

Institutional Explanations of Organizational Learning
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On February 1, 2003, the Space Shuttle Columbia broke apart over Texas and all of the crew were lost. The accident was caused by damage that occurred during launch when the leading edge of the wing was struck by a large piece of insulating foam from the huge external tank that fuels the Orbiter. Smaller foam strikes were a relatively frequent event and had come to be classified as “turnaround” or maintenance events. This was the second shuttle Orbiter lost to a well-known but tolerated divergence from specifications, leading the Columbia Accident Investigation Board (CAIB) to conclude that “the lack of institutional memory in the Space Shuttle Program ... supports the Board’s claim... that NASA is not functioning as a learning organization” (CAIB 2003, 127).

Earlier I investigated this learning failure in one of our principal public science organizations and offered an account of public organization learning in an institutional setting (Mahler and Casamayou 2009). In this view, organizational learning is the result of three processes: problem recognition, analysis and inference about causes and solutions, and the institutionalization of solutions to make them available to all in the organization. Each of these processes are themselves complex with multiple and conflicting incentives and numerous sources of failure. But all of them take place in an institutional setting. Learning is an institutional process, based in institutional contexts and shaping future action and options (Berends, Boersma, and Weggeman 2003). Results are evaluated against prevailing expectations and norms of appropriateness to determine whether they constitute problems. The analysis of the causes behind the unsuccessful results relies on interpretations shaped by agency context and institutional memories of past events and a repertory of embedded design solutions. The ability to embed new solutions rests on their compatibility with established institutional norms, rules and structures. External laws and actions by Congress and presidents condition the alternatives open to NASA. Learning rests on institutions, but institutional development also depends on learning. March and Olsen note “It is a frequent observation of institutionalism that institutions accumulate historical experience through learning. The results and inferences of past experience are stored in standard operating procedures, professional rules and the elementary rules of thumb of a practical person” (1984, 745). Thus organizational learning rests on a complex set of memories, mental models, assumptions, incentives and rules that constitute organizations as institutions.

There are, however, at least three quite different and independently developed versions of new institutionalism currently in use: historical, public choice and organizational institutionalisms (Immergut 1998, Hall and Taylor 1996, DiMaggio and Powell, 1991). How do each of these three versions of institutionalism account for the absence of organizational learning about some key organizational and managerial lessons?

Multiple Institutionalisms

New institutionalism is the term applied to a variety of recent accounts of complex organizations, states and other political entities, but here particularly, public agencies. In general institutionalism looks at organizations as arenas for action in which are embedded implicit or explicit rules, language patterns, cultural assumptions, communication patterns, and mental models that shape the goals, interpretations, and actions of members. Institutionalism is not a new approach for political science or public management, and traditionally these fields looked at organizations and states from the perspective of their capacity to act based on laws and formal structures. Neo-institutional approaches look at organizational and political entities from a wider perspective emphasizing the cultural and social as well as constitutional influences shape the perceptions and actions of members. In contrast to rational, behavioral approaches that view organizations as the aggregated consequence of individuals' "interlocking choices" (March and Olsen 1984, 736), new institutional perspectives look at how cultures and organizations shape the individuals options and choices (Hall and Taylor 1996, 938). At least three versions of new institutionalism appear in contemporary work: historical, public choice and organizational or sociological institutionalism. Each of these has been used to account for organizational actions and events. Each of these institutionalisms will be described, the account it offers of the failures of organizational learning at NASA will be discussed, and the implications for fostering or unblocking learning will be offered.

Historical Institutionalism

For historical institutionalists, institutions are the "formal and informal procedures, routines, norms and conventions embedded in the organizational structure of the polity or political economy" (Hall and Taylor, 1996, 938). These can include constitutions and laws but also the rules and procedures of bureaus that emerge from these arrangements in the polity. Other factors such as leaders and their ideas also shape institutions. These institutions may engender unintended or paradoxical consequences, as Immergut (1998) illustrates from Terry Moe's study of the NLRB by showing how congressional stalemates in the 1950's led to compromises in nominating board members that contradicted the more conventional expectation of capture theory. Thus Moe explains the departure from the group interest explanations by reference to the interaction of historical accident and institutional structures and rules.

This approach is centrally concerned with interests and power in society, but it does not consider that these are reliably constituted from the "objective" (Immergut 1998, 25) individual preferences and their aggregation, but rather are shaped over time by institutional arrangements. These arrangements have an effect on what we come to see as our own interests, whether based on class, religion, or ethnicity as they are under different social regimes. Institutions, in the form of constitutions, state structures, interest groups and policy networks, for example, shape the political process and the ideas we hold about what we are doing. Thus reliance on preferences or behaviors as indicators of real interests or ideas of individuals leaves out the considerable influence that structures of the state and society play historically in their creation and expression.

