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SIGNALS AND INTERPRETIVE WORK:
THE ROLE OF CULTURE IN A THEORY OF PRACTICAL ACTION

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In their introduction to The New Institutionalism in Organizational Analysis (1991), DiMaggio and Powell consider the possibility of a micro-sociological supplement to the macro-sociological focus on structure, order, and persistence that has so far dominated research and theory in the new institutionalism. Searching for some answers, they analyze transformations in sociological theory since Parson's theory of action that offer alternatives to the Parsonian emphasis on norms and roles. They suggest that elements necessary to a "theory of practical action" compatible with the new institutionalism can be found in the more recent cultural turn in contemporary social theory that 1) "emphasizes the cognitive dimension of action to a far greater extent than did Parsons," and 2) "departs from Parsons' preoccupation with the rational, calculative aspect of cognition to focus on pre-conscious processes and schema as they enter into routine, taken-for-granted behavior (practical activity) (1991: 22)." DiMaggio and Powell conclude that ethnomethodology (Garfinkel 1967) and phenomenology (Berger and Luckmann 1966), in combination, offer an alternative, but one that leaves important questions - how do the micro-processes of these theories produce social order, what is the role of interests and intentionality - unanswered!

They then consider three theorists whose work deals with the problem of social order in a way that gives some insight into micro-level sources of macro-level stability: Giddens on structuration; Goffman on ritual order; Collins on interaction ritual chains. Noting that, in common, these theorists make gains by maintaining the importance of cognition and revealing more of the noncalculative, routine elements of practical reason, DiMaggio and Powell still find gaps. Chief among them is the failure to complete the macro-micro link: What, specifically, is the analytic equivalent of Parson's notion of the role system as a connector between

individual behavior and social structure? They suggest that Bourdieu's (1977) theory of the *habitus*, with its attention to the taken-for-granted aspects of social action and practical consciousness, may be the most viable candidate.

Although many theorists have explored the connection between structure and agency, strikingly absent is empirical work that specifically attempts to test the various possibilities about macro-micro connections that these theorists have presented. This paper is an empirical exploration into the microsociology of a theory of practical action, with particular attention to the relation between culture and cognition. Thus, this inquiry follows Zucker (1977), who argued that "Without a solid cognitive, microlevel foundation, we risk treating institutionalization as a black box at the organizational level, focusing on content at the exclusion of developing a systematic explanatory theory of process...neglecting institutional variation and persistence." In order to pursue this question, the new institutionalists' traditional focus on organization fields must be supplemented by empirical work that exposes processes. In this paper, I examine three case studies of decision making in naturalistic settings: Couples in deteriorating intimate relationships (Vaughan 1986), managers and engineers at NASA making assessments of technical components of the space shuttle (Vaughan 1996), and air traffic controllers reading information on radar screens (Vaughan, unpublished data).

These cases are analyzed as situated action. A situated action approach is built on the sociological understanding that a full theoretical explanation of the action of any social actor needs to take into account, to the greatest extent possible, the fact that individual activity, choices, and action occur within a multilayered social context that affects interpretation and meaning at the local level (Vaughan 1998b; cf. Suchman 1987). Using a situated action approach for a comparative case analysis of decision making in naturalistic settings is a particularly advantageous methodology for considering macro-micro connections. Whenever the research focus is kept on situated interpretation and the dynamics of interaction, the micro-level focus and point of entry will allow us to observe the situational logic and contingency that marks a situation while at the same time broadening our vision to encompass macro- and meso-level factors, enabling us to examine the linkage between environment, organizations, and individual action and meaning. Methodologically, this situated action approach is consistent with the theoretical perspectives of Jepperson (1991), who emphasizes the connection between constructedness at the micro-level and higher order effects (but does not explicitly consider the

meso-level), and Friedland and Alford (1991), who do include the meso-level by emphasizing the interconnection between individual, organization, and society.

In the next section of this paper, I briefly introduce the method of analogical theorizing, in order to explain the logic on which the case comparisons are based. Next, I establish the comparability of the three cases by summarizing the substantive findings about decision making, signals, and interpretive work for each case analysis. Then I examine how the social context affected the interpretive work and decision making that went on in the three cases, analyzing the data by its appropriateness to the categories of environment, organization, and individual cognition/choice in order to attend to the macro-, meso-, and micro-layers of situated action. Finally, I reflect on the theoretical significance of this analogical comparison for understanding the relationship between culture and cognition in general and what it suggests about a microsociological theory of practical action in particular.

Methodology: Analogy, Cases, and Comparative Social Organization

The logic of comparing intimate relationships, a flawed space shuttle launch decision, and air traffic controllers doing routine work may not be immediately apparent. What follows is the briefest possible exegesis. Extended explanations are in Vaughan (1992) and Vaughan (2001, in preparation); for recent examples in addition to those mentioned in this paper, see Vaughan (1998a; 1999a).

Analogical theorizing is an heuristic, theory-generating comparative method using qualitative data (e.g., comparative historical, ethnography, interviews). It relies on selecting cases on the basis of some event, activity, or phenomenon of theoretical or substantive interest, and then comparing it with another example or examples that appear, hypothetically, to share that feature. However, in contrast to the more conventional approach of comparing similar units of analysis (all families, all social movements, all nation states), analogical comparison is made between socially organized settings that vary in size, complexity, and function. The point is then to proceed with comparison in a discovery-oriented yet systematic way that identifies both the similarities and differences between cases, which then (depending upon the findings) may aid in the development of general theory across cases. The method draws from Blumer on sensitizing concepts (1969) and from Glaser and

Strauss on grounded theorizing and comparison (1967), but it is explicitly different in its requirement of comparing different units of analysis. The precedent for selecting cases based on analogous circumstances occurring in different social settings finds legitimacy in Georg Simmel's formal sociology and his argument that the distinctive task of the sociologist is to discover essential social forms - commonalities of structure and processes that exist despite the appearance of difference in events, activities, and phenomena (1950). His most well-known illustration, used to demonstrate the search for form across social settings, is that sociologists ought to be able to study both marital conflict and martial conflict and find characteristics in common.

He did not leave a road map for how to proceed, but implicit in what he said is the legitimacy of comparing similar events, activities, or phenomena despite variation in the unit of analysis. Neither did he provide a methodological rationale for proceeding in this way. I suggest that the methodological rationale for doing so rests in analogy of another sort: Socially organized settings, despite differences in size, complexity, and function, do have generic structures and processes in common that make them comparable in fundamental ways: Division of labor, socialization, culture, hierarchy, conflict, power, environments, network ties, and so forth (Vaughan 1992: 179-80). Thus, when we select cases on the basis of some dependent variable (X), qualitative data tend to offer a window into the relation between some of these generic structures and processes and X, allowing comparison across cases on those conditions. The primary goal must be to explain the substantive problem first. This strategy produces a rich, complex analysis in each instance that brings the details of each case to the fore. Thus, the differences between the cases (the substantive detail, analysis, and the theoretical explanations) become salient to the researcher, controlling for possible bias in comparison (1992: 195-9). What is to be gained? In my experience developing theory with this method since 1980, I have found that comparing different units of analysis enhances the potential for theory-generation in two ways: 1) shifting units of analysis yields different kinds of data, making it possible to study new aspects of some phenomenon, and 2) sometimes when we shift units of analysis, we simultaneously shift levels of analysis, allowing insights into the micro-elements of a macro-level explanation, or vice-versa (1992: 182-4). The comparisons in this paper fulfill both these promises, thus we are able to reflect upon the connection between culture and cognition and

the possibility of *habitus* as a microsociological complement of the new institutionalism.

How these cases were selected needs explanation. Initially, I had no plan for a coordinated project entailing a three-case comparison on signals and interpretive work, the title of this paper. My work on intimate relationships and the Challenger case each began as an investigation of a unique substantive question. The only connection I saw between them was that, conceptually, I was treating both the dyad and NASA as organizations. Using analytic induction and other strategies that force the analysis toward differences (Vaughan, 1992: 195-9), the fact that signals, interpretive work, and mistake were part of the explanation of both projects only became apparent to me midway through the second project. Despite their many differences, both cases, I realized, were studies of decision making in which mistakes were made in the interpretation of information, with signals and interpretive work essential to the explanation. Spence's (1974) theory of market signaling, which was central to the explanation of uncoupling, also became critical for understanding what happened at NASA, so serendipitously became part of the analogical theorizing project (Vaughan, 1998a). Whereas the first two cases in this comparison were chosen by virtue of serendipitous discovery, in fall 1998 I initiated the air traffic control study with the express purpose of making a comparison with the other two. This third case was selected on the basis of *difference* in order to explore the "flip side" of what I had found about signals, interpretive work, and mistake.

