# 8 Punctuated Equilibrium Models in Organizational Decision Making

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Many literatures on decision making have involved heated debates over the capacity of people and organizations to make large changes. Scholars have argued about the capacity of decision makers to make substantial changes from prior decisions at the individual and the organizational levels. Those who argued that substantial change was rare pointed to the conservative nature of decision making in a variety of areas including budgeting and policymaking. In this view (that I will call the incrementalist view) stasis is the characteristic state of organizational and individual decision making. In the incrementalist view, there are strong disincentives to making decisions that depart substantially from the status quo (Lindblom, 1959). These disincentives make large departures rare and dangerous. Those who disputed this argument pointed to examples of large change. Many policy areas seemingly experienced large changes; popular examples included the space program and military budgets. For the most part, the debate raged as both parties talked past the others.

Out of this melee, punctuated equilibrium theory emerged as a way out of the dispute between incrementalists and their critics by providing a model that explains the existence of long periods of stability with occasional, but infrequent, dramatic change. This chapter traces the development of punctuated equilibrium models in paleontology and policy theory and the incorporation of this approach into research on budgetary policy making. This chapter then provides a detailed account of the theoretical structure of a punctuated equilibrium model and the empirical implications of these models. Finally, this chapter reviews the extant literature applying punctuated equilibrium models to organizational decision making and explores the frontiers of research into punctuated equilibrium processes.

## 8.1 TWO RESEARCH CONUNDRUMS

Two distinct literatures—the dynamics of policy change and the dynamics of species change—faced similar disputes over the speed of change processes. These two literatures eventually found a proposed resolution to the dispute in punctuated equilibrium theory. This reviews the challenges faced by scholars of policy and species change with special attention to the similarities between the academic debates in these disparate areas. This analysis will reveal the problems common to each research dispute and the factors that led to the common acceptance of punctuated equilibrium theory in each field.

### 8.1.1 LINDBLOM'S THEORY OF ADMINISTRATIVE INCREMENTALISM

Charles Lindblom's theory of incrementalism is discussed in detail in Hayes' chapter in this book, but a brief summary is needed here, as his theory has a direct connection to punctuated equilibrium theory. Lindblom (1959) was unsatisfied with traditional rational models of administrative decision making that assumed that decision makers possessed more information than they did. Lindblom sought to replace the assumptions of the rational choice model of decision making with more realistic alternatives. The result is a model of administrative decision making based on "successive limited comparisons."

Each decision must limit the consideration of alternatives. Individuals cannot consider all alternatives because searching for alternatives is a costly process in terms of both money and time. Real administrative processes cannot absorb the costs of a large, nearly comprehensive search. Instead, limited searches produce a small set of alternatives subject to consideration. In most cases, the limitations of the search process result in the consideration of local alternatives, those that are very similar to the status quo.

Once a small set of alternatives is defined, administrators interactively evaluate those alternatives with the goals of the decision process. Goals (or values) are not set in stone and are instead under constant reevaluation relative to the available alternatives. Means and ends of any process are considered simultaneously.

Additionally, administrators only consider a small number of values relative to each decision. Just as a search for alternatives is costly, the consideration of diverse values is costly. Considering diverse values increases the difficulty of reaching a consensus in a group decision process. While there are many possible ways to evaluate a policy, only a small number of considerations are used in any decision process, for example efficiency, environmental sustainability, or equity (Braybrooke and Lindblom, 1963).

The result of narrow search routines, interactive application of values, and limitation on the number of considerations is conservative administrative decisions. Administrative decisions change policy only slowly through time as "successive, limited comparisons" prevent radical change. To adopt the language of incrementalism, decisions occur only in small increments. The basis for these limitations is information. When searches for alternatives are costly, increment-alism will dominate. When searches are inexpensive and many alternatives are subject to

consideration, comparisons need not be "limited." The result may be non-incremental change. Incrementalism will only change over time (or cross-sectionally) as levels of complexity change.

It is important to note that this theory of decision making applies to individual and organizational decision making. Both individuals and organizations must confront the costs of searching for alternatives. Organizations face the additional barriers to change when multiple people are involved in the decision process, complicating the consideration of relevant values. So while the theory predicts incremental decision making by individuals, the incremental processes are likely to be more pronounced in organizational settings.

### 8.1.2 WILDAVSKY'S THEORY OF BUDGETARY INCREMENTALISM

Aaron Wildavsky (1964, 1992) applied the logic of incrementalism to budgetary processes. Incrementalism takes on a specific manifestation in the context of budgetary processes. An incremental budgetary process defines all decisions in terms of change from the baseline. In many cases this baseline is the previous year's budget. Budget outputs consist of changes in increments around the baseline.