Yet historical institutionalists do not leave out the role of human agency, self reflection and the role of ideas in directing individual and collective action. "Institutions do not determine

behavior, they simply provide a context for action that helps us understand why actors make the choices that they do. Facing the same sets of institutional hurdles, self-reflective actors can make creative decisions about how to proceed” (Immergut, 1998, 26). Thus this approach tries to account for the course of events that led to puzzling organizational arrangements and help interpret how agency officials and their choices might be affected by the institutional arrangements in which they find themselves.

The evolution of organizations and policies are seen as the products of particular actions that might have unfolded differently. Outcomes are path dependent, so that choices made early in the history of an organization can be seen to shape the its capacity for subsequent actions. This dependency can be taken to be can be tightly coupled, so that a chain of events leads inexorably to an outcome, or loosely coupled, so that events or choices at one time close off some later options and make some outcome likely but not inevitable. These historical processes are not “efficient” in that similar situations may not yield similar organizational arrangements. Accidents of timing, emerging ideas and leaders may direct the organization down a new path for good or ill. The changing importance of the space program after the fall of the Soviet Union and the emergence of government reinvention ideas are such for the Shuttle program. This view places historical institutionalism at odds with behavioral social science that seeks regularities in behavior and in larger social and political processes, and may constitute a weakness in the approach if it holds to the impossibility of finding regularities (Immergut, 1998, 20, 27) and the inevitability of idiosyncratic explanation.

Historical Institutional Accounts of Organization Learning at NASA

The history of the Shuttle accidents indicate that at NASA, as in many other technologically complex organizations, there are many lessons that should have been learned. Routine information about departures from the specifications for elements of the Shuttle system could have been more thoroughly observed, tracked, and collated for use in Flight Readiness Reviews. The concerns of NASA and contract engineers could have been sought out rather than quashed. Safety programs could have aggressively monitored these concerns rather than being silent during the immediate run up to each of the accidents. Instead information tracking of ongoing technical problems were underfunded and crippled by outdated legacy data systems and fragmented and stove-piped organizational program structures. And in the end managers overlooked warnings in the belief that they were serving larger organizational mandates by meeting nationally visible schedule goals. Each of these organizational factors contributed to both accidents, even though some effort had been made to remedy them. That is, some lessons had been learned and put into practice. However, in most cases the changes were reversed and the problems reappeared, prompting the CAIB’s assessment of the agency’s inability to learn.

Underlying these repeated failures are long term political and organizational factors that made these developments likely. The loss of congressional funding and the decline of public interest in the space program after its spectacular early achievements created budget pressures on the agency which they tried to cope with by attempting to ramp up the launch rates and payloads. This pattern of tight funding and scheduling continued in the decade following the Challenger accident as the Shuttle program was downsized and its work was linked to the completion of the International Space Station. Much earlier design choices for a reusable vehicle led to the shuttle

Orbiter design with booster rockets and an external tank, leaving behind even more elegant but costly internal tank systems and less elegant but also less complex crew capsule designs, such as are now planned to take over as the shuttle is retired. The agency has been coping with great complexity and continual technical challenges from this choice ever since.

Another major influence in the Shuttle's history, with direct consequences for the accidents, was the evolution of multiple program centers, geographically disbursed and culturally distinctive, that made Shuttle program coordination difficult. The Rogers Commission investigating the Challenger accident directly identified inter-center rivalries as a factor in communication lapses between Marshall Space Flight Center and Johnson Space Center in Houston. Marshall was criticized for management isolation and failing to provide "full and timely" information to other program offices (Rogers Commission 1986, 200). Efforts to remedy some of the effects of this structural problem were sidelined by the multiple reorganizations that followed the Challenger accident and the reinvention strategy of Administrator Goldin in the 1990s. Together these developments shaped choices made about where to invest its increasingly scarce resources and affected the ability of the agency to respond to reports of problems at the launch of Columbia (Mahler and Casamayou 2009).

The existence of multiple centers in the Shuttle program management was the result of earlier choices in the history of the agency. NASA was established piecemeal in 1958 from several separate agencies: the National Advisory Committee for Aeronautics, parts of the Naval Research Laboratories, and the Army Ballistic Missile Agency in Huntsville. The Johnson Space Center, in Houston, was added in 1961 as the Manned Spacecraft Center, and the Kennedy Space Center began as the Cape Canaveral Spaceport in 1962. The Huntsville establishment became the Marshall Space Flight Center. It evolved from the even earlier Redstone Arsenal and was at the center of efforts to create a military missile program in the immediate post-war period. The Marshall Center also managed the contracts with Morton Thiokol in Utah for the Solid Rocket Boosters and Solid Rocket Booster Motors and the contract with Martin Marietta Denver Aerospace in Michoud, Louisiana for the External Tank. The multi-center form was seen as a political benefit, fostering economic development in the South and disbursing the benefits of contracts across multiple states and congressional districts (Handberg 2003, 212).