Both previous cases showed that the crisis was preceded by a long incubation period filled with early warning signs, clear in retrospect, that were ignored or misinterpreted at the time decisions were made. Because signals of potential danger were misinterpreted in both preceding studies, mistakes were made. I wanted a project that allowed me 1) to examine the relationship between social context and cognition in a circumstance in which early warning signs are detected, and 2) to be present in the decision making context as decisions were being made, rather than analyzing cognitive processes retrospectively, as was the case with both previous projects. Air traffic control is ideal because first, air traffic controllers seldom make mistakes: They have the ability to recognize anomalies early, responding to correct errors and thereby avoid collisions. Second, the problems of retrospective analysis are eliminated: Interviews and observations of air traffic controllers on the

job are possible.

Advantages accrue from both the analogies and differences between the cases being compared. In each case, the substantive focus is how social actors interpret and respond to signals of potential danger; the analytic focus is on decision making and choice within social context. Substantively, the three cases have in common 1) decisions that are being made about objects and issues that are high on uncertainty and therefore, interpretive flexibility (Pinch and Bijker 1984): The quality of an intimate relationship, the performance of an unprecedented large scale technology for which the sky is the laboratory, and the position of aircraft in space without direct observation or evidence, 2) the decision process involves some risk of harmful consequences if mistakes are made, and 3) the decision makers are involved in the social construction of meaning. The analytic focus on signals that warn of risk, mistake, and the possibility of harmful outcomes is a particular advantage, given our stated interest in the taken-for-granted and prerational aspects of choice, because mistake, when recognized and defined as one, causes taken-for-granted assumptions to surface in the minds of people who hold them, calls them into question, and allows people to articulate what otherwise remains unquestioned and thus, invisible.

Case differences are also helpful. In analogical comparison, it is the differences in the cases that throw similarities and differences in structure and process into broad relief. Here, the variation in substantive content evidenced in the three cases - i.e., the distinctive categories, beliefs, and motives created by specific institutional logics - allow us to examine the link between institutions and their relationship to organizations and individuals (Friedland and Alford, 1991: 251). The organizational settings vary in size, complexity, formalization, and function. The strategy of varying the units of analysis has benefits because the data from each case provide new insights, not available in the others. Moreover, the variation in the organizational forms being studied (a social group and two complex organizations) varies the degree of institutionalization. Thus, we are able to consider the relationship between micro-processes, change, and the production of social order - key issues in institutional theory.

A final methodological note on situated action: For the NASA research and the air traffic control project, all three layers of situated action were part of the original explanations, because the projects were

designed specifically to investigate the links between macro-, meso-, and micro-levels of analysis. However, my 1986 research on uncoupling was social psychological in orientation. This paper is based on a re-reading and re-analysis, done in order to pay new attention to data that reflect on the macro-level contingencies of choice and action, thus allowing a comparison between the three cases on the three levels of analysis. A reconsideration of that (1986) work is particularly suitable for a discussion of a microsociological component of institutional analysis because the original theoretical framing of the problem was Berger and Kellner's (1964) "The Social Construction of Marriage." Preceding Berger and Luckmann (1966), who argued that shared cognitive systems come to be viewed as objective and external structures defining social reality, Berger and Kellner showed how, in marriage, the more institutionalized the cognitive categories and belief systems, the more the actions of partners are defined by a widening sphere of taken-for-granted routines. Uncoupling analyzed the reverse of this process, showing lower-level processes that counter higher order institutional effects.

It is first necessary to establish that the three cases are comparable at the micro-level on the substantive topic of signals and interpretive work in order to proceed with the more detailed analysis of similarities and differences, as they pertain to the theoretical issues that are the topic of this paper. Differences at the meso- and macro-levels will become clear as the comparison proceeds.

Signals and Interpretive Work: Three Cases

Uncoupling (1986)

The research problem was to understand the process that occurs when intimate relationships break up. The data were interviews with married and cohabiting couples, both gay and straight. I collected oral histories of their experience of their relationship.ⁱⁱ I began with the question, "Tell me about your relationship from the moment you first realized something was seriously wrong." They began a chronological autobiographical account. The main finding was that uncoupling happens in a patterned way. It is not a sudden chaotic break, as people tend to experience it, but a social process, a gradual transition with an identifiable pattern that has as its core a process of redefinition of self, other, and relationship. That pattern has one person, whom I called the "initiator," beginning to leave the relationship socially and social psychologically before the other. By the time the

partner being left behind realizes something is seriously wrong, the initiator has been in transition for some time, making the relationship difficult to retrieve. Typically, partners being left behind experience grief and shock, saying "I didn't even know anything was seriously wrong," while initiators say they had been "yelling and screaming about the quality of the relationship for years." Soon, however, the partner redefines the relationship as seriously troubled and begins going through the same social transition that the initiator began long before. Both people make the same transition, but it starts and ends at different times for each. The question remaining to be answered was this: In an intimate relationship, the smallest organization we create, how is it possible for one person to get so far away without the other person noticing and acting to forestall the transition? Returning to my interview transcripts, I found that the answer lay in information and how it was interpreted: How the unhappy initiator signaled his or her discontent to the partner, and how the partner interpreted those signals.

In early stages of the transition, for complicated reasons, the initiator does not send clear strong signals of discontent. As the initiator's discontent grows and she/he sends more frequent and stronger signals, the initiator still refrains from giving direct signals, instead (again for very complicated reasons) relying on indirect methods. Nonetheless, the landscape of the relationship is littered with warning signs. However, the partner does not define the relationship as a serious problem because the salience of these signals is reduced by the social context and the patterns of information. Rather than strong signals that the relationship is in serious trouble (the initiator's point), the partner confronts signals that are mixed (an argument [a signal that the relationship might be in trouble] is followed by a blissful making-up [a signal that all is well]); signals are weak (the initiator starts working late; the initiator says "I'm unhappy in this relationship" but doesn't say "I'm unhappy - and I'm seeing someone else"); and signals that become routine (sleeping in separate beds; arguing;). Only when the initiator is socially and psychologically ready to go does that person send a clear strong signal (a direct confrontation; leaving) that the partner can not miss or reinterpret in a way that reduces its salience. Then, alone, the partner is able to look back and see clearly the meaning of the warning signs that were there all along.

The Challenger Launch Decision (1996)

The research problem was to understand why NASA managers had launched the Challenger in January

1986, despite a recommendation by contractor engineers that the mission be delayed because of unprecedented cold temperature predicted for launch time. My data were original documents stored at the National Archives, Washington DC, interviews, the published volumes of two official investigations, and other materials.ⁱⁱⁱ The analysis showed a decision making pattern that was fundamentally like the pattern that occurs in the demise of intimate relationships. The demise of the Challenger was preceded by a long incubation period filled with warning signs that something was seriously wrong with the technology. In the 8 years prior to that flawed launch decision, NASA and the contractor made repeated decisions to launch space shuttles despite frequent in-flight anomalies on the Solid Rocket Boosters - the very component responsible for the Challenger accident. In this project, I also treated information as signals but here I identified them as "signals of potential danger." One key research question was to determine how it was that, despite repeated signals of potential danger in the years preceding the Challenger accident, the managers and engineers of the NASA and contractor organizations who did the hands-on engineering work continued to make official launch recommendations to their superiors, based on engineering analyses indicating that the technical component was (in NASA language) an "Acceptable Risk" for flight?

