor problems have a negative and significant ($p < 0.05$) effect on the rate of proposing nonhuman factor rules. The coefficients on human and nonhuman factor problems are −0.03 and 0.012, respectively. With one additional human factor problem, the number of nonhuman factor rules decreased by 3% and with one additional nonhuman factor problem, the number of nonhuman factor rules increased by about 1.2%. In terms of the magnitude of the problem impact, it appears that the overall magnitudes of both human and nonhuman problems on human factor rules are larger than those on nonhuman factor rules. Given the overall slow process of FAA rulemaking, it is obvious that the number of problems plays an important role in proposing rules.

Table 4 presents the descriptive statistics and correlations for the key study variables related to the hypotheses regarding problems and rates of finalizing rules. From 1983 to 2000, about 70% of the FAA's proposed rules were finalized. The absolute number of finalized rules was 314, of which 270 were nonhuman factor rules and 44 were human factor rules. The percentage of rules finalized is similar (about 71%) for both human and nonhuman factor rules. Because I was not able to collect information on the complexity of certain rules, the final sample in this study includes a total number of 305 rules, of which 262 were nonhuman factor rules. To address the concern of possible multicollinearity due to some high correlations, separate models were used by adding one variable of interest at a time and assessing the model fit after each addition. These models showed no deleterious effects of collinearity among the main variables.

Table 5 presents the results of the Cox models estimating the hazard rate of finalizing rules. The dependent variable for Model 4 in Table 5 is the hazard rate for finalizing all proposed rules. Model 6 includes the control variables and the total number of problems. The result shows that the total number of problems has a positive and significant ($p < 0.01$) effect on the overall rate of finalizing rules, supporting Hypothesis 2. The coefficient is 0.043, meaning that with an additional problem, the likelihood of finalizing rules increases by 4.4%.

Table 4 Descriptive Statistics and Correlations for Key Study Variables in Models for Finalizing Rules ($N = 10{,}283$)

Variables	Mean	SD	Min.	Max.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Rule density (domain specific)	716.28	663.56	29	1,553	1															
2. Number of firms	75.36	15.28	51	102	−0.07	1.00														
3. Industry average ROE	−0.06	0.48	−3.42	0.65	0.00	0.04	1.00													
4. Number of court cases	0.57	0.91	0	7	0.00	0.19	−0.05	1.00												
5. Number of proposed Congress bills	1.48	1.62	0	7	0.02	0.11	−0.15	0.14	1.00											
6. If a Republican administration (yes = 1)	0.38	0.49	0	1	0.10	−0.17	−0.26	0.15	0.20	1.00										
7. Number of negative media articles	1.31	2.85	0	19	−0.01	0.08	0.05	0.10	0.11	−0.18	1.00									
8. Percentage of fatal accidents	0.52	0.21	0	1	−0.02	0.12	0.07	−0.12	−0.02	−0.15	−0.08	1								
9. Number of proposed rules	2.11	2.51	0	18	−0.03	0.00	0.05	0.00	0.03	−0.13	0.26	−0.12	1							
10. Total number of FAA AVS employees (ln)	8.60	0.11	8.32	8.73	−0.03	0.18	0.03	−0.17	0.04	0.03	−0.15	0.06	0.02	1.00						
11. Problem complexity	0.27	0.18	0.00	0.90	0.05	−0.14	−0.15	0.06	−0.01	0.32	−0.03	−0.13	−0.10	−0.19	1.00					
12. Industry flying hours (ln)	9.38	0.17	8.79	9.66	−0.09	0.10	0.24	−0.25	−0.18	−0.80	0.08	0.19	0.12	0.35	−0.42	1.00				
13. Industry accident/incident rate	0.01	0.00	0.01	0.02	0.02	0.18	−0.18	0.17	0.16	0.58	−0.09	−0.11	−0.09	0.17	0.21	−0.61	1.00			
14. Calendar time	11.7	4.48	1	18	−0.10	0.19	0.28	−0.21	−0.21	−0.86	0.09	0.18	0.14	0.30	−0.43	0.97	−0.60	1.00		
15. Importance of rules (significant = 1)	0.33	0.47	0	1	−0.19	−0.10	−0.01	−0.03	−0.01	−0.05	0.02	0.01	−0.02	−0.11	0.01	0.02	−0.06	0.00	1.00	
16. Complexity of rules	12.79	8.83	0	49.76	−0.21	0.04	0.03	−0.03	−0.04	−0.14	0.03	0.02	0.03	0.04	−0.07	0.15	−0.11	0.16	0.25	1.00
17. Number of all problems (monthly)	16	7.82	0	44	0.03	−0.03	−0.17	0.21	0.05	0.38	0.00	−0.14	−0.03	−0.08	0.22	−0.47	0.43	−0.49	−0.01	−0.08

