Organization as Transaction Set (*)

İşlem Kümesi Olarak Örgüt

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Abstract

Over the years, sporadic efforts have been made to create grammars of social action, interaction, and organization. One of the attractions of grammatical representation is its generative capacities. First, we summarize the advantages of generative theories. We then outline a strategy for creating a grammar of organization that avoids the pitfalls of previous attempts. We then create two grammars of organization, one for transfer, and the other for exchange transactions. We discuss the work that institutions do in regulating transactions by relating them to the features of transactions that the grammars reveal. A grammar of organization is a medium for integrating micro and macro organization theory and for developing better and more testable theories of institutions and behavior. We demonstrate the advantages of thinking grammatically about organization theories by applying grammatical thinking to three well-known studies of organization.

Keywords: Organizational Form, Organizational Grammar, Microfoundations, Context of Organization Behavior, Agency-Structure

Özet

Yıllar içinde sosyal eylem, etkileşim ve örgüt için gramerler oluşturma konusunda düzensiz çabalar gösterilmiştir. Gramatik temsillerin cazip yönlerinden biri, onların üretken kapasiteleridir. Bu makalede ilk olarak, üretken teorilerin avantajlarını özetliyoruz. Ardından, önceki girişimlerin tuzaklarından kaçınan bir örgütsel gramer oluşturma stratejisini ortaya koyuyoruz. Daha sonra, biri transfer işlemleri diğeri değişim işlemleri için olmak üzere iki örgüt grameri oluşturuyoruz. Bu gra-

(*) This paper originates from a draft of the grammar written by Jerry Salancik in March, 1992. The grammar must be understood in the context of Huseyin Leblebici and Jerry's efforts to construct a generative theory of organization at that time. Huseyin was a co-author of that draft. An earlier version of this paper, also co-authored with Huseyin, was presented at the Management Theory Conference in San Francisco in September, 2013. The original draft consisted primarily of the grammar itself and the section titled "The internal control of organization". I have made minor changes to those parts of the paper, focused on technical aspects of the grammar. The front end, the applications, and the discussion sections are mine, with some help from Huseyin. While I have tried to be as true as possible to Huseyin and Jerry's original intent in re-writing and adding to the grammar, their input would certainly have made the paper different – and better.

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merlerin ortaya çıkardığı işlem özelliklerini ilişkilendirerek, kurumların işlemleri düzenlemedeki rolünü tartışıyoruz. Örgüt grameri, mikro ve makro örgüt kuramını entegre etmek ve daha iyi ve daha test edilebilir kurumlar ve davranış kuramları geliştirmek için bir araçtır. Örgüte dair iyi bilinen üç çalışmaya gramatik düşünmeyi uygulayarak örgüt kuramları hakkında gramatik düşünmenin avantajlarını gösteriyoruz.

Anahtar Kelimeler: Örgütsel Form, Örgütsel Gramer, Mikrotemeller, Örgütsel Davranışın Bağlamı, Eyleyen-Yapı

Our grammar of organization was originally conceived as a contribution to the discussion of organizational form that engaged the new institutionalism, population ecology, and transaction cost economics in the 1980s and 1990s. The idea was to move that discussion to one about forms of organizing. The concept of organizational form has been defined in various ways: as configurations (Mintzberg, 1979), as standard types like functional, divisional, and matrix, specialist and generalist (Hannan & Freeman, 2011), or M-form and U-form (Williamson, 1975). These theories of organizational form have in common that they are descriptive theories; they are abstract descriptions that explain form based on purported forces, strategies, or logics to which they are an outcome. In contrast, forms of organizing are defined on the transactions that constitute a transaction set. Based on transactions, it should be possible to represent the various ways an activity can be organized. For instance, a length of woolen cloth to be sold in the market involves the carding of the wool, spinning, dying, and weaving, and has been produced using craft production based in a family unit, a putting-out system, and a firm. If a grammar of organization can be worked out, the transformation of one into another form for organizing activity could be represented. It could also represent forms of organizing that, while possible, may never have appeared. Given this representational capability, the relative strengths of various theories concerning costs, risks, norms, conventions, and technological change could be tested in relation to these forms and the absence of some possible forms. In other words, the theories about the motivations and institutions that underpin organized action could be compared, and the role of technological change addressed.

We theorize organization as the acts in a sequence of transactions and represent the theory as a formal grammar. Following Barnard (1938) and Weick (1979), we assume that actions rather than people are organized and that these actions involve transactions of goods. If the physical world is defined broadly enough, as it is here, no social interaction can occur without the involvement of

things. The objects involved in organizational life are not just the artifacts that have appeared in the organizational technology literature (e.g., Orlikowski & Scott, 2008). We broaden this definition to include anything that can be "put down" by one actor and "picked up" in a transaction by another. Thus, radio broadcasts and information of all sorts, as well as labor services, are included. Although we have a broad definition of the material, the focus of our grammar is narrow. How does the fact that action is embodied affect the organization of collective production? Goods vary and their differences affect the organization of their production and the transactions involved. However, we present our grammar in the context of a generalized economic good: a good that is both discreet and alienable.(*)

The approach taken in this paper to address how what we do affects the organization of its doing is best explained with an analogy. The workings of a personal computer have three levels: the hardware, the operating system, and the application levels. The hardware consists of paths and switches activated by a pulsing current. The electrical pulses will take one path or another depending on the operating system's translation of application-level inputs. The hardware level is a constraint to which operating systems and applications, in turn, have to conform. If, in this analogy, we view organizations as ordered sequences of transactions, the hardware of the organization is the pathways that transactions may take among actors, the electronic pulses are the goods transacted, and operating systems are institutions that guide and motivate behavior. Applications are the participants' behaviors as they make choices about the paths of pulses by turning switches on and off guided by the operating system. Just as a pulse moves through a microchip according to the changing inputs of an application mediated by the operating system, goods move through an organized system according to the desires and actions of the parties involved, mediated by social structures or institutions. We present below a theory of the hardware of purposive social behavior. Only with a clear and proper understanding of the constraints that the physical world puts on the possibilities for productive social organization can we gain a clear understanding of the institutions that guide and the behaviors that activate

(*) People's actions in transferring goods among each other are often subject to the peculiarities of the labor exchange and its many forms. The exchange of labor – an inalienable good that is neither countable nor measurable - for money - an alienable good that is both - is fraught with difficulties. Solutions to these difficulties are a significant part of the social structure of production systems; they are the institutional structure that coordinates collective productions. The transfer and exchange of discrete alienable goods is the most straightforward system, hence our focus. We touch on the labor exchange indirectly when discussing the internal control of organization.

it. The grammar we present answers the question: What does the hardware consist of, and how is it structured?

Why a Grammar of Organization?

There are three interrelated reasons for believing that the grammatical theorizing of organizations may be fruitful. First, it provides a foundation for integrating "macro" and "micro" organization theory. Second, it improves the comparison and testing of alternative explanations of organizational phenomena. Third, by defining possible alternatives, it is a new approach to organization design.

The Micro-Macro Divide

Our grammar defines organization in a way that allows institutions and actor behaviors to be related to one another and to the achievement of collective outcomes. We propose that our solution to a problem that dates to the field's earliest days, that of how "organization" can be precisely and usefully conceptualized is, in turn, the solution to two more recent problems. Current interest in microfoundations, institutional entrepreneurship, and institutional work in the institutional literature indicates a difficulty in linking institutional dynamics and functioning to individual action and discretion. Furthermore, for at least the last 30 years, there have been periodic calls in the organization behavior literature for more attention to be paid to the organizational context (Banburger, 2008; Cappelli & Sherer, 1991; Johns, 2006; Mowday & Sutton, 1993; Rousseau & Fried, 2001).

The grammar provides a context theory, not in the sense of a theory of the "surrounding phenomena or temporal conditions that directly affect lower level phenomena" that Banburger (2008) advocates, but as a theory of the substratum of social action. By this, we mean that in defining how collective outcomes may be produced and how that production may go wrong, it provides a theoretical definition of a situation in Stinchcombe's (1991) sense: it describes the structure and boundaries of the organizational phenomenon being studied. Whether viewed as "substitutes for leadership" (Kerr & Jermier, 1978), as HRM practices, as working rules (Leblebici, 1985; Leblebici & Salancik, 1982), or as law (Commons, 1924), much of the work to ensure that transactions are completed is done invisibly and seamlessly by institutions. Some of this work is done through the costs they impose on different courses of action and the motivational effects of resource distributions. Nevertheless, actors' commitments and identities signifi-

cantly affect how they process information and react to situational constraints. The context of organizational behavior is the interdependencies that constrain the possibilities for organized action and the institutions that guide and motivate the actions taken. It is they that make organized behavior organizational.

Our grammar provides a set of concepts and their interrelations, a language that joins behavior to institutions and institutions to behavior in the analysis of collective production. By defining the constraints that the physical world puts on the organization of collective action, our grammar defines what behaviors are required and the work institutions do in constraining and motivating actors' decisions and generating desired outcomes. Hence our grammar provides a medium through which the interplay of institutions and motivations can be better understood in the everyday activation of organized systems. Relating behavior to a grammatically defined organizational context is one way of moving organization studies forward to a more unified understanding of our subject matter.

Generative Theory

The second reason for believing that theorizing organization grammatically might be fruitful is that it provides a generative alternative to descriptive theorizing. Much of organization theory is descriptive; dimensions or attributes of organized activity systems are isolated, abstracted, and related to one another. Yet these are produced by managerial policies and behavioral conventions. It is difficult, if not impossible, to infer rules or policies from detailed descriptions of the complex systems that they generate (Ulam, 1962). Salancik and Leblebici (1988) critique the organizational literature, and Barth (1966) does the same for the social anthropology literature from this point of view. We direct the reader to those papers for a more detailed rationale.

In summary, the argument is that past perspectives have focused on theoretical description and hence are written to account for known variations. "At best, theories written to account for known variations can say nothing more about organizations than is already known. And to the extent they are based on accurate accounts of existing variation, they are untestable and cannot be falsified, because any proposition already incorporates the variation it seeks to explain" (Salancik and Leblebici, 1988). By defining the possible ways that an activity can be organized, the grammar is the foundation of a generative approach to theorizing social organization. If the grammar properly represents its subject domain, it will

generate arrangements of its lexicon that should be possible to realize but do not yet exist. Here a chemical analogy might be appropriate. With knowledge of the properties of the elements, covalent and ionic bonding properties, a chemist can generate and produce molecules that do not exist in nature and predict which might be stable. Armed with a grammar of organization, a researcher may generate alternative forms of organizing that should be possible but do not now exist. By doing so, the researcher can produce counterfactual hypotheses to explain the presence and absence of different forms of organizing or the prevalence of some over other extant forms.

Organization Design

The flip side of counterfactuals in scientific reasoning is the generation of designs for social organizations that may better fit our needs and desires. Once we have a theory of how embodied actions are bound to one another, we can better represent how the problems of organization relate to institutional solutions. An organizational grammar is a way of imagining a world unconstrained by institutions. It can guide us in imagining alternative institutions and judging whether they might be stable or unstable. Our grammar can represent all the possible ways a particular activity can be organized and the ways that the organization of the activity may fail. Unconstrained by institutions, the probability of failure is both high and quantifiable using our grammar. Six-sigma reliability, in this light, is the result of institutions that tightly constrain and motivate action. A grammatical representation of organization as a sequence of embodied actions in a transactions set provides diagnostic leverage. Combined with the generative capacities inherent to grammar, this is the basis for an approach to organization design that more systematically suggests alternatives.