Analogical with the pattern in uncoupling, as incidents occurred the managers and engineers did not define the technical design as a serious problem because the social context and patterns of information affected interpretive work: As decisions were being made, signals of potential danger appeared mixed, weak, and routine. Mixed signals were information indicating something was wrong, followed by information indicating all was well. For example, the first incident of a technical anomaly on the Solid Rocket Boosters (a signal of potential danger) was examined, the cause identified, and the problem corrected. Then for five subsequent flights, there were no anomalies on the boosters (signals that all was well). A weak signal was one that at the time had no apparent clear and direct connection to risk and potential danger, or one that occurred once but the conditions that created it were viewed as rare and unlikely to occur again. Routine signals were anomalies that occurred repeatedly, but were expected and predicted as a consequence of a new safety procedure, and that engineering analysis supported as tolerable. Analogically, like the person left behind in an intimate relationship,

only after the disaster were the managers and engineers able to look back and see clearly the meaning of the signals of potential danger that were there all along.

Dead Reckoning: Technology, Culture, and Cognition in Air Traffic Control (in progress)

The advantage of a long incubation period is that it increases the possibility that intervention might occur early, staving off a harmful outcome. The air traffic control research is multi-faceted in the questions being asked; for this paper, however, I address only the question of how signals of potential danger are recognized and small mistakes corrected before they turn into big mistakes with harmful outcomes. The study is a comparison of three air traffic control facilities that vary in size, architecture, amount and kind of technology, type of aircraft, traffic patterns, and traffic responsibilities. Still in progress, it combines ethnography and interviews in three settings: A small tower that handles take-off and landing with primarily Visual Flight Rule traffic, a large tower and approach that handles national and international traffic, and a large radar facility that directs traffic at high altitudes. The findings I report here are from the radar facility only. My data include observations of controllers and supervisors making decisions about aircraft while on position at the radar screen, exchanges between pilots and controllers I listened to while wearing a head-set with controllers on the job, informal conversations with controllers and supervisors on break, and interviews with facility directors and Traffic Management Unit personnel.

Explaining Decision Making and Cognition within Social Context

Having established the logic of this comparison based on the centrality of signals and interpretive work in the three cases, we now turn to the explanations of decision making in each setting. Why were signals of potential danger misinterpreted and mistakes made that resulted in harmful outcomes in the first two cases, and why not, in the third? What aspects of situated action explain cognitive processes in each of the three settings? To organize the data and the discussion within a situated action framework, thus forcing attention to three levels of analysis, I artificially divide social context into individual, organizational, and environmental levels of analysis. Although creating these boundaries breaks up and contradicts the reality of everyday lived experience, it helps to set the stage for our later discussion on the relation between culture and cognition and the potential

for a microsociological theory of practical action.

Uncoupling

Individual cognition and choice: The analysis showed that the long incubation period preceding a break-up is linked to the quality and quantity of the signals that the initiator gives the partner. However, we are primarily interested in explaining the partner's contribution: How that person interprets the warning signs that something is wrong. Typically, despite the initiator's display of discontent, the partner still finds that the relationship, warts and all, affirms identity and definition of self. Consequently, the partner interprets the array of information from the initiator within a frame of reference, or "world view," that all is well in the relationship. The partner's world view is developed from practical activity: It is comprised of taken-for-granted assumptions about the relationship that result from the partner's history and experience in the social world. These taken-for-granted assumptions constitute the frame of reference against which the partner decides what is normative and what is anomalous in the relationship.

The break-up itself is a strong signal that contradicts the partner's world view, challenging many of the taken-for-granted assumptions that comprise it. The realization of mistake (the partner recognizes, in retrospect, the warning signs that had been there all along) has cognitive consequences. The crisis makes the partner aware of his or her assumptions, forcing the partner to confront them. Therefore, partners are able to articulate and thus make visible to others the cognitive components of world view that usually guide the construction of meaning and choice invisibly. Interview data indicate that the sources of the partner's world view are layered and that they arise from history and experience linked to that person's social location in 1) the organization (i.e., the relationship), and 2) the environment. Initiators are exposed to these same influences, yet interviews with initiators show that in order to make the break, they shift to a different frame of reference/world view than that the partner. This aspect of the initiator's transition bears importantly upon the question of institutional persistence and change, and will be addressed in the concluding section of this paper.

Organization. At the meso-level, partners' experiences in their own relationship generate taken-for-granted assumptions about what is possible in it. These taken-for-granted assumptions originate in

practical activity that creates and recreates routines and rituals that constitute aspects of the culture of the relationship. These routines and rituals have symbolic meaning that typify the culture of a relationship: The words "I love you," holidays, good sex, mediocre sex, meal and shopping rituals, styles of talk, fighting, the routine exchange, "How was your day?" These routines and rituals come to represent the relationship. For the partner, they are themselves signals that indicate the well-being of the relationship. Their repetition constitutes and affirms the partner's definition of the situation, reinforcing the partner's world view that all is well, affecting the partner's interpretation of the initiator's signals as follows:

The initiator's signals occur within the context of cultural patterns with established meaning for the partner. Consequently, the partner's reliance on daily rituals and routines to define the relationship tends to obscure change. The partner's frame of reference includes expectations about the range of signals that the initiator might convey, based on the past. Change happens gradually. As the initiator's transition progresses and signals incrementally increase, becoming frequent and repeated, they tend to become part of the culture of the relationship (routine signals), rather than a sign of impending demise. If all signals occurred in a very condensed time frame, they would dramatically reorder the daily routine, thus surely would create a strong, attention-getting signal. However, uncoupling is a transition, not a sudden split. A new signal interjected into a daily schedule or a conversation style with taken-for-granted meaning that reinforces the partner's definition of the situation becomes simply a break in the pattern of information the partner normally takes into account (a mixed signal), rather than a challenge to world view.

Signals that fall outside the partner's world view (weak signals) may not be taken seriously, may be denied, or may be reinterpreted to fit within the partner's experientially-defined understanding of what is possible in the relationship. For example, the partner may interpret signals that deviate from expectations as perhaps temporary anomalies that will go away "when the job crisis is over," or as a signal that the initiator is biologically or psychologically not himself or herself, but not as signals that the relationship is seriously troubled. The partner's interpretation is further complicated by the fact that even late in the uncoupling process, the initiator continues to participate in established rituals and routines, reproducing the culture of the relationship.

The partner interprets these activities as signals that all is well. Thus, at the same time the initiator is signaling discontent, that person is affirming the taken-for-granted assumptions of the partner and therefore sustaining the partner's world view.

Environment. The partner's world view also is comprised of institutionalized beliefs about relationships in general that originate in the partner's history and experience outside the relationship. Zucker (1977: 85) points out that when acts are institutionalized, they have ready-made accounts. Identifiable in interviews with both married and cohabiting partners are three institutionalized cultural beliefs about marriage, family, and partnership. First, partners articulate their belief in the institution of marriage, family, and/or togetherness, affirming the social expectation that people belong in couples - that they should come in pairs, like the animals of Noah's Ark. Second, they also articulate social expectations about the duration of the relationship: Partners comment, "I believed that once you're married, you're married," "The idea of divorce never occurred to me," "The holy sacrament of marriage is binding until death;" or "I was sure we would be together for the rest of our lives." Third, they express allegiance to a reinforcing set of institutionalized assumptions about gender roles that proscribe the division of labor in and commitment to the intimate dyad as taking priority over the individual. Partners articulate the belief that if things get tough, the tough stay put: "It was my job to make sure it worked and keep us all together," "I stayed for the sake of the children," or "A man has a responsibility to support his family."

Finally, partners' accounts assert an allegiance to institutionalized beliefs about the quality of relationships, once we are settled in them. These taken-for-granted cultural assumptions have a folklore-like quality: "All marriages have trouble. Ours wouldn't be normal if we didn't;" "After a while, all couples lose their interest in sex;" "We had some arguments, but, you know, all couples have their arguments." As the initiator's signals of discontent increase (withdrawal, abuse, repeated absence, cheating, lack of interest in sex, complaining), the quality of the partner's experience in the relationship changes. Yet, typically partners do not immediately react by redefining their relationship as at a danger point. Instead, within the context of these cultural scripts about what can be expected in relationships in general, partners tend to view their own relationships as merely visited

by normal, natural trouble. Their accounts reflect classificatory principals about the quality of relationships in general, derived from history and experience, as in this woman's statement:

"Why in the world, even though if one looked one might see that I was not happy, why in the world would I ever want to change that? I mean, I never saw my mother happy. Why should I assume that I should be happy? You know. Happy, what's that?" (1986: 104)

In sum, then, the partner's interpretation of early warning signs is shaped by a world view, comprised of nested cultural beliefs from history and experience, that derives from social location in the environment and the relationship (i.e., the organization): Macro-level institutionalized beliefs of the larger society about the value of relationships, the socially expected duration of relationships, gender and commitment, the priority of the group over the individual, and typifications about the quality of established relationships; meso-level taken-for-granted assumptions about what is possible in their own relationship, measured by culturally embedded expectations based on routines and rituals of everyday life past. This world view, or frame of reference, influences the partner's construction of the meaning of the relationship, the partner's interpretation of the initiator's signals, and consequently, choice and action.