Table 5 Cox Models for Hazard Rate of Finalizing Rules

	Models					
Variables	4. All rules	5. All rules	6. Rules of high complexity	7. Rules of low complexity	8. Significant rules	9. Nonsignificant rules
Accumulated prior rules (domain specific)	−0.008 (0.009)	−0.007 (0.009)	−0.051 (0.032)	−0.008 (0.011)	−0.099** (0.040)	0.012 (0.013)
Number of firms	0.007 (0.009)	0.006 (0.010)	0.045 (0.033)	0.003 (0.013)	−0.030 (0.039)	−0.010 (0.012)
Industry performance (average ROE)	−0.377** (0.147)	−0.171 (0.183)	0.037 (0.504)	−0.761*** (0.176)	−0.166 (0.494)	−0.560*** (0.161)
Number of court cases	−0.016 (0.088)	−0.028 (0.092)	0.170 (0.261)	−0.141 (0.117)	−0.994*** (0.340)	0.003 (0.101)
Number of proposed bills	−0.036 (0.044)	−0.032 (0.044)	0.341** (0.173)	−0.043 (0.056)	0.090 (0.283)	−0.016 (0.052)
Party (Republican party = 1)	1.395** (0.591)	1.427** (0.590)	0.132 (1.037)	1.554* (0.888)	2.253* (1.163)	0.609 (0.917)
Number of negative media articles	0.087*** (0.023)	0.090*** (0.023)	−0.008 (0.035)	0.126*** (0.039)	0.136** (0.050)	0.071** (0.034)
Percentage of fatal accidents	0.649* (0.357)	0.590 (0.353)	1.647 (1.438)	1.204** (0.526)	−1.555 (1.296)	1.174** (0.482)
Number of proposed rules	0.047* (0.027)	0.050** (0.027)	0.121 (0.119)	−0.003 (0.037)	−0.055 (0.088)	0.075** (0.032)
Total number of FAA employees (ln)	−2.068 (1.355)	−2.152 (1.343)	−1.593 (2.631)	−1.711 (1.988)	1.740 (3.439)	−1.870 (2.230)
Industry flying hours (ln)	4.652* (2.554)	4.448* (2.622)	1.289 (9.365)	−13.683 (74.996)	−307.937 (206.067)	23.748 (71.596)
Industry accident/incident rate	−45.530 (52.100)	−46.240 (52.224)	−85.347 (251.452)	0.120 (0.559)	−3.050 (2.104)	0.917* (0.546)
Problem complexity	0.581 (0.430)	0.663 (0.429)	6.635** (1.852)	4.956 (3.641)	−31.527** (12.835)	8.220** (3.532)
Calendar time	0.119 (0.140)	0.121 (0.143)	0.317 (0.479)	0.179 (0.192)	1.884*** (0.558)	−0.139 (0.208)
Importance of rules (significant = 1)	−0.137 (0.186)	−0.131 (0.188)	3.155*** (1.050)	−0.904*** (0.291)		
Complexity of rules	**−0.040***** **(0.010)**	**−0.039***** **(0.010)**	**−0.078**** **(0.031)**	**−0.062**** **(0.031)**	**−0.068**** **(0.031)**	**−0.054***** **(0.014)**
Number of all problems	**0.043***** **(0.013)**	**0.037**** **(0.013)**	**0.077** **(0.057)**	**0.076***** **(0.017)**	**0.073** **(0.063)**	**0.054***** **(0.016)**
All problems ∗ Industry performance		**−0.274*** **(0.140)**				
Number of observations	10,262	10,262	3,966	6,296	3,392	6,870
Number of events	304	304	106	198	81	223
Log likelihood	−337.96	−336.67	−37.61	−172.5	−40.66	−202.72
Chi-square	78.3***	77.67***	39.71***	64.27***	52.51***	60.65***