The rivalry between the Marshall Space Flight Center and the Johnson Space Center (JCS) was of long standing and has been well documented. The centers were competing for resources and control of projects since at least the early 1960s, when they begin to plan for the lunar programs and intensified in planning for the post-Apollo projects. To clarify the division of labor and head off some of the increasingly bitter feuds, the Headquarters Associate Administrator for Manned Space Flight, George Mueller, brought these and other center staff to a retreat in 1966 (Dunar and Waring 1999, 139) to work out a formal division of labor giving one center the lead on each project. Rivalries continued in planning for the Shuttle, but by the mid-1960s, the centers signed on to an agreement similar to that worked out for the Apollo project. Marshall would design and manage the contracts for the solid rocket boosters and the external tank, while Houston would manage the Orbiter project. This, however, effectively made Houston the lead center on the Shuttle project. Commenting on this, a Shuttle Program developer noted, "There is a certain amount of competitiveness and parochialism between the Centers that makes it difficult for one Center to be able to objectively lead the other.... That was

the real flaw in that arrangement” (282). In fact, Houston took firm control of the Shuttle project management, and disapproved some of Marshall’s facility requests while filling their own. This design pitted one level in the program hierarchy against the other, with the result that Marshall became unwilling to report on persistent and unresolved problems with the joints between the segments of the Solid Rocket Boosters. Instead managers at Marshall claimed that the problems were under control, even when the evidence was clear that they were not. What looked like a reasonable structural solution took on a life of its own and generated an unintended and destructive consequences.

In some areas real strides in data sharing were made in the aftermath of the accident. A GAO study a decade later based on focus groups and questionnaires, respondents “identified multiple channels, both formal and informal, for communicating flight safety information. (GAO 1996, 19). But the same GAO study found that a new automated problem reporting data base was “cumbersome to use because it is based on older technology, some trend and other data is not centralized in the system, and software needed to convert contractor data to NASA database format has not been developed (GAO 1996, 42). Similar concerns were raised in another GAO study in 2002, which investigated NASA’s Lessons Learned Data System. “[O]ur survey found that lessons are not routinely identified, collected, or shared by programs and project managers. Respondents reported that they are unfamiliar with lessons generated by other Centers and programs”(GAO 2002, 3).

Efforts to overcome the problems with the multi-center structure were unavailing. After the Challenger Accident, the agency adopted a change in the chain of command by going back to the more centralized design of the Apollo program in which the Headquarters office directed the program (even though that office was actually located in Houston). This move illustrates learning, in that the agency drew an inference from the past about the structural causes of the accident. But under the reinvention strategies of Administrator Goldin, the shuttle program was again decentralized in 1996 to shorten the chain of command, improve efficiency, and change the culture of the agency from large to small scale space science project. (Lambright 2007). Many of the structural and programmatic ideas for this strategy were adapted not only from the government-wide reinvention model, but also from the more successful if less complex Strategic Defense Initiative Organization following the recommendation of the White House National Space Council in the late 1980s. But by 2001, with the public failure of several of the smaller science projects, serious cost overruns, and the inability of the Shuttle program to track repairs, Goldin recentralized the institutional responsibility for directing the shuttle program under Joe Rothenberg, the headquarters Associate Administrator for Space Flight (Lambright 2007).

The many reorganizations took their toll on the clarity and costs of Shuttle program management. In 1990, Augustine Report on the future of the space program, detailed the costly impacts of continued "management turbulence, defined as continual changes in cost, schedule, goals” (NASA 1990, Managerial Turbulence) that resulted for design changes to the Shuttle components, budget forecasting problems, and reorganizations. They note further, “Each change induced has a way of cascading through the entire project execution system, producing havoc at every step along the way.” Similarly, the Kraft Report on NASA’s contract management cited reorganizations that followed the Challenger accident and the advent of the Space Station program as generating “confusion within and among NASA Headquarters, the centers, and the

contractors as to responsibility and decision making. It is now increasingly difficult for center management to provide the classical technical inputs to program management and to provide the customary checks and balances that were essential in previous programs” (NASA 1995, 6).

The resulting fragmentation of information and organizational knowledge contributed to the loss of the Columbia. The unwieldy problem tracking software and the lack of a mechanism for integrating safety information about the Shuttle all reduced attention to the dangers posed foam shedding both before the flight and in-flight. The responsibility for solving the foam debris problem was also fragmented. The Space Shuttle Systems Integration Office did not, in fact, cover the Orbiter, limiting its real ability to integrate information or management. Nor could the Integration Office clarify the locus of responsibility for dealing with foam shedding. Sometimes it was seen as the task of the External Tank Office and sometimes the Orbiter Office (CAIB 1993). Post-Challenger efforts to create an integrated problem tracking system and to establish integrated procedures for investigating reports of hazards were at least in part casualties of multiple reorganizations and downsizing. Known safety routines were inadvertently obscured, and this complicated efforts to get images of the Columbia’s wing. Knowledge and institutional memory were lost.