The Challenger Launch Decision

Individual Cognition and Choice. The research showed that the long incubation period (1981-1985) preceding the mid-flight break-up of the Challenger was typified by in-flight anomalies - early warning signs that presented an opportunity to intervene and possibly avoid the loss. Because formal organizations keep records, because engineers write everything down, and because the official investigations of the accident made all materials available to the public, I was able to trace design decisions made about the Solid Rocket Boosters (SRBs) (the technical cause of the accident) during the developmental stage of the space shuttle program and for all decisions, including each of the 25 launch decisions made for the space shuttle once the program was operational. The analysis showed that in the years before the Challenger launch, managers and engineers in the work group assigned to the SRBs repeatedly made official, written, recommendations in formal launch decisions that the design was an "Acceptable Risk," despite recurring anomalies.^{iv} The explanation for these

official decisions is "the normalization of deviance:" The process by which anomalies (technical deviations from performance predictions) that engineers and managers first interpreted as indicative of escalated risk (a signal of potential danger) after an examination of the evidence and engineering analysis were subsequently officially and formally found to be an "Acceptable Risk" by the work group. The normalization of technical deviation is an institutional and organizational construct: Macro- and meso-level factors shaped cognition and choice.

Analogous with uncoupling, the data indicated that sources of the work group's pattern of of decisions to officially recommend launch in formal pre-launch decision making were layered and that they arose from history and experience linked to environmental and organizational influences on cognition and choice. Also analogous, the sources of the work groups' frame of reference were identifiable because the demise of the Challenger was, in retrospect, a mistake: the strong signal that contradicted the taken-for-granted assumptions on which the launch decision was based, so people were able to articulate those assumptions. Moreover (and in contrast to the previous case), written records existed that showed how these taken-for-granted assumptions operated in participants' logic as decisions were being made, prior to the accident and the official investigation. Thus, what people said in the aftermath of the tragedy could be evaluated against what they wrote, said, and did at the time. These data allowed a reconstruction of interpretation and meaning to insiders as meanings developed, were negotiated, maintained, and changed.

Organization. History and experience in the organization generated cultural understandings against which signals of potential danger were evaluated. As partners in intimate relationships weigh their assessment of signals of potential danger coming from initiators against taken-for-granted assumptions about what was normal and routine within the organization culture, so did the SRB work group. Organization culture contributed to the normalization of technical deviation in formal launch decisions via 1) the uncertainty of technology itself as a context of decisions, and 2) the space agency's culture of production, with its triumvirate of cultural imperatives. In combination, the two provided a social context in which proceeding with official launch decisions, despite the repeated anomalies, became institutionalized at NASA.

Technological uncertainty created a situation where having problems and anomalies on the shuttle was

itself a taken-for-granted aspect of NASA culture. The shuttle technology was of unprecedented design, so technical deviations from performance predictions were expected. Also, the forces of the environment on the vehicle in flight were unpredictable, so anomalies on returning space flights were frequent on every part on every mission and therefore routine and normal. Within this context of taken-for-granted problems, having problems on the SRBs was not a deviant event: Problems were normal and expected. Changes in the quality and quantity of the problems on the SRBs occurred over several years, introduced gradually into a cultural context where problems and change were taken-for-granted. Had all the damage to the boosters occurred on one mission, or on a series of missions in close succession, the sudden change might have been the attention-getting strong signal necessary to produce an official redefinition of the situation that the booster design was not an "Acceptable Risk." As it was, signals of potential danger occurred in an ongoing stream of problems that tended to obscure change. History and experience mattered to the frame of reference the work group brought to the interpretation of information in a second way. The engineering rationale developed to justify the first anomaly became the precedent for accepting anomalies in the future. That first engineering risk assessment was foundational, for the first technical analysis was elaborated in greater detail with tests and analysis each time, so that the past and past decisions became the basis for subsequent analysis and launch decision making. The technical rationale for launching with anomalies was reinforced and made stronger in the process.

The space agency's culture of production was the second meso-level factor contributing to the normalization of technical deviation in official launch decisions at NASA. The culture of production maintained and sustained the definition of the situation that was developing at the micro-level. The culture of production was comprised of the original technical culture of NASA's successful Apollo era, political accountability, and bureaucratic accountability. Political accountability made cost and schedule a priority. Post-accident investigations uniformly showed that pressures to stick to the launch schedule permeated the culture. As one engineer said, "When people are working evenings and weekends, no one has to tell you that schedule is a priority. You know." Dramatic post-Apollo increases in bureaucratic accountability at NASA multiplied requirements for the agency to follow rules and procedures in making technical decisions, ordering hardware,

reporting contractor performance, and conforming to industry and government regulations. This greater preoccupation with rules and procedures had a cognitive consequence: Rule-following was accompanied by the cultural belief that if all rules were followed scrupulously in launch decision making, safety was as sure as they could make it, given the unprecedented, unpredictable technology. Finally, a main tenet of NASA's original technical culture valorized quantitative information above hunch, intuition, and subjective feelings.

In combination, technological uncertainty and these cultural imperatives affected decision making, contributing to the normalization of technical deviation in official launch recommendations in the years preceding the Challenger launch. Within this culture, compromise, both in design and in performance, was normative; flying with hardware that frequently deviated from design predictions was normative; and proceeding with the schedule despite flying with flaws that had engineers worried was normative because engineers were conforming to cultural imperatives about rule-following, the production schedule, and the validity of quantitative evidence over hunch and intuition.

Environment. Brint and Karabel stress that institutional analysis must include the "power structures and opportunity fields in the larger society that shape organizational possibilities" and "the efforts of organizational elites to take advantage of the environment to further their own interests as well as those of their organizations" (1991: 345). NASA's internal culture of political accountability and bureaucratic accountability resulted from elite decisions conceived to aid agency survival in a post-Apollo environment of scarcity and competition. Faced with reduced consensus and resources for its mission, NASA officials engaged in political bargains with Congress, compromising the shuttle's technical design, purpose, and excellence. Further, to mitigate against competitive pressures, NASA officials began "contracting out" work that used to be done in-house, which initiated the emphasis on bureaucratic accountability that was exacerbated by actions of the White House. These elite decisions trickled down through the agency, altering the taken-for-granted understandings of the original technical culture by introducing political accountability and bureaucratic accountability: Bringing business interests front and center, emphasizing procedural regularity and schedule to the detriment of safety.

These three cultural imperatives of the NASA organization culture gained in strength because they were

reinforced at the macro-level by institutionalized belief systems of the engineering profession in general and the aerospace industry in particular. In *Craft and Consciousness* (1991), Bensman and Lilienfeld show the relationship between world view and the occupational technique and methodology of many occupations and professions, which they argue create habits of mind that give each occupation its distinctive character. Engineering as a craft and as a bureaucratic profession contributed to the work group's normalization of technical deviation in official launch decision making venues by providing basic assumptions that were elaborated in the NASA organization culture. These, too, originated in history and experience, and manifested in daily engineering practice. Among them are the following:

First, engineers hold the belief that technology is messy and unpredictable in large scale technical systems; therefore making judgments under conditions of uncertainty is normal (Wynne 1988). Engineering decision rules are based on experience with the technical object and those rules change as understandings of the technology changes. So changing the rules for what was acceptable to encompass each succeeding anomaly was not procedurally deviant, but normal engineering practice in the work group, under those governing professional beliefs. Second, the social administrative arrangements of engineering also contain cultural scripts that are integral to the occupational world view. Engineers typically work in bureaucracies guided by the principals of capitalism. They are prepared for this existence in colleges and technical schools, where they learn not only engineering, but are prepared for work in production-oriented organizations, where cost, efficiency, and schedule are valorized. They learn 1) their place in the hierarchical system of these organizations and the importance of conforming to bureaucratic rules and procedures, 2) satisficing, rather than optimizing, in engineering design and practice, and 3) cost and safety are in constant competition.^v Third, at NASA science was used in service of technology, and engineers as a profession develop a set of beliefs about science and technology as truth-finding endeavors and about the methods on which truth is based. "Trust in numbers" (Porter 1995) dominates scientific practice, giving it legitimacy. Truth is revealed in the use of methods that quantify, such that proof is in mathematics, not intuition, observation, or tacit understandings.