Notes. (1) Nonhuman rules = rules in procedure, aircraft, airspace, etc. and general operation, air carrier, and airport domains. Human rules = rules in airmen and school domains. (2) Dummy variables of quarters are included in all models. (3) Cox models were stratified by domains and the number of accidents and incidents. Standard errors are in parentheses.

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$, two-tailed tests; robust standard errors are in parentheses.

Among all the control variables, the significant effects come from the average industry performance, the party affiliation of the administration, the number of negative media articles, the number of proposed rules, the industry accident/incident rate, and the complexity of the rules. The average industry return on equity is negative and significant ($p < 0.05$). This supports the argument that with the industry making lower profits (possibly due to accidents and incidents), the agency is more likely to enact rules. The number of negative media articles has a significant ($p < 0.01$) and positive effect on the rate of finalizing rules. Gresham's Law of Planning is supported from the effects of the complexity of rules: the complexity of rules has a negative and significant effect on the rate of finalizing rules. One interesting finding from the model is that the importance level of rules does not have a significant impact on the overall rulemaking rate. This might confirm the GAO's assertion that the FAA assigns "priority" to too many rules, and as a result nothing has priority (GAO 2001).

In Model 5, I added the interaction terms of rule complexity with industry performance. As shown in the model, the interaction of rule complexity and industry performance is negative and significant ($p < 0.1$), supporting Hypothesis 3, which states that the positive effect of problems is stronger when the industry has a lower performance level. Models 6 and 7 in Table 5 were designed to test Hypothesis 4, which states that the positive effect of the number of problems is stronger for rules of low complexity. Whereas Model 6 shows the effect of the number of problems on finalizing rules of high complexity, Model 7 shows the effect of the number of problems on finalizing rules of low complexity. The complexity of the rules variable was kept in both models to control for the heterogeneity of rule complexity within a particular group. As shown in the results, although the effect of the number of problems on the rate of finalizing low-complexity rules is positive and significant ($p < 0.01$), the effect of the number of problems on the rate of finalizing high-complexity rules is positive but nonsignificant. The results suggest that under the influence of the urgency by problems, attention was channeled more to the less-complex solutions. These results support Hypothesis 4. A note here is that this finding is descriptive in nature and does not suggest that the agency is taking a "wrong" action by focusing attention first on less-complex solutions. Fast and frequent adaptations do not necessarily produce effective learning (Lounamaa and March 1987, Greve 2003) and fast responses to complex issues could induce even more biases, leading less-effective performance improvement.

Discussion and Conclusions

Through examining the formation of airline safety rules by the Federal Aviation Administration (FAA), I found evidence to support my general propositions. At the stage of proposing rules, problems from different domains compete for attention, with attention paid to the domain with the greatest number of problems. At the stage of rule finalization, the rulemaking rate of is impacted by the urgency introduced by new problems. First of all, new problems tend to push the FAA to finalize more rules. Second, industry performance can significantly moderate the urgency effect. Third, urgency interacts with the *a priori* priority given to different types of rules. There is evidence suggesting that the FAA allocates more attention to less-complex rules when the amount of new problems increases.[4]

This study contributes to the study of organizational attention by highlighting the importance of context surrounding problems and solutions in the occurrence of competition for attention and in the emergence of different mechanisms guiding the process of attention allocation. It demonstrates that problems are likely to compete for attention in a context where attention capacity is relatively stable and the quality of attention is not ensured to enhance. Given the contention in the literature on the scarcity of organizational attention (Simon 1957, Cyert and March 1963, Weick and Sutcliffe 2006), this study is a useful first step toward the future direction of possibly integrating different perspectives on attention allocation. It also further reveals that mechanisms guiding competition for organizational attention can be different, depending on whether or not problems are substantively connected to the search for solutions. The current study thus enriches the notion of "situated attention" (Ocasio 1997) by showing the "indirect" effects of problems on attention competition.