Concepts, Problems, and Precedence

Before proceeding with the construction of the grammar, three issues need to be addressed. The first concerns the scope of the theory, and how we conceptualize actors (agents) and institutions. Second is the grammar's relation to previous attempts to construct a grammar of action and organization. By conceptualizing the problem differently, our grammar overcomes problems that stymied previous attempts. Third, we present a summary of the work this paper builds on, as it was done over thirty years ago and is probably unfamiliar to the reader.

Scope and Concepts

Scope – Our proposal is not a theory of organization*s*. Rather, the term "organization" in our title refers to the state of things in relation to each other. A cupboard, a desk or an academic paper can be well organized in this sense. Organization in the context of a transaction set refers to relations among elements in a production sequence. Hence, the organization of a sub-unit where a production sequence fulfills a production order, *an* organization where the organization's outputs are exchanged for cash, and an interorganizational field where the products of widely dispersed actors in a supply chain are disposed of in a final exchange with a customer, are all analyzable using our grammar. As Perrow (1967) points out, work processes are the foundation on which organizational structure is built. A theory of work processes is vital to any broader theory of *an* organization. Hence, the term *organization* differs from *an organization* or *organizations.* The former refers to a state; things can be organized or disorganized. This is the way that the term is used in the title to this paper. The latter two terms refer to entities.

Leblebici (2000) makes this clear. His conception of an organization includes not just the "Rules of Causal Order" – our grammar – but also rules of allocation, membership and discourse. Management also has a defining role, (Leblebici & Salancik, 1989). The grammar we present is hence both broader and shallower than a theory of organizations. It is applicable to a broad range of organizational phenomena, but it excludes other elements that are required for any comprehensive theory of organizations and their managers as functional and political actors. Furthermore, the focus in this paper is on production systems, or the operations side of organizations. It is these production systems that generate the economic surpluses that underwrite organizations as social and political actors that affect the distribution of resources in society.

Concepts - Leblebici and Salancik were inconsistent in their use of terms. We take "Allocation of Rights and the Organization of Transactions: Elements of a Generative Approach to Organizing" Leblebici (2000) as the standard. Here, Leblebici argues that four kinds of rules are required to constitute an organization: *Rules of causal order* describe the constraints the material world puts on transactions, *rules of membership* specify who may participate in a transaction, *rules of allocation* allocate the rights and obligations of members to act, and *rules of discourse*, akin to organizational culture or ideology, confer meaning on actors' actions and justify them. So in their radio study (1991) the term *institutions* encompasses *rule of discourse* as well as *rules of allocation*. Their use of the term

rules of discourse in Salancik & Leblebici, (1988) includes *rules of discourse,* as well as *rules of allocation*. In the present paper, *institutions* are equivalent to Leblebici's *rules of allocation*, and the *rules of membership*. We use the term institutions as shorthand for both types of rules because our focus is on the *rules of causal order* – the grammar.

In various papers Leblebici and Salancik refer to Commons (1924) in discussing rights and obligations, and their role in stabilizing inherently uncertain transactions. But we are also sympathetic to more recent treatments of social rules. Crawford and Ostrom (1995) as well as a Critical Realist view of institutions as cultural rules (Porpora, 1993, 2015) do two things. First, they conceptualize institutions as allocating rights and obligations to act, and second they juxtapose a conception of institutions to agency. Agency begins when action is intentional. Following Porpora (2015), intentionality is inherent to conscious thought. One need not be attentive to be purposeful; but one does need to be conscious. A related point is made by Cardinale (2017) in the institutional literature. So the actions of the participants in a transaction are intentional, they are purposeful adaptations to the physical constraints taking into account the institutions that allocate rights and obligations. Both actors and institutions are real. Actors are often deliberate and, when conscious, always purposeful. Institutions are objective and causal. Hence institutions limit actors' capabilities, while technology, by affecting constraints in the physical world, expands them (Lawson, 2010; Salancik & Leblebici, 1988). Organizational change is the result of the interplay between these countervailing forces.

Solving Conceptual Problems

The idea that strings of actions, organizational processes, and routines may bear some resemblance to language is not new, nor is the idea that a grammar, the tool used in the structural analysis of languages, might fruitfully be applied to sequences of actions and interaction. Skvoretz and Fararo (1980) specify a formal grammar of social action and interaction. Salancik and Leblebici (1988) demonstrate how a formal grammar of organization could strengthen organizational theorizing in their analysis of restaurant transactions. Pentland (1992a) analyses the activities of a call center and shows how a limited set of actions - moves - describes agents' interactions and are constrained by rules. Pentland and Reuter (1994) developed this idea of a grammar of organizational processes to produce a grammar for the routines particular to software support hotlines. Drawing on

these and other sources, Pentland (1995) discusses how the elements of a language grammar – lexicons, rules of grammar, and sentences - might look in a grammar of organization. These contributions have taken the language/organization resemblance literally and are motivated by the hope that formal grammars of organization can be constructed. However these efforts have not resulted in a coherent and concerted effort to develop formal organizational grammars.

The lack of progress may be due to the difficulties of applying grammars to organization. Pentland (1992b, 1995) argues that these difficulties come in two sorts: The lexicon of social interaction is not universal, and people do not follow rules. Constructing a formal grammar of organization requires an organizational equivalent to a language's words, rules, and sentences. Furthermore, these must apply to all forms of organizing. Also, if a grammar of organization is to be viable, it must avoid the difficulties that attend any conceptualization of people as social rule followers. Somehow, the rules which relate the lexical units of an organizational grammar to one another must be independent of the reflexive deliberations of actors. These problems can be overcome by analytically separating behaviors from people, organization from agents (Barnard, 1938; Weick, 1979), and by viewing organizations as goal-oriented (Aldrich, 1979).

Lexicons, Rules, and Collective Action

Language grammars generate sequences of words. These sequences are constrained by the rules of the grammar so that only valid, well-formed sequences – sentences – are generated. For a grammar of organization to be possible, equivalents of both the words and the rules of a language grammar have to be found. Also, some criterion, equivalent to a sentence, must be found to determine if a sequence of actions generated by an organizational grammar is well-formed or valid. As Pentland (1992b, 1995) notes, an organizational grammar's equivalent of a language's words must apply to all organizations, and the rules that relate these "syntactical constituents" to each other must be invariant.

Past attempts at constructing grammars of organizations have taken the behaviors or actions of people to be the basic lexical unit. While differing in their approach, Skvoretz and Fararo's (1980) "actions," Salancik and Leblebici's (1988) "acts," and Pentland's (1992a; 1994) "moves" all focus on the actions of actors with respect to other actors. An action, an act, or a move invites another party to act in turn. This focus is well-placed because organization results from inter-

locked behavior (Weick, 1979). However, a difficulty arises: Of the observed behaviors, which are to be considered part of the lexicon and which are not?

Diverse perspectives in the recent organizational literature use the term "practice" to refer to stable or repetitive organizational behavior, precisely the phenomenon whose pattern a grammar seeks to represent. The New Institutionalism gained prominence in the early 1990s. Yet, in the Handbook of Organizational Institutionalism, the terms behavior and practices are used interchangeably, and although the term appears in most contributions between its covers, "practice" is not listed in the index of the 800-page volume's first edition, nor is behavior (Greenwood, Oliver, Sahlin, & Suddaby, 2008). The new institutionalism is interested in how practices become institutionalized or deinstitutionalized, not in the practices themselves or the work they do in organizing. Practices in the institutional literature are undifferentiated activities performed in an organizational context. The term is also used in studies of routines (e.g., Feldman, 2004) and technology in organizations (e.g., Orlikowski, 2000). Again the interest is not in finding similarities and differences among practices, but in understanding processes, in these cases of change and structuration. In each of these perspectives, practices and behaviors are viewed as so variable and context specific that there is little hope of finding commonalities among them.

A similar problem arises when we attempt to define the rules that would relate the elements of a lexicon one to another into valid sequences. What is a valid sequence of actions? What kinds of rules would be necessary to generate valid sequences and only valid sequences? Institutional theory, studies of technology and routines are of little use. Rules are local, embedded in scripts, and dependent on the meanings actors associate with their context (e.g., Orlikowski, 2000; Pentland & Feldman, 2007). Alternatively, they constitute a broad institutional logic associated with organizational fields (Scott, 2001). Not only are rules not universal, but they are also subject to interpretation and strategic action. How people interpret rules determines whether and how they follow them, and people violate rules strategically and invent new rules (Pentland, 1995). Since grammars are "deeply structuralist and objectivist in orientation" (Pentland, 1992b), how can the fluid, changing reality of social organization, where interpretations, decisions, and actions intertwine, be grammatically analyzed? If rules can be strategically violated or changed, how can rules determine behavior in any important way? How can an analytical orientation that is so objectivist and structuralist possibly order the subjectively motivated and variably enacted organization of collective action?

In this abbreviated discussion, as it moved from questions about behaviors, practices, and actions to questions about the relationship between rules and actions, an interesting thing happened: actors appeared with their interpretations and decisions. Their interests and contexts entered the scene to undermine any possibility of conceptualizing actions and rules in a way that would make them tractable to grammatical theorizing. Developing an organizational grammar becomes tied to the relationship between social actors and rules. The question that has vexed sociology for decades, of the relationship between agency and structure, bars the path to the development of an organizational grammar.

The lexicon in our grammar is also a set of actions. However, unlike previous efforts to build grammars of organizations, these actions do not reference other people as "escalate," "refer," and "quick question" (Pentland, 1992a), and "serve" and "pay" do (Salancik & Leblebici, 1988). Instead, they reference objects. By building our grammar on actions that reference objects, the rules that relate actions to one another are no longer burdened with determining human social behavior. Specifically, your ability to pick up an object depends only on my having put it down, not on any utterance, behavior, intention, or understanding that you or I may say, do, or have. You do not reference me in any way that could be called social; in fact, you need not reference me at all. Behavior with respect to objects, sequenced in time and located in space, determines success in collective action. At this level, actors are like spies coordinating action through a dead drop. They are unaware of each other's presence, identity, and motivations, yet action is nonetheless organized as each acts at the prescribed place and time.

While it may at first seem that we have solved the problem of building a grammar of organization by making it irrelevant to actors' motivations and social institutions, this is not the case. All purposive organization involves transactions, and it is only in relation to these transactions that motivations and institutions become organizational and can be analyzed and understood organizationally. Located in the natural and technological world, ours is a grammar of organization, not of social interaction. Its lexicon is a set of actions with respect to objects, not actors. It is intimately related to and provides a foundation for understanding and theorizing organizational behavior and institutions. However, it is not a theory of either.

Valid Sequences and Social Organization

Goals and outcomes are implicit in previous efforts to analyze organizations grammatically. In Salancik and Leblebici's (1988) grammar of restaurant transactions, the goal is for the customer to eat a meal and the restaurant to receive payment. In Pentland's (1992a; 1994) analysis of software support hotlines, the goal is to resolve the customer's problem or to close the call. Outcomes are essential for our grammar of organization for two reasons: They allow us to determine whether a sequence of actions is well-formed or valid - the equivalent of a sentence in a language grammar. And, when designated desirable, they are turned into goals and bring people and society back in since goals are unintelligible without intentionality.