For historical institutionalists, this outcome could be seen to be the result of choices made in the early years of the program that took on a life of their own and led to unintended and fatal consequences. Early decision about center structures and hierarchy created a path to continuously fragmented management. Later repeated efforts at program integration were compromised by the embedded distrust among centers, and data integration was blocked by independent, incompatible data systems. Multiple reorganizations displaced knowledge of past procedures and their results.

The impact of these persistent organizational patterns on the capacity of the agency to learn from experience was to block the systematic comparison of outcomes. Learning based on analyzing results and linking cause and effect was truncated when organizational knowledge was disbursed and lost. What advice can the historical institutionalist perspective offer on improving the prospects for agency learning? By emphasizing the unintended results of choices, it directs attention to a close examination of the link between distant choices and present results. It counsels us to take the long view of the evolution of problems and the fate of solutions, planned and unplanned. As a conceptual tool for the public management of learning, it offers an approach consistent with the core learning process: determining what goes with what.

Public Choice Institutionalism

Public choice institutionalism looks at the effects of institutional rules on the costs of making and enforcing agreements in society and within organizations. The focus of analysis is “how institutions affect the incentives confronting individuals and their resulting behavior” (Ostrom 1999, 36). Organizational outcomes are the results of choices by actors whose options, goals, and actions are shaped by rules and incentives built into institutional arrangements by law or contract (Clark 1998, 246). Institutions originate as solutions for making collective action possible by minimizing the costs of trying to make and enforce agreements (transaction costs) in settings where the interests of the parties, principals and their agents, may not be compatible.

Politics is what we observe as actors attempt to resolve their “collective action dilemmas” (Hall and Taylor 1996, 945). Organizational members are seen as rational actors, engaging in strategic behavior to maintain their autonomy to realize their own goals and preferences even under agreements to carry out the will of the principals, the organization’s owners or overseers. Principals attempt to position themselves for greater control by changing rules and incentives while their agents seek to circumvent controls by using their asymmetrical information advantage. In this version of institutionalism, organizations such as NASA are seen as the agents of external principals, Congress, the President, and his administration, but other principal agent relationships may also exist among the elements of the organization and its contractors.

Institutions may be organizations, firms or public bureaus, but most often they refer to the invisible properties of these entities, the rules, constitutional or operational, norms, and strategies that shape interpretations and behavior (Ostrom 1999, 36-37). In organizations these elements include the visible formal structures and lines of authority, but also the explicit and implicit rules of conduct. The structure of an organization may be seen to reflect the ways members have found to order relations in the organization to minimize internal transaction costs. Research seeks to uncover the ways that the organizational arrangements do or do not operate to reduce transaction costs, improve transparency and enforce past agreements. Thus Williamson (1983), for example, examines the conditions under which organizations will contract out necessary tasks (markets) or create specialized internal units to carry our important work (hierarchy).

The approach has also been applied in government-wide settings to examine the relationship between an agency, often regulatory agencies, and Congress or the President and how particular rules or statues have or have not led to responsiveness in the bureaus (Moe 1987). Other research examines the real autonomy of agencies. Carpenter (2001), for example, demonstrates how the 19th century USDA was able to carve out its own agenda using a small grant of authority and limited program assets, only later obtaining Congressional authorization. Success was traced most directly to the actions of early leaders, most notably Harvey Wiley, in strategically creating constituency support . The evidence is not easy to interpret, however. Coppin and High (1999) argue that Wiley acted as an entrepreneur, more interested in his own career and perhaps even personal gain than in the public interest. And Shipan, tracking the fate of Wiley’s FDA, finds “that under certain conditions, the FDA is responsive to the preferences of committees and floors in Congress, but under other conditions the agency can act autonomously” (2004, 467).

Within this perspective learning too is subject to rules and incentives. The approach assumes that actors are rational, but they may still be fallible learners who miscalculate benefits and costs and are slow to correct their mistakes. Ostrom notes,

“ Fallible learners can, and often do, make mistakes. Settings differ, however, in whether the institutional incentives involved encourage people to learn from their mistakes.... One can then presume that the various institutional arrangements that individuals use in governing and managing common-pool resources (or other problematic situations) offer them different incentives and opportunities to learn. In some settings, the incentives lead them to repeat the mistakes of the past. In others, the rate of effective learning about how to make a resource sustainable over time is rapid. In all cases the repertory of institutional design principles

known to individuals also affect their capacity to change their institutions in order to improve learning and other outcomes when faced with repeated failures. (1999, 45)

Public Choice Institutionalism and Learning

Handberg (2003) examines NASA through the lens of public choice institutionalism. He argues that the agency made a number of tradeoffs and program sacrifices to accommodate Congress and the White House over many years in order to preserve in some form the mission to which it is principally committed: crewed space exploration and the establishment of a permanent human presence in space. According to Handberg, the agency balances two complex agendas in its effort to maintain the autonomy it needs: its own primary human space flight agenda and the external agendas of Congress and the White House to create contracts and jobs for constituents, to fulfill foreign policy objectives by demonstrating the technical and scientific prowess of the United States first with the Apollo missions and now with the U.S. role in the International Space Station, and also to contain costs. The result of these conflicting priorities, Handberg notes, is to “[drive] the agency to continually seek to carve out budget space within which to pursue its agenda” (208).