Implications and Limitations

This study suggests that problem load and organizational capacity together affect attention allocation among different problem-solving activities and consequently affect what problems are addressed and how fast they are addressed. These suggestions have important implications for the studies of organizational learning as attention allocation is closely related to learning (Cyert and March 1963, March et al. 2000). Although the evidence of organizational learning from past experience is ample (see Argote 1999 for a review), much of the prior research failed to realize that the process of learning can be constrained by both the nature of the experience and the nature of an organization's learning capacity. The findings from this study strongly indicate that the interactions between the properties of experience and organizational capacity in processing information and making decisions have a significant impact on the learning process. It is important for future studies to examine the impact of the dynamics of experience and organizational capacity on the emergence of learning mechanisms that affect a learning process.

The finding from this study that the attention allocation process under urgency is shaped by the complexity of the solutions, which can be mainly defined by political negotiations among different interest groups, suggests that how and when solutions are generated in the form of rules are constrained by the nature of the organization, either as a problem-solving body or as a political system. As a problem-solving body, an organization tends to generate solutions by maximizing its efficiency in solving problems, contingent on its limited resource capacity; as a political system, an organization tends to be responsive to institutional pressures. The outcome of attention allocation, therefore, can be constrained by the two properties of an organization. Although in the long run, an organization would seek final solutions for all problems, in the short run, "urgency" from problems embedded in institutional pressures can push an organization to move faster on solution generation, but this may or may not solve the real problems.

The findings from this study certainly have practical implications because airline safety rules not only affect the operation of the airline industry but also directly affect the lives of ordinary people. The findings from this study also have significant theoretical implications. This study suggests that new problems and organizational attention capacity together affect attention allocation to different problem-solving activities and consequently affect what problems are addressed and how fast they are addressed.

A few limitations should be noted when drawing general conclusions from this study. First, it is possible that I have not included all the problems to which the FAA may respond, yet this is unlikely to change the general findings from this study. Two other possible sources are NASA's Aviation Safety Reporting System (ASRS) and international aviation accidents and incidents. The ASRS data are often used as a supplemental information source for the FAA. These data were not included in this analysis because it is obvious that the FAA puts much less weight on ASRS reports than it does on NTSB reports. Also, as I pointed out earlier, the impact of aviation problems reported by the NTSB is to some extent institutionalized because the FAA is mandated to respond to NTSB recommendations. The impact of international aviation accidents, as revealed in my case analysis (available from the author), seems to lie more in the detailed content of rules rather than in the rate of rulemaking, which is the focus of the current study. Thus, the lack of information from the ASRS and international sources is unlikely to change the general findings and conclusions of this study. Nevertheless, we need to be aware that some other incident reports, especially those from the ASRS, could impact rulemaking at the FAA.

Second, due to data constraints, this study did not examine the specific conditions under which "attention contagion" takes effect. The effect of "attention contagion" may be likely to be observed with more refined problem and rule categories. For instance, within the category of nonhuman factor problems, we can further divide the problems into system and technical problems. Preliminary analyses of these two categories show that problems in the two subcategories have positive but mostly nonsignificant effects on the rate of rulemaking in their own and in the other domains. Although the results seem to suggest that these two types of problems do not compete against each other, the evidence for attention contagion is also weak. Future studies need to spell out the factors that lead to attention contagion.

Third, the use of a government agency in this study may raise the concern about the generalizability of the findings. This concern can be relatively eased by the fact that the issues I am examining also prevail in other types of organizations. Although the government agencies are highly institutional as political bodies, the institutional impact on attention allocation is not unique to government agencies (Ocasio 1997). In addition, I control for many technical and institutional factors that influence the FAA's rulemaking process. Because many prior studies on rules (e.g. Leblebici and Salancik 1982, Zhou 1993, Schulz 1998) looked at the rules in a single organization, an examination of rulemaking in a different organizational setting, a government agency, allows us the opportunity to refine and expand our knowledge in this research area. Although the question of whether the findings can be generalized to nongovernment organizations still remains, it is likely, though, that the findings from this study can be observed in any organization (or part of an organization) that has rules as its solution product. The stage differences observed in this study may be generalized to any organization where solutions need to be generated because most organizations experience the stages of proposing and finalizing solutions in their decision-making processes. Nevertheless, the generality of the findings from this study can only be established when studies in other organizational contexts are conducted.