For a sentence in a language to be well-formed, it must meet specific structural criteria. A sentence must have (at least implicitly) a subject, and it must have a verb. Outcomes are essential for the grammatical analysis of organization as they are the criteria for deciding whether a sequence or a routine is well formed. In discussions of routines, outcomes are often implicit. For instance, Feldman (2000), who uses the term organizational grammar metaphorically in her analysis, argues that routines change endogenously. She defines routines as "repeated patterns of behavior that are bound by rules and customs and that do not change very much from one iteration to another." Outcomes are absent from this definition, yet the triggers for endogenous changes she describes are all related to goals or intended outcomes. The challenge is to write an organizational grammar in which outcomes are defined within the grammar, and hence goals can be ascribed. Any sequence of actions that terminates with an outcome is valid or well-formed. When the sequence terminates in a goal, the sequence is also effective.

The second reason that goals are important is that they bring people back in. Specifying a grammar of organization that generates all the possible sequences of actions that accomplish a goal may be an interesting intellectual challenge, but it does little to advance our understanding of how *people* are organized. Sequences of actions only describe what must happen to achieve a goal. People must also produce those actions, in sequence. Motivations and institutions generate people's actions: they let people know what actions to take and bring about those actions. The many actions that constitute sequences of transactions are only potential until people choose which of the possible actions in a sequence to activate. The work of institutions and the motives of the actors can only be understood in relation to the organization of activity, as represented in a grammar. Like a

language grammar that can generate unintelligible sentences, our grammar of organizing can generate ineffective sequences of actions. Through their intentions or goals, human beings determine what an effective sequence is for them. Furthermore, it is in relation to these goals and intentions that sequences are chosen, and behavior is regulated.

Precedence and Terminology

This paper builds on Leblebici and Salancik's work done in the 1980s, in particular Salancik and Leblebici's 1988 paper, in which they define organization on a "transaction set". "A transaction set is defined on an exchange. It is the set of all acts necessary to effect a specific exchange. A transaction set thus includes at least the four acts that transfer goods and their associated rights and obligations. These are the minimum. A transaction set will contain additional acts depending on the need to transfer goods between agents within the transactions and the need to produce the goods to be exchanged. Goods may be entered into a transaction either as the result of a previous exchange or as a result of producing them within the transaction" (Salancik & Leblebici, 1988). Essential to the present work are the following:

1. Acts can be a part of a transaction between actors or a part of a transformative production process. Actors are what are organized. Hence, should a contiguous sequence of transformative acts be allocated to one actor in a production process, the transformative details are unimportant. The arrangements of acts in transactions among actors, not transformations, differentiate one way of organizing from another.
2. Transactions come in two kinds. A transfer transaction consists of one party putting an object down and a second party picking it up. An exchange transaction consists of two transfer transactions. Transaction sets are exchange transactions comprising sequences of acts in which the goods exchanged are produced in a sequence of transfers and transformations.
3. Putting down and picking up, the atomic acts in a transaction, are simply special cases of transformative acts. The transformation is to make a good available or unavailable.
4. The terms "act" or "action" in the context of our grammar do not denote anything that may be termed social. No intentionality is implied. Rather, their relationship to organization exactly parallels Weber's

(1968) distinction between "position" and "incumbent." Acts or actions are linked together and organized, just as positions are in a bureaucracy or on an organizational chart.

5. Actors can be individual or collective and are conceptualized analytically as having two distinct aspects. For the grammar of organization, actors are unthinking physical bundles of capabilities and actions. For the analysis of a social organization, actors are agents who choose what goals to pursue and pursue them.

6. Goals are outcomes that are desired or intended. Our grammar produces outcomes by unraveling sequences from a set of acts and a set of production rules. As a computational device, a grammar is indifferent to the outcome a sequence of acts produces. An interpretation of a sequence turns on the ascription of intentionality to outcomes. When outcomes become goals, they provide a fulcrum that generatively links the grammatical representation of interdependent acts to institutions and human behavior.

Constructing A Grammar

Creating a Lexicon

To construct our grammar, we need an explicit theory of a transaction. We begin with a simple transaction, a transfer of goods between two actors or parties. To model a transfer, we need to define the actions that effect the transfer. We assume two things are involved. One actor gives up possession of something, and another takes possession. We use two primitive and abstract representations for these actions, Aixo and Ajox. The capital "A" stands for action, while "i" and "j" stand for parties i and j, which are different. The symbol "x" represents the good or object transferred between them. In conjunction with the symbol "o," it indicates what each party does with the good to effect the transfer. The "Aixo" conjunction represents that party i put the object x down, and the "Ajox" conjunction represents that party j picks the object up. So the transfer is effected when i put x down and j picks x up. Putting down and picking up are used metaphorically to refer to giving up and taking possession of an object, or literally when the actions are physical.

But these actions are insufficient. We also need to relate them to one another and their associated capabilities since each party must be able to effect their

respective action. The first is not difficult; we assume that a capability associated with having an object is the ability to put it down, to give up possession. We represent this capability for i as Cixo, where the C stands for capability, and the i, x, and o means as they did when conjoined with A. We assume this capability exists at the start of any system organized to transfer a good between actors.

The ability of another party to take possession of an object is less apparent and requires an addition theoretical assumption. Unlike the previous case, we cannot simply assume the capability to take possession of an object exists at the outset of a transaction. If it did, there would hardly be any reason for transacting. The party could simply exercise the available capability and pick up the object, and no organized activity would be involved. It follows that the capability must be generated during the transaction. In particular, we assume that when one party puts down an object, that very act generates a new capability with respect to the object, and the other party can then pick it up. For the party j in a transfer of x, we represent this ability with Cjox and its associated action Ajox.

A Theory of Transfer

Coupling the two assumptions provides a basis for describing how transferring an object from one person to another is possible. The first person in possession of the object has the capability to put it down and, in doing so, empowers another person to pick it up, which transfers the object if he or she does so effectively. Constructing a theory from these simple assumptions requires that we recognize some important differences between the concept of an action and a capability. A capability is a state; in particular, it is a state of an actor regarding an object. On the other hand, an action is not a state but a production by an actor. The relation between the two is simple: Actions transform situations from one state of capability to another. These actions thus can be represented as transitions between states, as in:

where the actions on the arrows are productions that transform the transaction from one state of capability to another. The initial state is assumed to exist, with i in possession of x and able to put it into the transaction. Upon taking action, two changes alter the state of the transaction. The action enables j to pick the object

up, adding Cjox to the system's capabilities. However, i also loses the ability to put the object down, removing Cixo from the system's capabilities. When j does pick the object up by producing Ajox, the acquisition empowers j with a new capability, Cjxo, the ability to put it down, the same ability assumed for i at the beginning of the system.

The situation described still does not specify all of the transitions that can exist nor all of the capabilities being generated. Most obviously missing is i's own ability to pick x up once it is put down. There is no reason from our definitions to suggest that once a good is put down by one party, that party cannot pick it up again. If you have ever canceled a check or had a car repossessed, you know such things occur. Hence the second state expands to a set of two capabilities, {CioxCjox}, which ascribes to both parties an ability to take possession of an object. This additional capability then enables an additional action, namely Aiox. When implemented, the action moves the transaction back into the first state {Cixo}.

Similarly, the current description of the system is incomplete as it ignores the possibility that once j has taken possession of x, producing the state {Cjxo}, j could take the associated action Ajxo and return the transaction to the second state {CjoxCiox}, from which it could again move to either the first state or the last. We now have a more complex system and one that is more representative of organizational realities, which are not necessarily nicely ordered linear paths from start to finish but are potentially fraught with mistakes, wrong turns, and seemingly useless activities. Figure 1 is the complete description of the transaction.

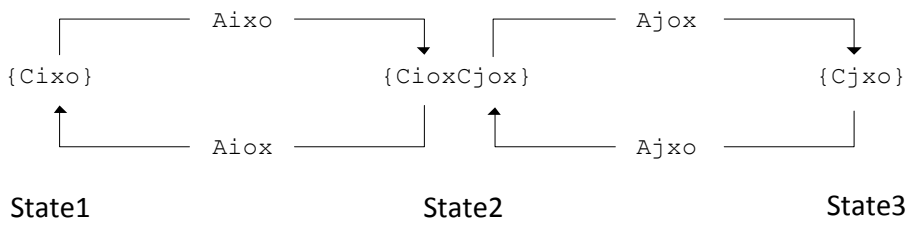


Figure 1. Organized System for Transferring a Good

We want to point the reader to a few features that relate this representation to important concepts in organizational theory. The direct correspondence between the productions from any state of the transaction and the state itself

should be noted: Cixo, through its corresponding action, Aixo produces the new state. Actions are limited to those for which capabilities exist. This result has two consequences. First, note that actions are associated with particular parties in the transaction. Organizational activities are not attributed to abstract entities but to individual actors. The organization and structure of these individual productions come about because the individual's actions depend upon their capabilities and affect the capabilities of others. Thus, while residing in individuals, capabilities and actions are organizational properties. They only exist because the parties' actions are organized. Capabilities, not descriptive attributes, differentiate one form of organizing from another.

Second, readers may notice that our specifications of the relations between actions and capabilities precisely define the interdependencies existing within an organized system of activities. Even in this small system, we see two of the interdependencies that Thompson (1967) recognized. A sequential interdependence exists between the parties when the transaction is in its first leftmost state. Party j can do nothing until party i does something, a condition that defines a sequential dependence. However, a pooled interdependence exists when the transaction moves into its second state: one party can do something only if the other party does not do something else. If party j implements its capability by producing Ajox, then party i will be unable to produce Aiox since the transaction immediately enters state {Cjxo}. Analyses of organizations, with Weick's (1979) being an exception, typically attribute interdependence to units of organizations and fail to reflect the fact that interdependencies may continuously change as participants take actions that affect each other. Yet, these interdependencies are precisely what produce some of the structure in organized activities. The remainder is produced by coordination.

The reader may also note that we have said nothing about the motivations of the actors participating in this transaction. This is not because we consider motivations unimportant. Indeed they are essential to the stability and instability of transactions. What happens happens because of the participants. They can implement or not any action they are capable of at any time. If motivations direct them to act in some ways rather than others, activities will organize in particular ways as a result. A theory of how individuals behave in interdependent systems is thus essential for describing the behavior of the systems. We exclude the issue from our discussion at this time solely to serve our goal of constructing a theory about the structure of organized activity.

A second important and purposeful exclusion from our description is the role institutions play in regulating transactions through an orderly production of their desired states. As with motivations, we believe institutions are essential to organized activities. Indeed, we believe institutions, policies, and other management practices are created precisely to coordinate the actions of individuals in organized relationships (Leblebici & Salancik, 1989; Leblebici, Salancik, Copay, & King, 1991). Most such institutions are transparent and seamlessly do their work. In the present case of transferring goods between i and j, we would expect that institutions will exist to ensure that party i will indeed take the action it is capable of taking with the system in State-1 and that other institutions exist to discourage i from taking action it is capable of when the system is in State-2. Comparable regulations or institutions would work to get party j to act appropriately. A common institution for coordinating both parties in appropriate ways is the job assignment, whereby a job description prescribes each party's allowable actions. However, we do not discuss this or other institutions at this point, for it would distract from our purpose, Yet, they are critical for the internal control of the organization. Indeed, one of our motivations for representing organized activity as a grammar was to represent its structure precisely enough so that the places where institutions do their work in coordinating actions would be well defined. Once theories about the structure of organized activity are in hand, we do not worry about being able to append theories about the behavior of individuals in the structures.