These three institutional logics of the profession were taken-for-granted aspects of the SRB work

group's world view. They were cultural scripts that pre-existed engineers' entry into the NASA workplace, were reproduced in the organization, elaborated upon, and materialized in the cultural triumvirate that existed after Apollo.

Dead Reckoning: Technology, Culture, and Cognition in Air Traffic Control

Located in Nashua, NH, Boston Center is an en route Center responsible for regulating all air traffic for upper altitudes (14,000 ft. and higher) in the New England region, which includes the New England states, most of New York, northeastern Pennsylvania, plus 200 miles out to sea. The Center has 280 controllers monitoring 30 radar positions around the clock, handling an average of 5,000 flights a day. The controllers' two main tasks are 1) to direct traffic movement within their air space, coordinate traffic between their air space and other regions, and between facilities within their own region that direct traffic at lower altitudes, and 2) direct traffic safely, avoiding mistake and the ultimate harmful outcome - collision. In 1999, despite the annually expected increase in air traffic, no collisions of commercial aircraft occurred. Figures for 1999 at Boston Center are not yet available, but the number of aircraft handled during 1998 was 1,944,583. How is it that air traffic controllers are able to recognize signals of potential danger early, so that anomalies are identified and corrected?

When asked what are the most important characteristics of air traffic controllers, controllers recite individual characteristics. They stress the importance of vision and hearing, intelligence, the ability to do many things at once, the need for lots of stimulation and activity, excellent memory, and finally, "common sense." Common sense is, to them, the ability to avoid "messes." A mess happens because of an anomalous incident, bad weather, a technical problem. Common sense, they say, helps them avoid a mess in the first place by planning ahead, and get out of a mess "whatever way you can." Because getting out of messes is how they avoid mistake - common sense is what we will examine.

Geertz (1983: 73-93) writes that common sense is a loosely connected body of belief and judgment, rather than just what anybody properly put together cannot help but think. He argues that common sense is a cultural system, a frame of mind, that both differs from place to place and yet takes a characteristic form. Controllers state that "much of traffic management is rote;" it "becomes second nature." It becomes second

nature because their cognitive activity is embedded in a cultural system of knowledge from which decisions can be made and coordination effected without thinking. Common sense, for air traffic controllers, is a frame of mind and capacity to act shaped by 1) institutionalized formal rules governing the air traffic system, 2) local knowledge gained in the facility to which they are assigned, and 3) tacit knowledge. Institutionalized formal rules, local knowledge, and tacit knowledge are overlapping and mutually reinforcing meaning systems. In combination, these three comprise a system of taken-for-granted understandings that enable radar controllers to (a) make sense of what they see on the screen and (b) identify signals of potential danger early, so corrections can be made before small deviations turn into big mistakes.

Below, I treat the air traffic system as the environment and the air traffic management facility where the controllers work as the organization.^{vi} Because the project is in its early stages at this writing, here I define environment narrowly (cf. Brint and Karabel 1991). The data nonetheless yield insights about the connection between macro-level institutionalized rules and the cognition and action of individuals. In contrast to the previous two cases presented, I reverse the order of the situated action categories used to organize the case comparison, so that we first consider environment, organization, and then individual cognition and choice. The reversal not only follows the explanation inductively derived from the case study data but provides the most clear explanation of this case for the reader.

Environment. In the air traffic system, institutionalized formal rules and practices exist nationally and internationally to effect global coordination. All air traffic operates on Greenwich Mean Time, for example, and English is the common language for pilots and controllers. Other rules and regulations fill volumes. Controllers learn these formal rules and practices in four-month training schools: "Letters of Agreement," which are rules about transferring traffic between sectors and facilities; "The Book of Phraseology," a common language for communication within the system between pilots and other controllers; air traffic routes - highways in the sky, with names and named intersections; types of aircraft equipment; how to calculate position of an aircraft. Controllers report struggling as students to learn these rules, because they are tested under stressful conditions on their ability to memorize and reproduce rules and procedures. Standardization is the core of the system.

These institutionalized formal rules are learned, but they become taken-for-granted understandings that guide cognition, pre-rationally.

Organization. Geertz (1973: 4) writes that "the shapes of knowledge are always ineluctably local, indivisible from their instruments and their encasements." After four months of formal training, controllers are assigned to a facility. Added to the formal rules of the air traffic system are sets of organizational procedures and practices that are peculiar to that facility and its distinctive traffic: "This is how we do it here." As one controller said, "You have to learn the facility - what are the patterns - before you can start paying attention to other things, like talking to people in the room, being able to cooperate with them, share tasks, do the job." Local knowledge comes from both experience at the facility and over-the-shoulder supervision by the trainer.

Local knowledge from experience. Air space is divided into sectors. Each sector has its own name, different physical characteristics, traffic patterns, aircraft, winds, and connections with other air traffic facilities that controllers must master. Sectors are also typified by highways with named intersections, terrain, radar beacons, and Tower and Approach facilities; standardized departure and destination points give each sector its own traffic patterns that cross the sector in predictable ways; the amount of sector traffic is also patterned: Quiet times and busy times vary by day of the week, by season, by holiday. In the facility, controllers also learn from the performance capability of equipment in a sector, and how responsive that equipment is under different conditions: What aircraft are hard to turn in certain winds, what is sluggish climbing in the summer.

Local knowledge acquired from trainers Senior controllers are assigned as trainers during the three years in the facility designated as developmental years prior to a controller being certified as a "Full Performance Level" controller. Local knowledge learned from trainers is enacted in subtleties of traffic management skills not visible to the outsider observing controllers at work, but can be seen in on-the-job training sessions with trainers. Other knowledge learned from trainers is observable in variations in the styles of talk controllers' use with pilots; variation in how crisply and briskly they use the official phraseology, the rhythms of routine commands and responses, and in distinctive ways of using the technology to practice traffic management

Individual Cognition and Choice. Formal rules are institutional; local knowledge is organizational. They

are taught, memorized, and practiced. Experience doing the work builds upon this foundation, adding an intuitive component to cognition: Controllers develop tacit knowledge. Polanyi (1958) describes tacit knowledge as "our ability to perform skills without being able to articulate them," making the further observation that skills involve "the observance of a set of rules which are not known as such to the person following them." Nelson and Winter (1982: Ch. 3) make the point that in the exercise of a skill, choice is highly automatic, occurring without deliberation: Choice is, they argue, suppressed by its preconditions - routines and programs confine behavior to well-defined channels, reducing option selection. The making of a controller happens when "the light bulb goes on," as one said, enabling them to move beyond thinking and calculating based on many individual rules to an integrated cognitive approach to traffic management that enables decisions to be made without thinking. The "light bulb goes on" as a result of practical activity - history and experience as controllers work at regulating air traffic in simulators during training and in on-the-job training experience in their facility. The result is a cultural system of knowledge consisting of scripts that minimize choice, making air traffic control "common sense," in their view, and explaining why they say, "much of it is rote."

How does common sense as a cultural system affect controllers' ability to make sense of what they see on the screen? To the uninitiated, the radar scope is a screen crammed with disorganized data. Airplanes on a radar scope are represented by a square of flight data identifying an aircraft by number, equipment, altitude, airspeed, etc. The number of planes in a sector may be as high as 20-30. Radar scopes also indicate the highways and intersections of the sector. But controllers do not see separate bits of information and individual flight paths, they see a gestalt. Controllers view activity on the scope with a frame of mind and capacity to act shaped by common sense as a cultural system. Cognition is an activity embedded in history and experience, and grounded in institutionalized formal rules, local knowledge, and tacit knowledge. Common sense as a cultural system enables them to have foresight. They can be proactive: To plan ahead and avoid messes, to correct small mistakes thereby avoiding big ones, and to get out of messes when they happen.