The agency is helped to some extent in this objective by the sporadic oversight of Congress and the White House. Even Kennedy, who initiated the lunar missions, did not put NASA at the top of the policy agenda and Congress has most often lacked the interest or capacity to effectively oversee the scientifically and technically complex work of the agency. This information asymmetry creates optimal the conditions for principal-agent conflicts. Thus, Handberg concludes, the agency is responsive, but strategic and even in some cases evasive and misleading in reporting to overseers in order to ensure a role for crewed missions in its programs (Handberg 2003, 211-212). This responsiveness, led the agency to attempt to accommodate itself to budget reductions and cost containment measures that even threatened the future of the agency and led to staffing reductions that meant the loss of major portions of its experienced workforce in the 1990s. Reinvention under the direction of Administrators Goldin and O’Keefe might have led to greater cooperation with principals and a less divided organizational agenda. But, Handberg argues, even Goldin, an outsider from TRW but a NASA employee in the 1960s, at root believed in the human spaceflight mission and used cost containment strategies to ensure a human presence in space by maintaining the partnerships needed to keep the Space Station alive.

Against this backdrop of multiple priorities and agendas, learning encountered barriers especially in acknowledging and acting upon serious problems. The situation is further complicated by the existence of three principal-agent relationships in this case: the President and Congress were the principals for NASA as a whole; the Johnson Space Center, as lead center for the Shuttle program, was the principal in its relationship with the Marshall Space Flight Center; and Marshall in turn was the principal in contracts it managed for the elements of the propulsion system, the Solid Rocket Boosters and the external tank.

Prior to the Challenger accident the actions of officials at Marshall can be interpreted as capitalizing on its control of information by limiting reports of unresolved problems to Johnson. To admit that the propulsion systems for which they had primary responsibility had unresolved

problems would could have led to even closer monitoring of program management, a clearly unwanted result. Thus, evidence of charring and “blow-by” in the seals between the segments of the Solid Rocket Boosters were not always reported. Failure to report problems and waivers of requirements to resolve them prior to approving launch could be accounted for by public choice institutionalists as instances of information asymmetry and efforts to gain autonomy.

The efforts of first Marshall engineers and later Thiokol engineers to draw attention to these problems and the potential for catastrophic loss of vehicle and crew was ignored by middle managers in both organizations, who placed a high priority on maintaining schedules and, early on, avoiding the costs of new joint designs. These mid-level agents in each case were supported by higher level actors with similar concerns. Though the Marshall engineers were unwilling to jump the chain of command to draw more emphatic attention to the problems, the Thiokol engineers did speak out on the eve of the Challenger launch in meetings. However, their advice was rejected by both Thiokol and Marshall managers who expressed dissatisfaction with the idea of postponing the already late launch. While public choice accounts clearly for the actions of Marshall managers in this episode, it is more difficult to explain the actions of engineers within this version of institutionalism.

The charge that NASA was not a learning organization stems in part from the fact that 17 years later some of the same kinds of organizational problems plagued the agency. These were revealed in the tensions between engineers and mid-level managers about conveying and acting on information about potential launch hazards, in this case damage to the external heat-shielding tiles from foam debris from the external tank. Responsibility for resolving the problems was fragmented as noted in the section above. While the Columbia was on orbit, launch photos of debris hitting the left wing led some of the engineers from NASA *and* from the contractor, United Space Alliance, to declare a “out of family” or unfamiliar problem. Under existing procedures this should have led to further investigations and action to resolve the problem before other flights, but midlevel managers at NASA failed to push for further investigation of possible problem from the strike, citing a lack of evidence of damage. They were also unwilling to accept the delays that requiring the resolution of such a frequent event would pose for future launches. Pressure from the White House and Congress to keep the International Space Station construction on schedule created demands on NASA as a whole and mission managers in particular. Again, though this version of institutionalism accounts for the action of managers, it does less to explain the actions of engineers. In a reversal of what principal-agent theory might seem to predict, the agents at one level were attempting to provide more information than their principals would accept.