A Grammar of Transfer

These caveats aside, we now define the grammar of a transfer as a prelude to demonstrating its potential for describing the structure of complex, organized activity. The system in Figure 1 is a kind of finite state automation or machine (FSM). The states are subsets of capabilities available in the transaction. The actions are production functions that move or transform the system from one state of capability into another. We use an FSM to represent the activity structure to exploit a well-known relationship between these state machines and certain grammars.

To construct a grammar from the machine for a transfer, we need only say what the states for starting and terminating are and translate the arcs and the states of Figure 1 into rules. Naming a stopping state is easy since we seek to con-

struct a grammar for representing an activity organized to achieve some purpose of the organization (Aldrich, 1979). Thus, a stopping state for a grammar of a transfer should be State-3 in Figure 1. We also add State-1 since transfers can abort with the initiating party keeping the object or putting it elsewhere. State-2 is not a stopping state as we assume that some actor must end up with the object. A starting state is also easy for our case since we had to assume specific capabilities existed at the start of a transfer, namely State1 in Figure 1.

The grammar T for a transfer is thus defined as T = (A, C, P, S), where A is the set of actions, including the empty action, ε, (terminal symbols). C is the set of system states (nonterminal symbols), P is the set of production rules relating actions to states, and S is the start symbol and a member of C.

Table 1. A grammar for a transfer

T = {			
	A ={Aiox, Aixo, Ajox, Ajxo, ε },		
	C ={Cixo, Ciox, Cjxo, Cjox, CioxCjox, S),		
	P ={		
		[1] S	→ Cixo, [initial condition]
		[2] Cixo	→ ε, [terminal condition]
		[3] Cixo	→ Aixo CioxCjox,
		[4] Cjxo	→ Ajxo CioxCjox,
		[5] CioxCjox	→ Ajox Cjxo,
		[6] CioxCjox	→ Aiox Cixo,
		[7] Cjxo	→ ε [desired terminal]
	},		
	S}		[Start symbol]

Each rule in the production set specifies how a particular nonterminal symbol (on the left side of the arrow) translates into a string of one and only one terminal symbol and zero or more nonterminal state symbols from our FSM (on the right side of the arrow). The symbol ε, epsilon, is an empty terminal symbol that represents no action is produced. The rules are applied by substituting the right-hand side of the rule for a given nonterminal symbol whenever that symbol appears in a string to generate a transfer sequence. A valid sequence is generated by applying production rules until the translation contains only terminal sym-

bols. Since the terminal symbols represent actions produced by parties to the transaction, a non-empty sequence is always an organization of activity for reaching a terminal state from the initial state defined for the transaction. Applying rules 1, 3, 5, 4, 6, and 7, for instance, results in the following translations into the terminal sequence Aixo Ajox Ajxo Ajox:

Rule	Translation	
1	Cixo	
3	Aixo CioxCjox	[substituting Cixo]
5	Aixo Ajox Cjxo	[substituting CioxCjox]
4	Aixo Ajox Ajxo CioxCjox	[substituting Cjxo]
6	Aixo Ajox Ajxo Ajox Cjxo	[substituting CioxCjox]
7	Aixo Ajox Ajxo Ajox	[substituting Cjxo]

We call any valid arrangement of terminals of a grammar of organization that terminates in a desired state an effective arrangement of the transaction and any that does not an ineffective arrangement. We call any non-empty arrangement that terminates in a state with minimal production a minimal or efficient production. Alternatively, efficient production is a sequence produced with the system never being in any state more than once. An efficient and effective arrangement for the grammar for a transfer is Aixo Ajox; a minimal ineffective production is Aixo Aiox. For this grammar, these are the only efficient arrangements.

The reader will probably have noticed that our terminating conditions appear arbitrary. They are. Had we not included Rule 2, we would have constructed a grammar representing only effective transfers, each terminating with the good in j's possession. By modeling an organization of activity so it produces inefficient and ineffective results, we can evaluate why undesired outcomes may arise and take steps to limit their possibility. Admittedly in this simple system, the problems are apparent. However, they nonetheless model problematic aspects of an organization. Bottlenecks, unwanted inventory build-ups, "dropping the ball," SNAFUs, and "passing the buck" all describe or are the outcomes of ineffective transfers.

A Grammar of Exchange.

One might think that generalizing from a transfer to an exchange merely adds a new production function S → Cjyo to the definition of T since an exchange is

composed of two transfers. While some exchanges are simple conjunctions, such as Aixo Ajox Ajyo Aioy, all are not.

Two complications arise in merging systems. One is that the set of initial conditions from each system must first be combined. Thus, if an exchange is two reciprocal transfers, the capabilities required for each, Cixo and Cjyo, form the state CixoCjyo as its initial conditions. S → CixoCjyo would be the start production asserting that for an exchange to occur, two parties must be able to put goods into transaction. An exchange can move from this initial state into a new state if either one of two actions is taken, Aixo or Ajyo.

The second complication arises at this point. To what state would the transaction move if one party acted first? Suppose party i did, producing Aixo. By the meaning given to this action, the good x will be made available to either party i or j. Hence the system will move into a new state containing at least two capabilities, Ciox and Cjox. But what should be done with the capability Cjyo, present in the initial conditions but not required for the action Aixo? Since it is not involved in the action Aixo, this capability should still be among the system's capabilities. It must be, by the definition of an exchange**.** It follows that the actual state of the system after Aixo would be CioxCjoxCjyo. Similarly, had the exchange begun with Ajyo, the resulting state would be CioyCjoyCixo.

Assumptions about the effects of actions on the capabilities of a system are the heart of any theory of organization, for they define the system's interdependencies precisely. Actions that deplete capabilities produce pooled interdependencies, and actions that create capabilities produce sequential interdependencies. Since interdependencies structure activity, it should be evident that any theory of organization is entirely determined by its assumptions about the effects of actions on capabilities and assumptions about a system's initial capabilities. Knowing only the initial capability of the organization, the actions taken from the initial state, and their effects on the next state of the system, we generate the production rules for exchange and present the full grammar in Table 2, with four terminating conditions. The grammar is entirely defined by the set of actions, the set of states, the set of productions, and the start symbol S. The resulting grammar E is a regular grammar and can also be represented as an FSM. We illustrate the machine for an exchange in Figure 2.

Table 2. Grammar for an Exchange

E={
A = {Aixo, Ajyo, Aiox, Ajox, Aioy, Ajoy, Aiyo, Ajyo, ε},
C = {CixoCjyo, CioxCjoxCjyo, CixoCioyCjoy, CioxCjoxCioyCjoy, CjxoCjyo, CixoCiyo, CjxoCioyCjoy, CioxCjoxCiyo, CjxoCiyo, S},
P= {

[1] S	→CixoCjyo	
[2] CixoCjyo	→Aixo CioxCjoxCjyo	
[3]	→Ajyo CixoCioyCjoy	
[4] CioxCjoxCjyo	→Aiox CixoCjyo	
[5]	→Ajox CjxoCjyo	
[6]	→Ajyo CioxCjoxCioyCjoy	
[7] CixoCioyCjoy	→Aixo CioxCjoxCioyCjoy	
[8]	→Aioy CixoCiyo	
[9]	→Ajoy CixoCjyo	
[10]CjxoCjyo	→Ajxo CioxCjoxCjyo	
[11]	→Ajyo CjxoCioyCjoy	
[12]CioxCjoxCioyCjoy	→Aiox CixoCioyCjoy	
[13]	→Ajox CjxoCioyCjoy	
[14]	→Aioy CioxCjoxCiyo	
[15]	→Ajoy CioxCjoxCjyo	
[16]CixoCiyo	→Aixo CioxCjoxCiyo	
[17]	→Aiyo CixoCioyCjoy	
[18]CjxoCioyCjoy	→Ajxo CioxCjoxCioyCjoy	
[19]	→Aioy CjxoCiyo	
[20]	→Ajoy CjxoCjyo	
[21]CioxCjoxCiyo	→Aiox CixoCiyo	
[22]	→Ajox CjxoCiyo	
[23]	→Aiyo CioxCjoxCioyCjoy	
[24]CjxoCiyo	→Ajxo CioxCjoxCiyo	
[25]	→Aiyo CjxoCioyCjoy	
[26]CixoCjyo	→ ε	
[27]CixoCiyo	→ ε	
[28]CjxoCjyo	→ ε	
[29]CjxoCiyo	→ ε	[Desired result of exchange]

},
S}

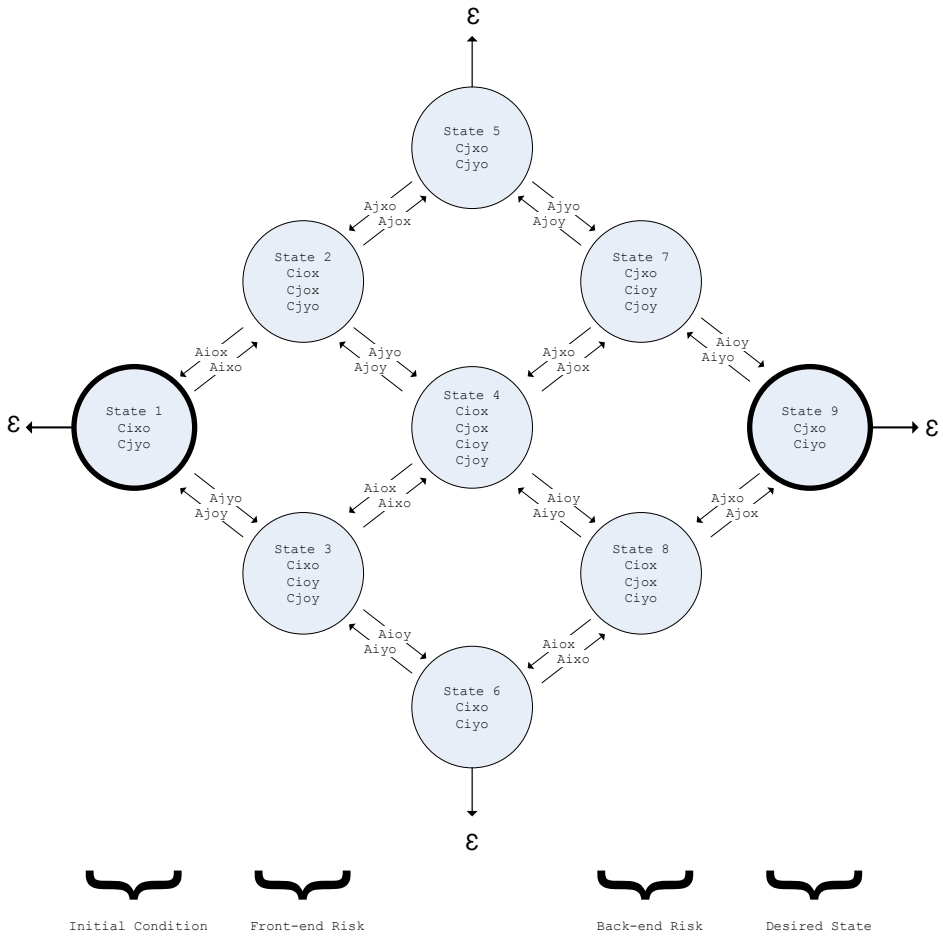


Figure 2. Machine for Exchange

While only one minimal effective production existed for a transfer, six translations of E are efficient and effective arrangements for an exchange:

Aixo Ajyo Aioy Ajox	{Rules 1,2,6,14,22.29}
Ajyo Aixo Aioy Ajox	{Rules 1,3,7,14,22.29}
Aixo Ajyo Ajox Aioy	{Rules 1,2,6,13,19,29}
Ajyo Aixo Ajox Aioy	{Rules 1,3,7,13,19,29}
Aixo Ajox Ajyo Aioy	{Rules 1,2,5,11,19,29}
Ajyo Aioy Aixo Ajox	{Rules 1,3,8,16,22,29}

Effective arrangements terminate with each party possessing the good brought to the exchange by the other party. Ineffective arrangements terminate with each party having the good she or he began with or with one party possessing both goods. The last two arrangements in the list could have terminated, with one party having both goods after the second action. The first four arrangements could terminate in similar states after the third action. Given these possibilities and the possibility that exchanges could terminate at the initial state, inefficient or ineffective arrangements appear more likely than efficient and effective arrangements.