Foresight is possible because formal rules, local knowledge, and tacit knowledge enable them to predict the flight path of an aircraft in the sector and get it through the other aircraft. The relationship between

institutionalized rules and habits of mind is best illustrated by the cardinal concern for controllers: The "Rules of Separation." The Rules of Separation dictate the required distance between aircraft that controllers' must maintain in order to avoid collisions. At Boston Center and other high altitude facilities, the Rules of Separation require a 5 mile radius between aircraft and 1,000 ft. clearance above and below. Maintaining separation requires calculation, based on airspeed, equipment capabilities, and wind. But the calculation of these multiple factors becomes automatic, a habit of mind, that becomes prerational, manifesting in this visualization: Controllers at Boston Center envision a plane as a block moving through space, having a destination from the moment it enters their airspace. The ability to convert a flat radar screen into three dimensions is not simply an innate cognitive skill, but reflects the connection between institutionalized formal rules and cognition. Controllers report this visualization is due to the Rules of Separation. The assertion about the conversion of multiple formal rules into a habit of mind that enables them to make decisions without thinking is supported by data from a small facility handling take-off and landing. There, the task is different, so the rules of separation are different. Controllers are concerned with sequencing aircraft one-at-a-time for take-offs and landings. The Rules of Separation call for sequencing with 3000 ft. between aircraft, with pilots sharing responsibility for visual separation. In this setting, controllers report visualizing aircraft as "a string of pearls," not a block flying through space, reflecting the Rules of Separation that are particular to their task and that guide their work practice.

Common sense is a cultural system, however. Institutionalized formal rules upon which foresight (done without thinking) is based include standardized flight data that tell controllers of departure and destination points, and formalized highways give guidelines by which traffic patterns can be predicted. Local knowledge sharpens foresight because controllers are familiar with refinements in patterns. Foresight helps them develop a plan early and move traffic so no crisis develops. They describe their work as a series of "moves." A new plane on the scope alters the plan, so the controller has to make adjusting moves with other aircraft. Experience with equipment capability and airspeed allows them to avoid collision: ("Here are two flights, a jet and a prop, on the same altitude, but they are distant now. It looks like they would violate the Rules of Separation, but air speed means they will clear by five miles.")

These sensemaking processes are fundamental to directing traffic. How, then, do controllers recognize signals of potential danger? They are able to respond early to a deviation/anomaly by selective attention to a problem that gets identified as a problem by the cognitive frame comprised of common sense as a cultural system. Some signals of potential danger are clear, strong signals that take no special skills to recognize: Bad weather; aircraft emergency; failure of controller technology. But others are recognized only because institutionalized formal rules, local knowledge, and tacit knowledge form a base from which controllers are able to notice deviations from the expected. Taken-for-granted assumptions about traffic means easy monitoring of most traffic. They don't watch everything equally; normally they pay more attention to the planes that seem to be the most important to follow.

Some concrete examples, from field observations: An aircraft following a standard traffic pattern, but uses a "strange approach" (e.g., "Lear jets don't normally fly that way"); traffic taking the wrong route to a known destination; rule violations by pilots; pilots procedurally reading back controllers' directions but making an error in the response (e.g., 20,000 altitude may be read back as 21,000). pilots use correct phraseology and procedures, but deviations in speech characteristics draw attention (tone of voice, weak phraseology, foreign accent, hesitation, long periods of silence, rapid talk with elevated pitch - a sign of crisis). Like uncoupling and NASA's tragedy, decision making for controllers also has an incremental quality, although the sequence of decisions culminating in some final outcome is in seconds or minutes compared to the possibility of years in the other two. Nonetheless, the incremental character of their work is an acknowledged part of controllers' practical activity. On monitoring the progress of an aircraft across the radar scope, one controller observed, "There are many mistakes that get identified and corrected before the final decision (two aircraft clearing each other, within the Rules of Separation)".

In sum, in air traffic control cognitive practice is embedded in an intricate, overlapping system of formal rules, local knowledge, and tacit knowledge, which provides the standardized frame of reference against which even small anomalies (what in other decision contexts might appear as weak signals that did not attract attention) stand out as strong signals, enabling controllers to recognize early warning signals and take corrective

action, thereby preventing small deviations and errors from turning into mistakes with harmful outcomes.

A Microsociology for Institutional Theory: The Role of Culture in a Theory of Practical Action

We turn now to the implications of this three case comparison of decision making in naturalistic settings for a) the connection between culture and cognition and b) the potential of Bourdieu's theory of *habitus* as a microsociological supplement to institutional theory.^{vii} The comparison shows patterns common to the three cases that shed some light on 1) the complex, layered connection between structure, culture, and cognition, 2) institutional processes of variation and persistence, and 3) *habitus*.

Culture as mediator between institutions and cognition. In each case analysis, cultural understandings and scripts played a major role in the interpretation of signals of potential danger by establishing the preconditions of choice. Scott observed that "Perhaps the single most important contribution of institutional theorists to the study of organizations is their reconceptualization of the environments of organizations...to include a neglected facet: Institutionalized beliefs, rules, and roles" that comprise shared cognitive systems (1991: 165). In each case, the analysis showed sets of organizing assumptions - pre-rational, cultural, and layered - that permeated nested structures, shaping individual cognitive processes. Because each case in the comparison was originally investigated in order to find an explanation of its own substantive problem, I identified these taken-for-granted assumptions differently in each: World view in uncoupling, institutionalized cultural beliefs at NASA, common sense as a cultural system in air traffic control. Although named differently, all three cases were typified by distinctive sets of institutional values and culture was the medium through which they were expressed. All cases show culture at work, cognitively, in the nexus of information, schemata, and larger symbol systems. DiMaggio (1997: 277) distinguishes between "logics of action," or constraints that influence action in a given domain, and more recent work that identifies "institutional logics," emphasizing the cultural aspects of the connection between institutional requirements and mental structures. Quoting from DiMaggio,

"Friedland and Alford (1991: 248-9) provide the most thorough exposition and definition, describing "institutional logics" as sets of "material practices and symbolic constructions" that constitute an institutional order's "organizing principles" and are "available to organizations and individuals to elaborate."

Confirming Friedland and Alford, the data for each case showed how institutional logics were comprised of material practices and symbolic meanings that guided decision making and consequently, action. The comparison demonstrated empirically the overlapping, layered character of these organizing principles. Each case verified a trickle-down effect, wherein institutional logics originating in the environment (professions; industries; American society) affected practical activity and were reproduced in the course of that activity. These institutionalized cultural beliefs were elaborated upon by organizations and individuals, such that they were transformed into substantively crafted, situation-specific scripts that derived from one's history and experience in that organizational setting. At the macro-level: In uncoupling, partners held taken-for-granted assumptions about marriage and cohabitation; at NASA, institutional logics about engineering as both a craft and a production-oriented bureaucratic profession were part of the work group's interpretive frame; in air traffic control, institutional logics about science, technology, and standardized rules framed the interpretive process. Local variations on these larger institutional themes are identifiable at the meso-level: In uncoupling, institutional beliefs about marriage and relationships were a foundation for more detailed cultural scripts idiosyncratic to the specific relationship; at the space agency, institutional logics surrounding the profession and craft of engineering were elaborated into cultural beliefs about cost/safety tradeoffs, bureaucratic rules, and technical practices that were peculiar to the NASA organization; in air traffic control, taken-for-granted assumptions at the institutional level were refined by local, organizationally-based cultural scripts grounded in history and experience in the air traffic facility. Each cultural layer was, in many ways distinctive, but in each case aspects of one layer carried over and interpenetrated the next. They were mutually reinforcing systems of meaning that contributed to and stabilized individuals' definition of the situation, narrowing choice.