Under public choice institutionalism, learning between the accidents would be expected to result from new rules or incentives to improve compliance by agents, who would then do a better job of achieving the principals’ goals. Thus the advice these institutionalist would offer to improve learning would be to design more effective incentives for agency actors to figure out how to comply with the wishes of the principals. But it seems that the incentives for NASA leadership to comply with external political goals were already strong, so strong that actors were willing to take risks with the mission and with the agency reputation rather than fail to comply with external and top level agency administrators about schedules. The top agency administrators themselves seem to have been less effective, however, in creating incentives for

managers to learn make decisions based more centrally on safety. The willingness of mid-level managers to listen to and act on information from engineers about hazards had improved in the years after the loss of the Challenger (GAO 1991, 29). But by the last Columbia launch, other, more immediately urgent priorities reasserted themselves. Budget pressures and accompanying changes in structure and workforce seem instead to have reinforced the perverse incentives under which agency managers were operating.

Sociological or Organizational Institutionalism

Sociological or organizational institutionalism (hereafter simply organizational institutionalism) sees itself as distinct from but indebted to the efforts of earlier institutional scholars such as Weber, who focus on formal organizations, or Selznick, who studied the ways in which informal social relations within organizations led to unintended organizational practices and outcomes. Those characterizing themselves as neoinstitutionalists in this mode view organizational routines, scripts and roles as shaped by conformity to social institutions that extend beyond the organization, to the wider culture and its social and technological manifestations. “Environments, in this view, . . .penetrate the organization, creating the lenses through which actors view the world and the very categories of structure, action and thought” (DiMaggio and 1991, 13). This, not rational choices or aggregated preferences, accounts for the similarity of organizational forms. Ideas about progressive public management or enlightened leadership sweep across organizations shaping how actors see what it is they are doing and why. Contemporary management movement or traditional cultural myth templates may shape work and identity in agencies (Mahler 1988).

Here institutions are “macrolevel abstractions” (DiMaggio and Powell 1991, 15). They include the organizational forms, the ideas about structure, roles, leadership and purpose that shape specific organizations and the routines and actions that are seen as legitimate. March and Olsen (1984) identify the standard of “appropriateness” shaped by these forms as the typical basis for action in organizations, not the logic of rational action. Understanding an organization, an industry or an interorganizational field or network depends on understanding the taken-for-granted assumptions under which the organizations function and locating the source of these assumptions. Cultural values and ideas in good currency shape the roles and expectations of organizational members. The approach seeks to explain how particular organizational forms such as matrix structural forms or transformational leadership arise and persist, often justified as a rational choices, with little real investigation and uneven success. Within the organization, perceptions and motivations of members arise from rationalized scripts and schemas that maintain the current organization and define what is appropriate.

Slow change arises from incremental adjustments as templates overlap and collide. Radical changes arise only with the advent of alternative scripts and new cognitive templates in the wider culture. But given the stabilizing norms of appropriateness, such change is difficult and uncommon. Politics in this perspective is concerned with mediating relationships among different institutional logics and determining how different categories of action will be applied and to whom they will be applied (Friedland and Alford 1991).

Implications for Learning at NASA

An organizational insitutionalist view of the history of the Shuttle accidents looks to the effects of external social templates on organizations. Romzek and Dubnick, for example, demonstrate how the shift in the logics of accountability and oversight that Congress in particular imposed on NASA created strains within the agency that contributed to the Challenger accident. As the agency was forced to adopt a hierarchical accountability system rather than the professional processes that had shaped the agency, managers rather than engineers were assigned reponsibility for making launch decision.

Under NASA's shuttle program, responsibility for specific aspects of the overall program was allocated to supervisors at lower levels in the reporting hierarchy, and the burden for giving the go ahead to launch decision makers shifted from the engineers and experts toward those supervisory personnel. As scheduling and other pressures increased, so did the reluctance of those supervisors to be the individual who threw a monkey wrench into the shuttle program machinery. (Romzek and Dubnick 1987, 233)

Other governmental and cultural templates also affected what was considered appropriate in the agency. The new public management and government reinvention movements, themselves the amalgamation of private and public sector notions of effective management, influenced the structural and programmatic changes in the agency in the 1990s, with results noted earlier. The model of hands-on engineering that the German rocket scientist brought with them from their own universities shaped the structures and modes of maintaining reliability at Marshall (Mahler and Casamayou 2009).