But how likely? An answer to this question is not derivable from the grammar itself. The grammar E is a theory of the structure of activity in exchanges. It is not a theory of the behavior of such systems. However, by knowing the structure, we can speculate how such systems might operate by speculating about the parties and their behavior.

We might speculate how such systems would look if actions were random and equally likely. Then, for every state in the system, productions from that state to another would be proportional to the number of productions from that state. For an exchange in Statel, with its three possible productions (Aixo, Ajyo, ε), a sequence starting with Aixo would have a probability of 1/3. The sequence Axio Ajyo Aioy Ajox would have a joint probability of 1/3 * 1/3 * 1/4 * 1/3 * 1/3 = 1/324. Summing across all minimal effective sequences indicates that the probability of an efficient and effective exchange occurring is less than 1/49, which suggests that smooth exchanges would be uncommon if left to chance.

The Internal Control of Organization

Assuming that the real-world probability of an exchange being efficient and effective is greater than 1 in 49, we might speculate about what facilitates their successful completion. Again, a theory of the structure of activity, such as the grammar E, is helpful. If a grammar describes a system accurately, its problematic features will be easier to identify, as well as the opportunities for constraining behavior in particular directions. In exchanges, these situations exist whenever one party can take action that would put the other party's interest at risk. Two kinds of such risk arise in an exchange. One kind is the front-end risk that occurs when one party has put his or her good into the exchange, but the other party has yet to do so. This risk exists in State 2 and State 3. For instance, in State 2, party j

could take possession of x, putting i at risk, for the system would move to State 5, where it may terminate with j having both goods. Another kind of risk is a back-end risk, which arises later in a transaction, when one party has taken possession of its desired good, but the other party has yet to do so. These risks exist in State 7 and State 8. In State 7, a party j could reclaim the good that he had put into the exchange, moving the system to State 5, where it may again terminate with j having both goods and i having nothing.

How likely are these risks? Well, again, the answer depends on a theory about the participants. If the behaviors of people in an exchange were regulated solely by their self-interests in acquiring each other's goods, the exchange would always end with one party possessing both goods and the other with nothing. We invite readers who might think otherwise to play a game, the entry requirement being a hundred-dollar bill that is to be put down on a table simultaneously with a like bill from an opponent. After the bills are put on the table, either party can pick up as many as possible. We recommend readers be leery of an opponent who says, "Now, be assured, I will put my hundred down exactly at the same time you do."

Given the potential for unsuccessful transactions, one might expect that institutions will have evolved to coordinate participation in the exchange. One practice to encourage effective exchange would be simultaneity. The grammar makes it clear that if parties acted simultaneously at the outset, the transaction would immediately be in State 4, from which no one party can act opportunistically. And if each took their intended actions at this point, they would immediately complete their exchange. However, simultaneity in real exchanges is difficult, if not impossible, to achieve.

When exchanges appear to be simultaneous, powerful institutions usually achieve this appearance. Real estate transactions are a case in point. Communities have evolved several institutions to ensure that parties to a house sale put their property and money into the exchange before either is allowed to acquire that of the other. The position of a "closing agent" is one such institution. The closing agent simulates simultaneity by having the seller sign the deed and the buyer sign the check, holding each in tow until both actions have been accomplished. Since the deed and payment are signed over to the parties, the closing agent can be trusted in this role. However, since both checks and deeds can be faulty, other institutions have evolved to ensure the signings entail the release of possession, such as title searches and bank checks. Commodity markets have evolved similar

institutions. The commodity exchange serves a role similar to the closing agent, demanding that deposits be put up to cover any speculative options that may end in ineffective transactions (Leblebici & Salancik, 1982). Another institution to protect against front-end risk is the practice of "Cash on delivery" (COD).

Risks at the back-end of an exchange have evolved different kinds of institutions. Back-end risks arise after both parties have put their goods into the exchange, but only one party has taken possession of the other's. The person who cancels a check after receiving and paying for the goods is an example of this, as is a home seller who removes chandeliers and draperies from the property between closing and possession. Front-end risks are avoided by getting parties to take the actions they should take. Back-end risks are avoided by getting parties not to take actions they are quite capable of taking. The institutions that guard against such risks involve restitution through external guarantors, such as courts or insurance companies. Credit card companies have taken on this guarantor role for many businesses that deal with many strangers as customers. This allows businesses to enter transactions where an anonymous customer has taken possession of their good before they have taken possession of the customer's cash with little need for determining the good faith of their customers.

While this is no place to construct a complete theory about the role of institutions in coordinating transactions, we should note that the grammar of organization reveals why coordination is necessary. The grammars we have constructed are theories about the structure of action based on our assumptions about how actions affect capabilities. These interdependencies are such that activities are only partially structured and ordered. Activities that remain unstructured must be coordinated, either by individual motivations or by institutions.

Discussion

Our grammar of organization defines an action space. It specifies a finite range of possible sequences of actions, some of which terminate effectively and others that do not. At each juncture, actors choose the actions they take. However, our grammar says nothing about which actions will be taken in any particular instance. It says nothing about the behavior of the actors involved. Put another way, if a grammar defines the possibilities for goal-directed organized action, it also defines the motivations required and the work that institutions must do. Organized action is contained between the rules of causal order (Leblebici, 2000) or syntax

(Salancik & Leblebici, 1988) and institutions or the rules of membership and allocation. The former defines the capability–action interdependencies required for organized action to be effective. The latter defines who may participate in a transaction and the institutions that constrain and motivate actors in their choices.

The term "rules of discourse" (Salancik & Leblebici, 1988) refers to what we call "institutions" in the present paper. "The Rules of Discourse specify the meanings that the acts are to have in a transaction set, whereas the Rules of Syntax specify the valid arrangements of acts within the set" Rules of discourse come in two forms: membership rules and allocation rules.(*) The first specifies who may participate in a transaction; the second allocates rights and obligations to act: who may or must do what in a transaction. These can be viewed as categories of institutions. With this simple addition to our grammar, we see that capabilities are defined for a set of members and that they specify what actions these actors may validly take. Capabilities hence come in two forms. Actors may be task capable; they can transform x into y. And they may be institutionally capable; they are legitimate members of the group permitted to participate in a transaction and have specific rights and duties in doing so.

We demonstrate how, even in the rudimentary form the grammar now takes, it can unravel causal processes and explain organizational phenomena in new ways by analyzing three well-known studies: Barley's study of radiology departments (1986), Leblebici, Salancik, Copay and King's study of the US radio broadcasting industry (1991), and Woodward's study of a diverse group of industrial firms (1965).

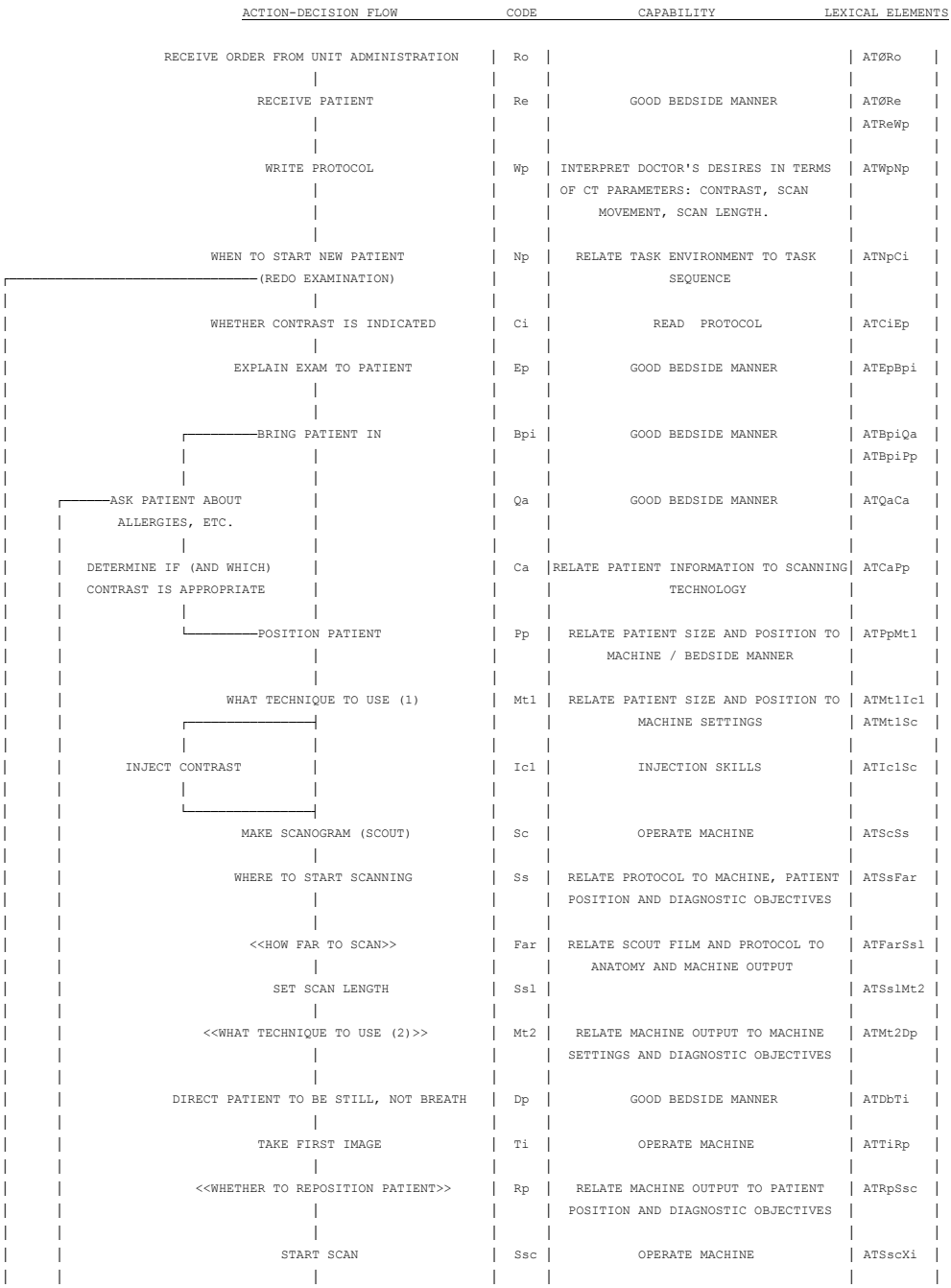
Occasion for Structuring or Constraints on Action