Institutional processes: variation and persistence The variation in the three cases compared offers some insight into reproduction and the problem of macro-stability and change. Institutionalists argue that routines and scripts, not norms and values, are the source of macrostability. They stress the structuring quality of rules, routines, scripts, and frameworks. Although they make room for both agency and change, most of the empirical work has focused on fields rather than micro-level bases of institutional processes like variation and

persistence. The most extensive research into these issues at the micro-level has been through the laboratory experiments conducted by Zucker (1977). She concluded that her settings varied in the degree to which acts are institutionalized. In contrast, the three cases of decision making compared in this paper allow examination of the effects of the natural setting. They, too, vary in the degree to which acts are institutionalized. Whereas in all three cases, cultural scripts originating in the environment played a role, permeating and being elaborated in more immediate organizational settings, a major difference is at the meso-level of analysis: The decision making takes place in a social group and two complex organizations. This condition allows us to consider variation in institutionalization and cultural persistence in natural settings.

The formal organization, Jepperson writes, is a "packaged social technology, with accompanying rules and instructions for its employment and incorporation in a social setting (1991: 147)." Zucker hypothesized that an act being performed by the occupant of an office in a formal organization will have a high degree of institutionalization, whereas an act being performed by actors exercising personal influence (i.e., not acting through an office) will be low in institutionalization. She also hypothesized that the degree of institutionalization would affect the resistance of those cultural understandings to change. These case comparisons verify Zucker on the relationship between institutionalization and change. Suppose we array our three organizational settings on a hypothetical continuum by degree of institutionalization. As a social group, the intimate dyad would be at the left, indicated as low institutionalization, and the two complex organizations toward the right, indicated as high institutionalization. However, variation exists between kinds of intimate dyads. Uncoupling was based on interviews with both marrieds and living together couples, gay and straight. Marriage being the more highly institutionalized of the three, it would be placed between the complex organizations and the other dyads on our hypothetical continuum. Variation also exists between the two complex organizations. (This, too, is consistent with Zucker, who allowed for variation in institutionalization between formal organizations.) Micro-activity in air traffic control is more highly institutionalized than activity in the Solid Rocket Booster work group at NASA because all air traffic controllers' choices are based on institutionally and organizationally programmed routines and scripts (a skill, see Nelson and Winter 1982) to make the same kinds of decisions about the same objects

every day, whereas the engineering decisions of the SRB work group were more discretionary, based on universalistic guidelines rather than the particularistic ones used in air traffic management. Therefore, air traffic control would be on the far right of the hypothetical continuum.

The cases show the expected variation in cultural persistence. The greater the degree of institutionalization, the greater the cultural persistence, the greater the resistance to change. In directing aircraft, air traffic controllers reproduce nearly exactly common sense as a cultural system: The institutionalized formal rules of the system and the local knowledge gained at the facility, with tacit knowledge the only decipherable source of variation. Choices are made without thinking: As controllers say, much of it is "rote" and "common sense." As they direct traffic and identify anomalies, air traffic controllers' decision making and choice are so narrowly channeled that the adjective "determined" may be more appropriate than the softer term, "constrained." Training is intensive and repeated at intervals; innovation is minimal. To deviate from the layered system of rules that guided traffic management is 1) to lose one's job, and 2) to be immediately and publicly responsible for the loss of the lives of others. The high costs of deviation all but eliminated resistance to institutional scripts. Ritualistically, the practical activities of air traffic controllers feed into cultural persistence and the reproduction of institutional rules about controlling traffic.

In the comparatively less institutionalized environment of NASA in which the SRB work group was making decisions, there was an effort to initiate change by challenging the official (and long-standing) documentation establishing "Acceptable Risk" of the Solid Rocket Booster design with a "no launch" recommendation on the eve of the Challenger accident. The work group's official definition of the technical components of the SRBs had become institutionalized within the organization, reinforced by layered meaning systems of the culture of production that originated in the environment. But that night, the engineering protest contradicted the culture of production. Nonetheless, as they discussed the technical issues about the Challenger launch that were on the table, their construction of meaning and interpretation of signals was shaped by history and experience - past decisions on the SRBs and the technical engineering rationale for proceeding that had been developed over many years. Even as contractor engineers in the work group argued against the launch in the

short run, cultural persistence was reinforced in the long run because all participants exactly followed the dictates of the culture of production, reproducing the shared symbol systems that guided their actions.

Taken-for-granted assumptions were about hierarchy, schedule, satisficing, quantitative data versus intuitive data, and rule-following were re-enacted, affecting the proceedings, with the result that participants once again followed precedent. The official outcome was to expand the bounds of "Acceptable Risk" yet another time. Their behavior was to a great extent scripted, conforming to institutionalized cultural beliefs and thereby reproducing them.

Perhaps the strongest case for demonstrating variation and cultural persistence in institutionalization is in the data on deteriorating intimate relationships. First, the analysis showed that the relationships of heterosexual and homosexual couples that live together are less stable and more likely to break-up. This is not because of either less commitment or greater promiscuity. Rather, these relationships are more precarious because of the lack of institutional support. Of the marriages that do break-up, the behavior of the initiator who eventually leaves the relationship is the source of several insights about variation in cultural persistence. First, in contrast to the other two cases we are comparing, change happens: Individual actors who become initiators do make choices and take actions that contradict layered, taken-for-granted assumptions about marriage, family, and gendered relations that their partners still hold. How does this change come about?

Friedland and Alford (1991) posit that contradictions between institutional logics can precipitate change. In the married initiator's transition, one such clash is between the cultural beliefs in the institution of marriage versus the democratic value of individual freedom. Initiators who uncouple make a shift from the former to the latter. The high degree of institutionalization of marriage is demonstrated by the fact that uncoupling is a gradual transition that takes time: The analysis reveals the lower-level processes that counter higher order institutional effects. Uncoupling takes time because in order to make a transition out of the relationship, the initiator must redefine taken-for-granted assumptions about self, the partner, and relationship. One of the redefinitions necessary is that the individual takes primacy over the group. This switch to a different set of cultural assumptions is a slow process because the initiator has to change social locations (i.e., *habitus*, see

discussion below) in order to make the switch. The initiator gradually shifts ties from the partner and those coupled friends who reinforce and objectify the relationship to others who share this alternative world view: The single, the divorced. Change does happen, as the divorce rates indicate, but the prevalence of re-marriage among the divorced attests to cultural persistence of marriage as an institution. The ideological shift is necessary to uncouple, but for most initiators it is temporary: As initiators state after they have recoupled, "Nothing is wrong with marriage, only the marriage I was in."

Habitus DiMaggio and Powell (1991), searching for a micro-level solution to the problem of macro-level stability, suggested Bourdieu's notion of *habitus* as the analytic link that connects individual behavior and social structure. Bourdieu, explaining the social construction of reality, asserts that the principle of that construction is *habitus*: A system of dispositions, acquired through experience and thus variable from place to place and time to time, that allows for agency without turning actors into rational calculators. These acquired dispositions function on the practical level as categories of perception and assessment or as classificatory principles as well as being the organizing principles of action; as such they portray the social agent as the "practical operator" of the construction of objects (Bourdieu 1990a: 12-13). This system of dispositions generates strategies that can be directed towards certain ends, but those strategies are "neither unconscious calculation nor obedience to a rule" (Bourdieu 1990a: 9-10). Bourdieu's notion of strategy is key to understanding agency, within his perspective. Strategy is

"...the product of the practical sense as the feel for the game, for a particular historically determined game - a feel which is acquired in childhood by taking part in social activities...(it) presupposes a permanent capacity for invention, indispensable if one is to be able to adopt to indefinitely varied and never completely identical situations...this freedom of invention and improvisation which enables the infinity of moves allowed by the game to be produced...the *habitus* as the feel for the game is the social game embodied and turned into a second nature." (1990a: 62-3).

Institutions are integral to this perspective because of their connection to the distribution of dispositions. Constituted in the course of an individual history, *habitus* makes it possible to inhabit institutions, to draw on

them practically, enacting their organizing principles and thus reproducing them but at the same time allowing for revision and transformation (Bourdieu 1990b: 57). Rational strategies of action, in this view, themselves are institutionalized, shaped by standard rules and structures and reflected in standardized cultural forms such as accounts, typifications, and cognitive models.