Other widely available organizational forms with immediate effects on NASA's capacities and choices were versions of centralization and chain of command often seen in this formerly quasi-military agency. These ideas were held in reverence as solutions to management problems. Both the Rogers Commission and the Columbia Accident Investigation Board saw the stifling of dissenting views and unwelcome information about hazards as contributing to both accidents. The power of the centralized organizational model at NASA is illustrated by the fact that after the Challenger accident and after a series of disappointments with Administrator Goldin's efforts to implement his faster, better, cheaper reforms, the agency adopted a more centralized structure with direct headquarters control over program elements, claiming it was the form that made the Apollo program successful. There is some evidence that this pattern was influenced by the origins especially of the Marshall Space Flight Center. Early on the Marshall program was headed by Wernher von Braun, a chief architect of the German rocket program, now working in the American program. Some say he practiced a distinctive management style based on an informal, organic, team-based strategy rather than "formalized, standardized document-intensive techniques" of systems engineering (Sato 2005, 563). But there is some dispute about this interpretation. Others characterize him as having been autocratic, harsh on those who disagreed, and too secretive (Adams and Balfour 1998 154) so that later, in the 70s and 80s, even after the German team had largely left the top leadership positions, "Marshall was run like a Teutonic empire" (124). Under this view, the pattern of top-down obedience had been set. Reversion to centralization as an appropriate organizational model may have blocked serious consideration of other kinds of solutions to management problems.

Evidence from NASA's history office and testimony in the aftermath of each accident shows engineers and managers admitting they had serious reservations about safety, but not speaking up because "you don't override your chain of command" (Dunar and Waring 1999, 377). Lawrence Wear, the Director of the Rocket Motor Project at Marshall "admitted that at Marshall 'everyone does not feel free to go around and babble opinions all the time to higher management'" (377), though he acknowledged that the dissenters may have been intimidated by the Marshall management pronouncements about the safety of the Solid Rocket Booster seals. Another project manager revealed before Senate investigators that the seal decision had suffered from groupthink and that other participants censored themselves in the context of established management statements that the seals constituted an acceptable risk (377).

During the flight of Columbia, Debris Assessment Team Co-Chair Rocha expressed serious doubts to colleagues about the decision of the Mission Management Team not to obtain images of the wing. "In my humble technical opinion, this is the wrong (and bordering on irresponsible) answer from the SSP [Space Shuttle Program] and Orbiter [managers] not to request additional imaging help from any outside source" (CAIB 2003, 157). But he did not press the matter further, noting that "he did not want to jump the chain of command" (157). The leadership of the Mission Management Team overseeing the flight also stifled discussion of the possible dangers from the foam strike on the wing by rushing to the conclusion that the strikes did not pose safety of flight issues and the Debris Assessment Team too admitted to self-censored in not challenging these decisions (192). The CAIB reported that even members of the Mission Management Team felt pressure not to dissent or challenge the apparent consensus.

A related, culturally based idea that seems to have shaped organizational responses might be termed the myth of human space flight, that is, the idea (shared by the author) that it is somehow human destiny to travel to outer space and distant planets, just as it has been to explore this planet. NASA is uniquely positioned to be inspired by this idea, and as Handberg was shown to observe, the agency and its leaders sought to preserve its role in maintaining a human space presence. However, the idea can also be seen to affect other agency roles as well. In this context, work on creating and maintaining mundane organizational features such as problem tracking systems and the well-intentioned Lessons Learned Database pales by comparison with the work the agency was created to do. This surfaced as an unwillingness to report unresolved problems based on what some have termed the "climate of fear" in the agency. NASA contractors are said call this unwillingness to be the first to speak out, "NASA Chicken" (Wald and Schwartz, 2003). Along with this came the tacit belief that raising safety concerns was indicative of weak performance. The effect of these patterns was an unwillingness to flag technical and managerial problems as truly serious that resulted in the compromised position of the safety, reliability, and quality assurance systems.

In each of the two accidents, the safety officials were silent, and did not advocate for searching out more information about the likely effects of cold weather launches or seek out better images of the site of the foam strike. The safety offices were identified as a problem after the Challenger accident, and were to have been enlarged, offering staff better pay and a more independent place at Headquarters and in the centers. NASA managers were to establish an open door policy, and new formal and informal means of reporting problems confidentially were created. A campaign to promote reporting about safety issues was initiated. Posters were erected

declaring “If it’s not safe, say so” (GAO 1996).

But in the years between the accidents it became clear that not all of these recommendations had been implemented. The structural changes were never completed and in time the presence of multiple safety offices to cross check project elements were cut back in the name of reducing redundancy. Furthermore, the safety systems were streamlined and contracted out in the 1990s, and again in the aftermath of the 1995 Kraft Report. That report, a product of an independent review commissioned by NASA leadership, recommended the elimination of the redundancies in the system that had been created after the Challenger accident, arguing that, “Safety is one of those terms that can be used to hide behind and prevent necessary change and innovation” (NASA 1995, 8). After the Columbia accident, the CAIB noted that the NASA’s testimony regarding its risk-averse culture that encouraged employees to “stop an operation at the mere glimmer of a problem” did not accord with reality (2003, 177). In fact, members feared retribution for bringing up unresolved safety concerns (192). Safety officials did not respond to signals of problems with debris shedding, and were again silent during key deliberations. As noted in Chapter Three, Rodney Rocha, one of the co-chairs of the Debris Assessment Team, invoked the “if it’s not safe...” slogan even as he declined to press further for images of the Shuttle’s wing (CAIB 2003, 157). By 2004, a survey of NASA employees found that the agency “has not yet created a culture that is fully supportive of safety,” and that workers were still “uneasy about raising safety issues” (David, 2004). As noted, in both cases the safety systems were silent. The cultural bias against working in the safety organization made it less likely that safety information would be taken seriously or that safety officers would gain significant visibility or authority.