Producing a grammar of organization is a three-step process. The first step is to map the sequences of transformational and transactional actions. The second is to infer the capabilities necessary for an actor to take action. The third is to generate a lexicon and production rules from the sequences of actions and related capabilities. Barley's (1986) published work does not include a detailed description or mapping of the sequences of actions in a CT scan, so a mapping was made based on interviews and observations of the radiology department of a Montreal

(*) Leblebici (2000) categorizes the rules that govern transactions in somewhat different terms. The rules of discourse are akin to culture, or ideology. Unlike in his earlier work with Salancik, membership and allocation rules are not subsumed by the "rules of discourse" category.

hospital in 1991. We are mindful that technological development may enable new sequences of actions and produce new constraints, but we believe that the fundamental constraints imposed by the machines we observed in 1991, which had been in use for several years, and those that were the focus of Barley's observations in 1982 and 1983, are not significantly different. Indeed, the fundamental problem faced by radiology departments of adapting a system fit for X-ray examinations to the new CT technology had not changed. We demonstrate that rather than an "occasion for structuring," the introduction of CT scanners to radiology departments introduced new and specific interdependencies - capability/action requirements - different from those required by the previously existing x-ray technologies. And the challenge these posed to the institutional order were resolved in ways predicted by previous theory.

A map of the sequence of actions in a CT scan is depicted on the left of Figure 3. A code for each of the actions is assigned in the second column. The third column briefly describes the capability required to perform each action. The lexical elements produced in the last column consist of a joining of three codes: the code for the actor, that for the action that is taken, and that for the action that follows in the sequence.


ACTION-DECISION FLOW
CODE
CAPABILITY
LEXICAL ELEMENTS
RECEIVE ORDER FROM UNIT ADMINISTRATION
Ro
ATØRo
RECEIVE PATIENT
Re
GOOD BEDSIDE MANNER
ATØRe
ATReWp
WRITE PROTOCOL
Wp
INTERPRET DOCTOR'S DESIRES IN TERMS OF CT PARAMETERS: CONTRAST, SCAN MOVEMENT, SCAN LENGTH.
ATWpNp
WHEN TO START NEW PATIENT (REDO EXAMINATION)
Np
RELATE TASK ENVIRONMENT TO TASK SEQUENCE
ATNpCi
WHETHER CONTRAST IS INDICATED
Ci
READ PROTOCOL
ATCiEp
EXPLAIN EXAM TO PATIENT
Ep
GOOD BEDSIDE MANNER
ATEpBpi
BRING PATIENT IN
Bpi
GOOD BEDSIDE MANNER
ATBpiQa
ATBpiPp
ASK PATIENT ABOUT ALLERGIES, ETC.
Qa
GOOD BEDSIDE MANNER
ATQaCa
DETERMINE IF (AND WHICH) CONTRAST IS APPROPRIATE
Ca
RELATE PATIENT INFORMATION TO SCANNING TECHNOLOGY
ATCaPp
POSITION PATIENT
Pp
RELATE PATIENT SIZE AND POSITION TO MACHINE / BEDSIDE MANNER
ATPpMt1
WHAT TECHNIQUE TO USE (1)
Mt1
RELATE PATIENT SIZE AND POSITION TO MACHINE SETTINGS
ATMt1Ic1
ATMt1Sc
INJECT CONTRAST
Ic1
INJECTION SKILLS
ATIc1Sc
MAKE SCANOGRAM (SCOUT)
Sc
OPERATE MACHINE
ATScSs
WHERE TO START SCANNING
Ss
RELATE PROTOCOL TO MACHINE, PATIENT POSITION AND DIAGNOSTIC OBJECTIVES
ATSsFar
<<HOW FAR TO SCAN>>
Far
RELATE SCOUT FILM AND PROTOCOL TO ANATOMY AND MACHINE OUTPUT
ATFarSs1
SET SCAN LENGTH
Ss1
ATSs1Mt2
<<WHAT TECHNIQUE TO USE (2)>>
Mt2
RELATE MACHINE OUTPUT TO MACHINE SETTINGS AND DIAGNOSTIC OBJECTIVES
ATMt2Dp
DIRECT PATIENT TO BE STILL, NOT BREATH
Dp
GOOD BEDSIDE MANNER
ATDbTi
TAKE FIRST IMAGE
Ti
OPERATE MACHINE
ATTiRp
<<WHETHER TO REPOSITION PATIENT>>
Rp
RELATE MACHINE OUTPUT TO PATIENT POSITION AND DIAGNOSTIC OBJECTIVES
ATRpSsc
START SCAN
Ssc
OPERATE MACHINE
ATSscXi

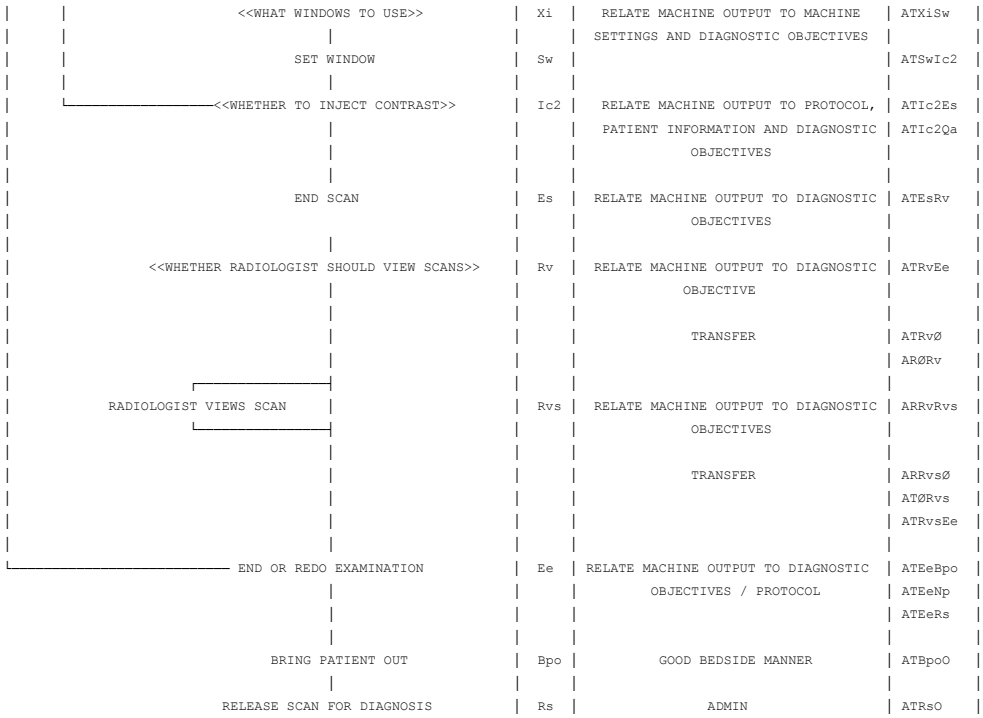


Figure 3. The flow of Actions in a CT Scan with a Diagnosis Capable Technician

It is assumed in Figure 3 that a technician AT (Actor Technician) has all of the capabilities in column three, including the authority to decide if a radiologist (AR) should confirm that the scan images are adequate for diagnosis. This situation is the division of labor in Montreal in 1991. The technician, because he or she is capable of understanding the goals of the CT scan and of interpreting the scanner's output in light of these goals, is capable of adjusting the scanner without calling on the diagnostic capabilities of a radiologist. The diagnostic capability constraints in the third column do not force activity to pass from technician to radiologist and back whenever diagnostic capabilities are required.

A different picture emerges if this is not the case. If one assumes the division of labor of a traditional X-ray examination, in which technicians operate machines and radiologists produce diagnoses from images, and that the examination terminates effectively, a complete set of production rules in a grammar of a CT

scan has 88 members. If, following rule RS-2 from Salancik and Leblebici (1988), which states that sequential acts Aixy, Aiyz performed by the same actor i can be rewritten as Aixz, the grammar for a CT scan performed by a diagnosis incapable technician has 70 production rules as activity is passed back and forth between technician and radiologist. Each of the puts and takes of these transfer transactions is attended by the risks described above. The same grammar with a diagnosis-capable technician has 15 rules. This grammatical analysis demonstrates that it is not the technology *per se* that is generating behavior when a new technology is introduced. Rather, it is the capabilities of the actors regarding the actions required. If actors are institutionally incapable of taking a necessary action, the organization is ineffective, the goal cannot be produced.

The key to our alternative understanding of Barley's analysis is the descriptive framework he uses. He organizes his analysis around changes in staffing patterns. He justifies this by noting that participants viewed staffing patterns as "crucial disjunctures." Why do the participants view changes in job descriptions or the division of labor as crucial? The interactions that Barley describes revolve around actors' capabilities. Changes in staffing patterns change the distribution of capabilities. Capabilities come in two forms: Actors may be task capable, able to transform x into y, and they may be institutionally capable, they have the right to do so. In a radiology department, membership rules define technicians and radiologists as permitted to participate in an examination; the allocation rules allocate diagnosis rights to radiologists and machine operation rights to technicians.

The interaction flows between technicians and radiologists that Barley parses and labels change with changes in staffing. He tells a story of how technicians' and radiologists' task capabilities, or the lack thereof, interact with their institutional rights and duties in the context of the efficient and effective completion of a CT scan transaction set. The difficulty of separating diagnosis from machine operations results in stress on the institutionally defined rights and obligations of the parties to the transactions. The CT scan mapping for Montreal demonstrates that an allocation of rights and obligations traditional to an X-ray transaction requires up to 12 transfer transactions between the parties. Rather than being softly causal, our grammar demonstrates precisely where traditionally defined institutional rights and duties are misaligned with the syntactical requirements of the new CT scan technology. Furthermore, reinterpreting Barley's story also demonstrates where theories of behavior may play a role.

The different settlements that Urban and Suburban arrive at both "yield CT techs more discretion than was typical of technologists in an X-ray area" (Barley, 1986). But why this difference? Task capabilities embedded in different staffing patterns certainly play a part, but theories of behavior also play a role. For instance, the CT-capable radiologists in Urban's initial staffing could have behaved differently. Their insistence on professional dominance might be explained by identity control theory (Burke, 2004; Burke & Reitzes, 1991) as an attempt to bring perceptions in line with their identity standards in the traditional division of labor in radiology departments. However, rather than insist on their professional dominance, they could have engaged technicians in a supportive learning process. Appending theories of behavior and applying them to the interaction patterns produced by the misalignment between the rules of syntax and the rules of allocation might explain the different institutional settlements produced at Urban and Suburban.