Remaining Theoretical Questions

Two important remaining issues that deserve future investigation are organizational slack and specialization. It is possible that the competition for attention among alternative problems may be eased by increased organizational resources. Scholars have argued that organizational conflicts may be reduced with relatively unlimited resources (March and Simon 1958). Therefore, with more slack available to the organization, the less attention given to one problem area because of the attention to other problem areas can be quickly redirected. Consequently, it may be hard to see a competition effect among problems. Slack might also have an important role in finalizing rules. Whereas an organization with slack resources might respond to new problems by increasing its rate of finalizing rules already under consideration, an organization with little slack might experience a collapse in finalizing such rules.

In addition, an important assumption behind the attention competition argument is that organizational resources are shared to deal with different types of problems. This resource-sharing assumption for a government agency is supported by descriptions from other research. Kingdon (1984) observes that, in government agencies, different agendas need to go through the same "pipelines" for processing and consequently share the attention and time of the same group of people. The flexible team-based rulemaking approach used by the FAA suggests a relatively lower degree of specialization within the organization. A strong presence of specialization in some organizations may not only reduce the competition for attention and other types of resources but also ease the need for an organization to set up priorities among different decision-making activities. How specialization plays out in the attention allocation process depends on the nature of an organization in handling particular types of problems and activities. In general, the tension and possible balance between the mechanisms discussed in this study and specialization need to be further examined in future studies.

The results from this study also suggest the possibility that different priorities in an organization can interact with each other. As mentioned earlier, the government agency does assign importance levels, significant or nonsignificant, to different rules. Models 8 and 9 in Table 5 indicate that problems have positive and significant effects on the finalization of nonsignificant rules but no significant effects on the finalization of significant rules, suggesting that it is possible that organization is channeling more attention to nonsignificant rules under the urgency effects. Results from this study further suggest possible interactions between the importance of the solutions and Gresham's Law of Planning: For rules of high complexity, the importance level has a positive and significant ($p < 0.01$) effect on finalizing rules, whereas for rules of low complexity, the importance level has a negative and significant ($p < 0.01$) effect (see Models 6 and 7 in Table 5). This suggests that organizational attention to easier solutions could be moderated by how an organization perceives the importance of a particular solution. It will be interesting to explore in future research under what conditions an organization would prefer certain priority orders to generate solutions.

Although the current study shows a particular context where attention capacity is limited and problems compete for attention, it will be particularly meaningful for future studies to explore certain organizational designs through which the quality of attention can be constantly adjusted and attention scarcity might be less of an issue. This will be another useful step toward fully understanding the mechanisms of attention allocation and possibly integrating different perspectives on attention. An examination of the interactive role of problem load with attention capacity in determining the rules of attention allocation can also help in this future endeavor. With a limited set of problems, it could be easier for an organization to adjust the quality of its attention to enable an organization to be "mindful" in its examination of solutions to problems.

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Endnotes
[1]Examples of recently published FAA regulations can be found at the following website: http://www.faa.gov/regulations_policies/rulemaking/recently_published/.

[2]An analysis of rules withdrawn from the finalization process as an alternative state of events could reveal some interesting mechanisms in the rule finalization process. The small sample size of withdrawn rules, however, prohibits us from doing analyses on this particular event.

[3]While including a lagged event count variable may help remove correlation over time, it could also cause other complications. It is included in this study because the coefficients of the key variables did not change with or without this variable; the variable, however, does show a significant effect in some models.

[4]Additional analyses show that at the rule finalizing stage, human and nonhuman problems do not seem to have the competition effect as presented in the rule proposing stage. That is, whereas human factor problems result in more human factor rules and fewer nonhuman factor rules, nonhuman factor problems lead to more nonhuman factor rules and fewer human factor rules. Rather, both human and nonhuman factor problems increase the rate of finalizing nonhuman factor rules but reduce the rate of finalizing human factor rules.

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