One obvious implication of the analysis offered by organizational institutionalism for learning is that embedding new institutional values or practices in organizations is very difficult. Change is slow to emerge, and in this view comes primarily from external sources. Organizational institutionalists are principally concerned with the contagion of ideas among organizations or across societies, criticizing assumptions of rational choices as the basis of organizational forms. And in the NASA case, some lessons about how to improve agency operations were never implemented or adopted but later jettisoned. In several cases, including the design of safety systems, it appears that agency members did understand the weaknesses and dangers associated with these patterns, had attempted to arrive a new solutions to them by experimenting with new designs and undertaking culture change programs, but the strong internal habits of mind about structure and deference proved very resilient. The patterns reappear before the Columbia. Of course, budget limitations also must be seen to play a role, but it seems unlikely that larger budgets would have been devoted to safety programs and problem tracking systems. Stronger safety programs were not fully adopted, or if there were, they were soon dismantled.

What advice could the approach offer about organizational learning? It appears that the best chances of getting innovations or changes adopted and implemented would be to work incrementally and link changes to well know and culturally established templates in society. That is to introduce new ideas in terms that link it to ideas or systems that are familiar, attractive and already well accepted. Galaskiewicz describes, for example, how efforts to get new,

outsider corporate heads to adopt the philanthropic habits of the older established firms was to devise public versions or previously closed, elite recognition rituals (1991).

Contrasts and Comparisons

Each of the insitutional perspectives offers something to an understanding of organizational learning. And each seems to highlight a different part of the complex history of Shuttle accidents and each reveals a different process in the learning cycle. The public choice institutionalism, with its emphasis on the the enforcement of contracts and the asymmetries of information, has most to tell us about the problems of problem recognition or acknowledging responsibility and blaim for unsatisfactory results. It offers the most concrete advice, thouth perhaps not the most easy to follow. To foster learning, we must alter the incentives for the agency to comply. That is, we must find ways to make “embracing error” (Korten 1980) less painful and more likely. This is a well recognized problem in the organizational learning literature (Morris and Moore 2000) and in the public administration literature on current efforts to craft effective accountability systems (Radin 2006). Romzek and Dubnick (1987) argue for the importance of adopting institutionally appropriate models or accountability. Elsewhere I suggest that public organization learning comes most fully into its own when its object is *ideas* about the work of the agency (2009). Thus a professional accountability model which, under which agency actors are able to carve out some of the discretion they need to pursue promising ideas and develop a “requisite variety” of experience, offers the best opportunity for learning.

Historical institutionalism seems to speak most directly to the problem of tracking cause and effect, particularly unintended and perhaps undesired effects. The concept of path dependency is a useful way to think about the links between external events, agency actions, and the results or outcomes that follow. These links are not in most cases clearly marked or obvious. Rather the pathways are likely to be faint, and extend over years. Organizational learning takes a is a long term view too, and the process of linking cause and effect and sorting through experience, direct or vicarious, to come up with likely solutions is a social rather than a mathematical exercise. The advice it offers, to seek out long-linked paths many of which may begin outside the organization, requires good memories and accessible information that can be integrated across the organization. Thus finding ways to disseminate or pass on organizational memories of past events, especially crises, “work-arounds,” and unsolved problems, becomes important. Tacit information, especially difficult to convey (Reagans and McEvily 2003) but can be especially valuable for learning (Brown and Duguid 1996).

Organizational institutionalism is in some respects the most challenging conceptual context for examining organizational learning. It addresses most directly the problem of embedding lessons learned into the organizational structures and routines so that they persist and are available widely. But it emphasizes the difficulties in doing so. In some ways organizational institutionalism is pessimistic about the possibilities of indigenously discovered solutions. By looking principally for external institutional influences on organizational forms and routines, it appears to suggest that internally devised templates are unlikely to be able to take root. What seems appropriate may have a long history in the organization and in the culture. Existing patterns are likely to have become well entrenched. Like genuine artifacts of organizational culture, they are not easily displaced.

Of all the neoinstitutionalist approaches, the historical perspective appears to offer the most useful and supportive base for understanding the institutional character of organizational learning. It is also the most eclectic (Hall and Taylor, 1996, 940). But by searching for the influences of external forms and ideas, but also accidents of history and the actions of leaders and organizational members, it appears to offer the most hospitable ground for building a institutionally based theory or organizational learning.

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