To Barley, the structuration process is a result of complexity and uncertainty; these are "functions of how the machine merged with the social system" (Barley, 1986). Rather than pointing to abstract attributes such as complexity, uncertainty, and social system, grammatical analysis of a CT scan pinpoints precisely where and how syntax and allocation rules, task capabilities and institutional rights and duties, are misaligned. When actions produce capabilities that cannot be acted upon because such actions are prohibited institutionally, motivated actors teach, usurp, blame, question, consult and mutually execute. The relative motivational strengths of their multiple role identities and task goals, as well as their reactions to goal and identity conflict, are questions best explained by theories of organizational behavior. The final institutional settlement depends both on staffing and behavior. However, the settlements in both Urban and Suburban, by allowing technicians more discretion in diagnosis, incorporated interdependencies into the technician's job. This restructuring of roles and relationships is more extreme in Montreal in 1991. Two points are noteworthy. First, earlier theorists, notably Thompson (1967), would have predicted just this outcome. Second, our grammar, by defining organization apart from people, provides a framework for understanding the work that institutions do, and hence a foundation for theorizing institutional change and development. In Barley's case, this change and development involved motivated social interactions that may be more adequately theorized now that the organizational context of this behavior is precisely defined.

Thinking Generatively about Interorganizational Fields

Our second example is itself the result of grammatical thinking, at the level of the interorganizational field. Leblebici et al. (1991) trace the US radio broadcasting industry's development from its inception to 1965. Starting with a simple transaction between broadcasters that financed, created, and broadcast radio programs to listeners, the organizational field evolved through various permutations of activities and their distribution and redistribution among a changing set of actors. Framed as an investigation of endogenous institutional change, the authors downplay the grammatical analysis which informs their approach. A transaction set view of the study offers new insights.

We presented the grammars in the context of a discreet and transferable object; a private/exchange-value good. In Leblebici's (2000) 2x2 categorization of goods, radio broadcasts are in the diagonally opposite quadrant. Goods vary along two dimensions: a use-value/exchange-value dimension, and a common-property/private-good dimension. Broadcasts cannot be appropriated and exchanged in further transactions, and they are non-rival, common-property goods. From a material, or grammatical point of view the broadcasting transaction is always a transfer between a broadcaster and an anonymous audience. But financing pivots around how the audience is packaged and sold. This re-packaging involved the invention of new activities, their allocation to participants, and their re-arrangement into a viable transaction set. Most of these participants have little to do with the basic, material transaction. Station representatives, raters, advertising and talent agencies, like the closing agent in a real estate transaction, only exist to facilitate exchange. When the medium of exchange is redefined and its value assessed in new ways, it triggers a reorganization of the transaction set. The internal control of organization is straightforward in the rudimentary exchange of discrete physical goods, as described above. Getting people to act appropriately is only part of the problem for radio broadcasts. Institutional control expands from inducing appropriate actions among the transacting parties, to the definition of the medium of exchange itself. As the audience's attention was increasingly well measured, the interorganizational field was re-organized. The radio study invites us to theorize how transactions in complex, institutionally defined goods are organized.

Organizational form is the result of both technological and institutional developments. Technology increases human capabilities and institutions limit them (Lawson, 2010; Leblebici et al., 1991; Salancik & Leblebici, 1988). This

interplay, between technology and institutions, played out iteratively as the interorganizational field developed. As radio became more popular and broadcasts more frequent, radio wave frequency interference ensued. This led to regulation of the use of the radio spectrum. As equipment manufacturers made use of others' inventions, the major manufactures banded together in the patent pool and established the Radio Corporation of America to market and sell radios. As the telephone wires became a choke point in establishing the scale economies of networks, the nascent networks bargained with AT&T to get it out of the radio broadcasting business and NBC, CBS and other networks were established. As the broadcast of recorded programs came to dominate, and the Federal Communications Commission allowed more low-power local stations, raters, station representatives and time brokers solved the problem of valuing and selling audience attention. At each stage of its development, problems of technology and knowledge were solved by inventing and changing institutions.

This history invites the reader to think about how the interorganizational field developed and continues to develop. Recent technological developments – satellite radio and internet streaming – have increased the ways that programs can be broadcast. Both address the fundamental problem of radio broadcasting; they have "solved" the funding problem technologically by transforming broadcasts from a common-property good into a private good. Satellite radio and internet streaming "broadcast" to specific parties and charge subscription fees.

What other possible sequences of transactions might have been, or are, possible? Broadcasting is a diverse industry. Some radio stations are affiliated with a national, regional or state network, and some are not. Some subscribe to syndicated shows, and others do not. Some produce their own content, others do not. Some receive government funding and some rely exclusively on listener donations. How do the "phrase structures" of these permutations of the broadcasting transaction set differ? What possible permutations of a broadcasting transaction set are absent? A theoretical account of what is observed must also account for what is not. A grammatical perspective on interorganizational fields provides a much more fine-grained view of organization. It spotlights possibilities, rather than just actualities, for configuring transaction sets,

It also highlights motive. The study can be read as an economic history: of how parties that were shut out of the dominant way of doing business invented new ways of transacting. This is certainly part of the story, but no social invention

is sustainable if it is not stable. The motive for both central and peripheral parties was to maintain stable transaction sets.

This is best demonstrated through inter-industry comparison, one that a transaction set analysis makes much easier and clearer. The film and the radio industries were both dominated by centralized producers between 1935 and 1950. In the film business a half dozen major studios employed all the talent required to produce a film: writers, actors, musicians, directors, editor, etc. In the radio business a similar concentration occurred, first under the auspices of advertising agencies, and then of the networks; the production and broadcast of radio shows was an integrated enterprise. The networks that produced sponsored shows owned radio stations in the major markets, like the film studios that owned theatres. They employed musicians and some performers. Although most talent was not controlled directly, networks controlled it indirectly through the talent agencies they owned. Both industries fragmented after 1950.

In the later period, film studios, now in competition with television, focused on fewer "blockbuster" films with bigger budgets. Studios outsourced many functions they had previously kept in-house; they substituted exchange for transfer transactions. Talent was no longer employed and agencies to represent them grew. Theaters were divested, a process that was accelerated by an anti-trust lawsuit by independent producers. Studios still maintained a central role through their control of studio space and contracts with theater chaines, but production, the management and coordinations of the diverse resources necessary to maka a film, was outsourced to production companies. Sound stages became resources assembled and coordinated by production companies that now took the central role, dependent on studios for resources, yet central to a project's development, production and success. In the radio business, spot advertising and the use of recorded music empowered local stations that catered to specialized audiences. Stations contracted with networks for news and sports programming, and syndicated talk shows. This led to a corresponding increase in the number of networks, on the state and regional as well as national levels. Stations could be affiliated to a national, regional or state network, or subscribe to programs produced by them, or not. Radio broadcasting fragmented.

Grammatical thinking forces the theorist to break down the interorganizational field and understand the relations among its elements. This contrasts with theorizing which builds constructs from descriptive attributes. Traditional

perspectives would abstract from the doings of the actors; dimensional, network or configurational measures would likely conclude that the two industries were similar in both their early and later periods. A transaction set view would look at the transactions involved and these fundamentally differed.

The centralization that characterized the early period was due, in both cases, to dominant players' moves to control and stabilize revenue. In the radio business, networks integrated backward to absorb radio's source of revenue: the programming that advertisers funded. Movie studios integrated forward and sought to control theaters, where tickets were sold. From a transaction set view, both aimed to stabilize revenues when production is costly and revenues uncertain. This same dynamic is evident in the later period of decentralization. In broadcasting, the use of recorded music substantially reduced the cost of production; and with spot advertising these costs could be spread over a greater number of advertisers. This empowered local stations by giving them access to a stable stream of local revenue. In the movie business, by contrast, to differentiate themselves from TV offerings, the number of films declined and costs increased. "Flops" and "blockbusters" were two sides of the same coin in this environment. The film business was reorganized around projects managed by production companies. The medium for transactions also changed. Films, no longer items on a studio production line, became projects and speculations on audience approval. Fragmentation spread the risks of production, no player betting all their chips on one project. Fragmentation was an epiphenomenon. In one, low cost broadcasters fragmented the field into a multitude of stations serving specialized audiences. In the other, the higher cost of production was spread over an increased number of independent parties.

The superficially similar changes that the two industries experienced conceal differences that become apparent from a transaction set point of view. Importantly, the mechanism that produced these differences was the same: seeking to mitigate the risks of transaction failure, participants redefined the medium of exchange, resulting in the reorganization of the field as a whole. Differing underlying transactions produce surface similarities. Advances in organization theory require that we eschew descriptive theorizing and dig for the underlying mechanisms that produce the observed facts.

Grammatical theorizing tells us to focus on transactions, the character of the good being transacted and the capabilities of the parties involved, including the

technologies in use. But in the search for better alternative arrangements institutions also stand in our way. Close study of the ways that radio is organized may reveal phrase structures that don't exist but may better meet our needs. An imaginative transaction set approach may unravel what Alchian's (1950) near-sighted grasshopper cannot. At the top of a foothill of efficiency, the grasshopper cannot see the peaks beyond the immediate valley. By being capable of representing transaction arrangements that are possible without being actual, development of locally efficient solutions to transaction problems may be compared to alternative arrangements that may be more globally efficient, (or in some other way more desirable), out of view to the near sighted grasshopper. Institutions, that could be otherwise, may block the establishment of alternative arrangements. This includes regulations and laws, as well as beliefs like the belief that broadcasting must be done live.

Transactions, Production Technology and Organization Design

Our third example demonstrates how grammatical thinking brings new understanding without resorting to formalization. A grammar explicates the effects that the put-and-take of transaction sequences have on risk allocation in the organization of transaction sets. We look at these dynamics by reanalyzing Joan Woodward's (1965) report on the organization of Essex manufacturing firms: she presents a theory of organization based on an inductive typology. Three types of firms are distinguished based on their production technology. These technology types are causally associated with patterns in organizational structure: their formal structure, occupational structure, informal organization, and the organizational identification of participants.

All firms must develop a product, market and produce it, and finance the firm's operations. Each of these functions corresponds to a line management department in the sample. The first three of these activities proceed in sequence, while the fourth is an activity related to the firm as a whole. The sequencing of activities differs among the three types of firms. A product is marketed, developed, and then produced for unit and small-batch firms. For mass and large batch firms, a product is developed, produced, and then marketed. For firms with process technologies, a product is first developed, then marketed, and finally produced. The logic which Woodward uses to explain these differences varies with each case. Marketing is the first activity in the unit and small batch production

because production is based on firm orders only. Producing bespoke items means that production depends on customers' orders and that planning horizons are limited to the orders in the order book. In mass and large batch production, the sequence of activities is explained by a tendency to produce for stock and planned rather than firm orders. The sequence is explained by referencing the firm's ability to forecast sales. Finally, no clear explanation is given for the sequence of activities in process production systems. Planning horizons are long, the organization of research and development activity is elaborate, and capital investment for a new product is relatively high. However, none of these facts is used to explain why marketing intervenes between development and production. What explains these different sequences? Like Barley's use of staffing changes as a descriptive framework, Woodward makes an observation that is of some help in unraveling this mystery. She states that it is the middle activity in the sequence in each of the three technology types that is the most critical.