This three case comparison affirms Bourdieu's notion of *habitus* as a microsociological complement to institutional theory: Affirming Dimaggio and Powell (1991), it could serve as the analytic equivalent of Parson's role system as a connector between individual behavior and social structure. However, some new insights and questions grow out of the comparison. Clear in each of the decision making cases compared was the operation of structuring predispositions - a system of cognitive and motivating structures. Decisions were made in a practical world of already realized ends - procedures to follow, paths to take - that drew on existing regularities that were institutionalized and became the basis of "the schemes of perception and appreciation through which they were apprehended." (Bourdieu 1990b: 53-4). Although not shown here due to space limits, the cases also show the role of agency, as actors enacted a variety of strategies within the constraining predispositions. Each case showed decision making processes as they unfolded, multiple small decisions, made incrementally, demonstrating the indeterminacy people face on a daily basis in the lived life. But exercise of agency was a matter of invention within limits.

Invention within limits was visible in all three cases: In air traffic controllers' enactment of tacit knowledge against a background of institutionalized formal rules and local knowledge from the facility; partners in relationships who turned "detective" as signals of potential danger accumulated; engineers at NASA who used memos and informal conversations to express increasing concerns, even as they continued to officially recommend launching shuttles. But also evident was the capacity for invention of larger scale. Bourdieu asserts the importance of the "contingency of the accidental," positing that the act arises from "the unpredictable confrontation between the *habitus* and an event (1990b: 55). Institutional contradiction at the micro-level does seem to initiate change. The contingency of the accidental manifested in the initiator's uncoupling, changes in the partner's world view at the realization that the relationship was seriously troubled, the shattering of the

institutionalized cultural belief in "Acceptable Risk" when Challenger was transformed into a ball of fire and smoke clouds in the sky. In each of the cases, challenges to taken-for-granted assumptions required a reconstruction of the immediate reality - a redefinition of self in relation to the world - but that redefinition nonetheless went on within the parameters already set by institutional arrangements.

What becomes more explicit as a result of the case comparisons is how social choices are shaped, mediated, and channeled by institutional arrangements. The cases verify that the repetitive quality of much organized life cannot be explained by a consequentialist rational actor model, but by the preconditions of choice. The persistence of practices lies in their taken-for-granted quality and their reproduction in structures that are, to a certain extent, self-sustaining: "Institutional arrangements constrain individual behavior by rendering some choices inviable, precluding particular courses of action...". (DiMaggio and Powell, in Powell and DiMaggio, 1991: 9-10). Also more explicit as a result of the case comparisons is the role of culture in organizing social reality. Culture becomes the medium through which institutional values and beliefs are both conveyed and enacted, and then reproduced. The nesting of institutional logics has a stabilizing effect. People are the carriers of culture, enabling institutional environments to penetrate organizational settings, where they are elaborated by organizations and individuals, shaping world view and thus categories of structure, action and thought. Both uncoupling and Challenger exemplified how schemas and scripts lead decision makers to resist new evidence. In all three cases, cultural categories shaped the rules by which rationality is perceived and experienced (Friedland and Alford 1991: 247).

What also emerges from these comparisons is new insight into the complex way the distribution of dispositions is tied to social location. Bourdieu states that *habitus* is a product of history that produces more history. He argues that it is a "present past," acquired through experience, that enables coordination of activities and macro-level stability. People have the same history, thus behavior can be coordinated without thinking, without any conscious reference to a norm or calculation. His discussion (1990b: 58-61) centers around group or class *habitus*, contrasting it with individual *habitus*. He acknowledges the importance of individual experience and the variation that implies, concluding that each individual is a "structural variant" of the social conditions

producing the class *habitus*. He acknowledges the singularity of an individual's position within a class system of dispositions that are common, but nonetheless the result is common schemes of perception, conception, and action. However, most of his discussion is about class dispositions, and the common experiences that shape them.

This empirical analysis suggests the importance of the meso-level of analysis in a theory of practical action. The meso-level of analysis focuses on the immediate social setting - the social group, the formal organization, the professional association - within which cognition and action take place. What this analogical comparison reveals is how organizational settings build upon and vary schemas derived from institutional logics, such that they become specifically tailored to practical activity in everyday life, reproducing universalistic symbol systems in the environment, but elaborating them locally in particularistic ways. This finding about the role of the meso-level of analysis suggests that instead of identifying *habitus* as social location, defined as history and experience shared by the same class, research and theory might better posit *habitus* as a product of *social location(s)*: Positions in multiple structures that cut across class as well as the trajectory of time, space, and history that typifies individual experience. Understanding cognition sociologically requires taking into account the fact that individuals belong to multiple organizations, both sequentially and simultaneously: Labor unions, families, gangs, business organizations, churches, sports teams, political groups, and so forth. This three case comparison shows that the social setting can reproduce collective beliefs to a greater or lesser extent. Different organizational settings are likely to vary in degree of institutionalization, allowing closer examination of variation and cultural persistence, and therefore the potential for agency and change.

Incorporating the meso-level renders Bourdieu's notion of the "system of dispositions" empirically more complex. For developing further a theory of practical action, taking the meso-level of analysis into account could be used productively to refine knowledge relevant to organization fields: How micro-processes produce social order and social change; what is the role of interests and intentionality; the nested relationship between culture, cognition, and practical activity. As a research strategy, a situated action approach, using qualitative methods and joining macro-, meso-, and micro-levels of analysis could explore several issues relevant

to institutional theory. First, studying interpretation, choice, and action in naturalistic settings provides the opportunity to view both the macro-level and meso-level contexts of choice, as they play out in individual and collective decision making. Second, it allows closer examination of activities of the elites - administrators and professionals - who use their power to determine the interests of the organizations they control. The Challenger data made possible not only situating the case within the larger economy and polity, but also attending to the "organization-enhancing behaviors of administrators," "opportunity fields," and "mental sets of organizational elites" (Brint and Karabel 1991: 345-52). Third, DiMaggio (1997) suggests that understanding the relationship between culture and cognition would be enhanced by work that distinguishes between socialization, experience, and history. These case studies suggest that the three are interconnected and difficult to separate, analytically. Research at the meso-level, in naturalistic settings, that specifically tries to untangle these connections while still acknowledging the role of larger symbol systems could be beneficial. Finally, a situated action approach that directs attention to the three levels of analysis could enable understanding of change because organizations sharpen and refine institutional logics. Disputes are a window into the social. By taking the organizational locus of practical activity into account, empirical work may begin to expose the contradictions both within and between organizations that Friedland and Alford posit are the source of change.

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NOTES

i. They review Garfinkel's ethnomethodology and Berger and Luckmann's phenomenology, two perspectives that began to shift social theory toward the link between culture and cognition. Garfinkel contradicted Parson's imagery of rational, reasoning individuals, instead explaining social order through the operation of cognitive processes that are preconscious, demonstrated in practical knowledge governed by rules only evidenced when breached, the ability of individuals to sustain encounters under difficult conditions, and retrospective interpretive capacity that orders and justifies actions after the fact by drawing on legitimating cultural accounts. Berger and Luckmann, in contrast to Garfinkel, connect individual cognition and meaning to institutions, both in the construction of institutions by individuals and the reciprocal relation between institutions and individuals that leads to habitualized actions.

ii. For details of the methodology, see Vaughan 1986: "Introduction" and "Postscript."

iii. For details, see Vaughan 1996: Chapter 2 and Appendix C.

- iv. This is a formal safety status for each technical component that must be conferred prior to each launch, based on engineering procedures that conform to NASA's "Acceptable Risk Process." J. B. Hammack and M. L. Raines, Space Shuttle Safety Assessment Report. Johnson Spce Center, Safety Division, 5 March 1981, National Archives, Washington, D.C.
- v. Scott brings to our attention the important but neglected work of Berger, Berger, and Kellner, The Homeless Mind (1973), in which they note that knowledge systems and cognitive styles association with bureaucratic administration include "beliefs in delimited spheres of competence, the importance of proper procedure, and impersonality" (1991: 166).
- vi. The logic of analogical theorizing legitimizes shifting units of analysis in this manner. See Vaughan (1992).
- vii. A requirement of analogical theorizing is that each case be analyzed, searching for a full explanation of the phenomena of interest. Then, the analyst compares the findings with some guiding theory or concepts that initially framed the investigation to see what has been clarified, discounted, or elaborated in the process. However, the role of culture in a theory of practical action was not a "guiding theory" behind the initiation of either of these projects. Instead, this question is imposed retrospectively.