In her discussion of the organization of unit production firms, Woodward states: "In many cases, it was an idea rather than a product which had to be sold to the customer." What the customer is purchasing is not a product but the capabilities of the engineering firm to produce a unique good with no alternative customer. Once the idea has been converted into a product by developing and producing it, if the customer does not "pick up" the good, the transaction fails. There are no alternative customers for bespoke goods. Woodward describes the relationship with customers as close and continuing. Unit production firms may be selling their ideas and capabilities, but the customer is "putting" their good down first and taking on the front-end risk. That is why unit production firms market, then develop, then produce. Understanding that the good being sold has only one customer allows us to predict which of the action sequences that Woodward describes would be chosen by managers of unit production firms. It also allows us to predict the behaviors of the participants that seek to ensure, on the one hand, that the money they have put into transactions will result in the products they want and, on the other, that the development process will result in products that customers want. Behaviors and institutions are motivated and designed to mitigate the risk that cannot be shifted in the exchange transaction. Development, the middle function, is critical. It is they that turn a salesperson's customer solution into a product for the customer and manage the risks of transaction failure.

In the case of mass production, producers are selling into established mass markets. New developments tend to be improvements on old models. Mass pro-

duction manufacturers produce goods for which customers find ready substitutes. Hence customers need not absorb the transaction completion risk as in unit production. They need not put money into an idea and hope it becomes a product. In order to complete a transaction at all, the producer must bet that what is produced can be sold. The seller "puts" first and takes on the front-end risk. In mass production firms, development, production, and marketing operate much more independently. Production personnel often resent intrusive changes made by development engineers. Production's dominance, according to Woodward, is grounded in the fact that a firm's short-term success is determined by the production department's ability to reduce unit costs, to decrease the cost/value ratio of its products in a competitive market. Large batch and mass technologies imply a develop-produce-market activity sequence. Transaction completion is assured by having goods ready to buy at a price that is attractive to customers. New products are occasionally rather than continually introduced, and marketing predicts sales as well as markets finished goods. Again, the put-and-take of transaction sequences is predictive of institutional and behavioral outcomes. Production efficiencies determine success in a competitive market and explain the production department's dominance.

Research in process production firms was discovery-oriented rather than customer-oriented (unit production) or product-oriented (mass production). It took place in three stages: knowledge discovery research, product development research, and "works chemical or technology" development. Research moves from pure knowledge generation to product development to production process design. The move from the second to the third stage of development involved a "go" decision from marketing, responsible for securing a market for the proposed product. These firms produce goods with limited storage capacity or that are difficult or impossible to store. Furthermore, process production involves relatively heavy capital expenditures, and "unlike large batch production, a drop in output in a process industry does not have an immediate effect upon the labor required; a plant not working at full capacity requires its full labor complement and is more difficult and expensive to run" (Woodward, 1965). New products have short shelf lives, high up-front costs, and unknown markets. Customers will not buy production capability (as in unit production) because of the costs and risk involved; a process production firm must "put" first. However, with producers reluctant to invest in the massive production required to recover capital and production costs without some assurance of sale, process technologies imply a devel-

op-market-produce activity sequence. The marketing department plays a critical role in assuring the firm's prosperity by assessing the risks of transaction failure.

Based on the sequences of actions in a transaction, this brief reanalysis offers an alternative explanation for Woodward's results. The varying risk allocations generated by the characteristics of the transaction parties – their number – motivate managerial choice in organizational design. The resulting sequences generate many of an organization's design and features. Personnel management, the quality of interdepartmental relations, customer relation management, modes of communication, status and CEO succession, and other behavioral and structural features were all a function of activity sequences. The "environment" of a transaction penetrates much more deeply into a firm's design than previously theorized.

Transaction Sets and Organization Theory

Our reframing of Barley's and Woodward's work and the radio broadcasting study demonstrates two things. First, a grammar can be usefully applied at the workgroup, the organization, and the field levels. The three levels are essentially the same from a transaction set point of view. They vary in the relative importance of collective and individual actors, each defining the relevant set of actors differently. However, the grammar describes an underlying physical world of embodied action whose features, at each of the three levels, reveal the problems that the organization of collective production faces. And organization as transaction set is as applicable to the boundaryless, networked, and shape-shifting organization of today's theoretical interest as it is to the industrial organizations of organization theory's traditional focus. The insights from each of our reanalyses can be applied equally at the other levels. Second, each of the three examples demonstrates one of the reasons for thinking that theorizing organization grammatically might be productive.

The reanalysis of Barley's study shows in detail how the behavior of actors and their social organization can be traced down to the sequences of actions in transactions. Organizational behavior and institutions, and their relations to each other, are best understood as supervening layers built on a "hardware" of embodied actions. The reanalysis of Barley's study demonstrates that by defining organization separately from both institutions and actors' motivations, a grammar is a medium for understanding both the context of organizational behavior and the microfoundations of institutions.

This view contrasts with a neo-institutionalist understanding of organization and action. Building on Goffman (1967), Garfinkle (1967), and Giddens (1984), institutionalists locate action in practical reason; a world of taken-for-granted rules of social behavior and interaction rituals that produce the organization in social interaction (Powell & DiMaggio, 1991). More recently, sensemaking, status expectations, and performativity (Powell & Colyvas, 2008) have been suggested as ways of understanding how micro actions produce macro order. Actors preserve their sense of self and well-being by following pre-conscious scripts. They only become aware of these when a role or interaction rule constituting the script is broken. Shared typifications, definitions of the situation, enable reciprocal role taking and collective action as the institutions that constitute organization are activated. Through practical reason, action is defined by the rules that constitute organization; and organization is the result of the routine, habitual actions of actors. In an institutionalist's world, action and organization presuppose one another.

As the reanalysis of Barley's study demonstrates, the "practical reason" that actors engage in is not only relational: attending to roles and status hierarchies. It is also that of practical goal attainment. Teaching, usurping, blaming, questioning, and consulting result from goal motivations in a world of embodied actions directed toward desired outcomes. Actors, radiologists and technicians, do not follow the inherited institutional order, producing failed CT scan after failed CT scan. Instead, roles are redefined and authority reallocated through an agentic process characterized by frustrated goal attainment. This differed at Urban and Suburban in part, at least, because of the different motivations of the actors. By locating organization in the performance of interdependent actions oriented to things rather than people, the grammar defines the objects of both institutional control and of individual motivation apart from the participants themselves. The conversation about institutional microfoundations may be broadened to include not just sociologically theories of the mind and action that DiMaggio and Powell (1991) and Powell and Colyvas (2008) mention but the entire panoply of theories that have attracted the attention of management theorists and psychologists. Actors are embedded in the interdependencies of organized action, constrained and motivated by institutions, rather than in the institutions-as-organization itself. Transaction sets provide a theoretical lever for understanding the agency-structure relationship.

The re-analysis of the radio study shows how grammatical reduction of or-

ganizational phenomena and counterfactual reasoning might lead to novel and better theorizing. The story – of technological change and the development of institutions –is best told when thinking generatively about real things. It theorizes real actors and their capabilities– not abstractions – and their relations to each other. The different effects of technology and institutions on field development in the broadcasting industry can be better understood for two reasons. The actual is best understood in contrast to the possible. A grammatical representation, or approach, always questions actual arrangements and challenges us to formulate theoretical proposition that explain the existence of a form of organization but also the non-existence of other possible forms. A view that explains the preponderance of one form or organization must also be able to explain the existence of a smaller number of alternative forms. Also, the grammar and its conceptual apparatus facilitate the comparison of different transaction sets. Two transaction sets, identical in some respects but different in others, can be broken down grammatically and the causes of the similarities and differences in their "phrase structures" systematically explored. What were the forces that shaped the radio and the movie industry? How did technology and institutions interact? Grammatical translation opens the door to counterfactual reasoning and inter-industry comparison.

The radio study also moves us beyond a world of discrete, exchange-value/private goods. Understanding transactions in such goods is important to understanding and planning in an organizational world dominated by service transactions. If organization theory is to have a place at the table in discussing the future of capitalism, or what emerges after it, it is essential that it takes a generative approach to theorizing the organization of production with an understanding of goods that are institutionally defined.

Organizational design has received renewed methodological attention from an analytical (e.g., Fiss, 2007; Grandori & Soda, 2006) and process viewpoint (e.g., Romme & Damen, 2007; Yoo, Boland, & Lyytinen, 2006). Yet too little attention is paid to what was once the heart of organization theory (Dunbar & Starbuck, 2006; Greenwood & Miller, 2010). The generative approach advocated here takes transaction completion to be the driver of design decisions and, like Perrow (1967), argues that work processes are the foundation on which organizational structure is built. In the analysis of Woodward's production sequences technology comes to the fore, but not in the way that Woodward or scholars since then have understood it. From a grammatical point of view, technology is syntax. It specifies the ways that collective production can be organized. But it

is in anticipation of the put-and-take of transactions that managers design sequences of activity and the institutions that guide them. Since development must precede production, Woodward's three sequences of the three activities are the only ones possible. Their association with markets of zero, one, and many possible exchange partners connects "organizations" to their "environments" in new and productive ways, ways that are not possible from a structural contingency, information processing, transaction cost or any other perspective. The re-analysis of Woodward's work demonstrates how dimensions and features of organizations and environments, as traditionally theorized, are derivative of more basic processes at the transaction set level. They are the surface expression of generative mechanisms that find their origins in transaction sequences as actors seek to stabilize exchange.

Conclusion

In this paper, we have tried to introduce readers to several ideas that we believe are both important and useful for constructing theories of social organization. We introduced modeling organization as a grammar; we showed that a grammar of organization is possible and indicated that such grammars are theories about the interdependence of actors' activities. We have shown that the organization of complex social systems can be derived from making only a few assumptions about actors and their effects on one another. We have also noted that constructing such grammars requires rigorous and explicit statements of one's assumptions about interdependencies.

We have offered what we believe is a helpful way to describe interdependencies, as the effects of actions on capabilities. The organization of complex social systems can be derived by making only a few assumptions about individuals and their effects on one another. Coupled with theories about the individuals, about their behavior, and how their motivations affect their willingness to contribute to organized activity, we believe that more testable theories about behavior in and of organizations are possible. Institutions and behaviors, the grist of the theoretical mill in organizational theorizing, might then be related to the underlying organization of transactions required for goal attainment. Variations in institutional configurations and their change, and organizational behavior, can be understood within this more slowly changing organizational context, the "hardware" of organization grammatically represented in a transaction set. We have demonstrated

this by reexamining three well-known studies, each at a different level of social organization and each demonstrating one of the ways that theorizing organization grammatically might be fruitful.

Our proposals derive from the fact that a grammar of organization can represent organization as a finite set of possibilities for organizing sequences of actions, independent of institutions, and involving actors devoid of all but the most rudimentary capabilities: those of picking up and putting down things, both tangible and intangible. Disentangling motivations and institutions from the organization of collective activity provide a criterion for institutional control's success and failure and a setting for understanding their power over individuals. In other words, by separating outcomes and action sequences from people and institutions, some leverage can be gained on the agency-structure relationship. By avoiding abstract descriptions, we suggested how many organizational phenomena are epiphenomenal. The features of organization that are counted, combined, and related to one another in theoretical description are surface manifestations generated by actors' attempts to stabilize the sequences of actions required for effective collective production.

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