Wildavsky's theory of budgetary incrementalism results in a conservatism similar to that inherent in Lindblom's theory of incrementalism. Programs are never considered in their entirety. In general, programs should emerge and disappear slowly over time. Instead, each program will see very small changes in their budgets over time.

The consideration of budget increments provides a number of benefits. First, administrators only have to consider a small number of alternative budgets (in this case representing a small number of potential increases or decreases from the budgetary base). Second, consideration of increments prevents revisiting past political struggles. Past budgets represent past political struggles. To fight over a budget from the first allocated dollar would require one to revisit the political struggles that resulted in the previous budget. By considering only incremental change, you avoid these fights and avoid agitating political interests.

Wildavasky also argued that the regularity of budgetary processes leads to incremental decision making processes. As a decision becomes routine, the parties become regular participants with well-formed expectations. The regularity of the participants expresses itself in the regularity of the budgetary outputs. As budgetary processes are bureaucratized and institutionalized, one expects a greater degree of incrementalism.

Wildavsky's theory of budgetary incrementalism added two factors that increase our expectation of incrementalism to the Lindblom's theory, political conflict and bureaucratization. More so than Lindblom, Wildavsky acknowledged that the degree of incrementalism might vary over time and between decision processes. In so far as political conflict and bureaucratization vary across time and across processes (cross-sectionally), Wildavsky would predict that levels of incrementalism would vary. Incrementalism should be positively related to both increasing levels of political conflict and increasing degrees of bureaucratization.

### 8.1.3 THE DIVERSE MEANINGS OF BUDGETARY "INCREMENTALISM"

The previous discussion conceals a lack of consensus on the use of the term "incrementalism" by focusing attention on a couple of authors. The incrementalist research tradition included a diverse set of authors working with diverse definitions of incrementalism. William Berry (1990) identifies 12 major conceptions of the term "incrementalism." Sometimes incrementalism meant small average change magnitudes. Other times incrementalism was a procedural characteristic but could lead to any level of average change magnitudes. The diversity of meanings led to a literature that resembled ships passing each other in the night.

For the most part, the volumes of work on incrementalism in budgets got stuck in this dispute. Debates raged over methodological issues (such as the appropriate level of budgeting to test the

competing explanations, the threshold of "small" and "large," etc.) but the literature progressed little. Because the meaning of incrementalism was so vague, few of the related propositions could be falsified. Each finding of large average change magnitudes or the existence of profound, fast changes in policy was met with a shift in definitions of incrementalism rather than with a rejection of any theoretical hypothesis. By the early 1990s, the debate over incrementalism in policy research had largely disappeared without a resolution. The ambiguity over the meaning of small changes left many dissatisfied and uninterested in the research question.

### 8.1.4 A BRIEF ASIDE ON PALEONTOLOGY

While the disputes between incrementalists and their critics raged among scholars of public policy, a similar debate occupied the attention of scholars in paleontology. The paleontological orthodoxy focused on the gradual nature of evolutionary changes. The Darwinian theory of evolution suggests that changes are the product of random genetic events (Gould, 2002, 750). This gradualist approach was challenged by scholars who pointed to instances of rapid change (in geological and paleonto-logical terms) in species. To the opponents of the gradualist approach, the key changes in the history of species are large changes.

Note the similarity between this and the dispute between incrementalists and their critics. The gradualists focused on the theoretical arguments for the relative rarity of large change. Their opponents focused on the existence of large changes in the fossil record. Again, standards for the "largeness" of a change were controversial. The nature of the empirical evidence was disputed as debates between the gradualists and their opponents raged. Without clear standards of evaluation or a clear fossil record, the debate could see no resolution.

## 8.2 PUNCTUATED EQUILIBRIUM THEORY—A WAY OUT OF BOTH CONUNDRUMS

It was the paleontological literature that developed a theory to escape the endless disputes between those who argued that large change was rare and those who said that large changes exist. Essentially, the answer was that both groups of scholars are right. There is nothing inconsistent in arguing that large change is rare but does exist.

The resulting synthesis was called punctuated equilibrium theory (Gould, 2002). In punctuated equilibrium theory, species spend most of the time in a period of stasis. In stasis, small genetic differences are present but these changes do not greatly affect the structural characteristics of the organism. There are constant forces for change in these periods of stasis represented by genetic variation, but these forces do not overcome natural barriers to large changes, representing the difficulty of change.

These periods of stasis are interrupted by rare episodes in which the forces for change override the barriers to change. This generally happens when pressures from the environment combine with internal genetic pressures for change. A punctuation may occur when changes in the environment make change necessary and the genetic variation randomly creates a competitive adaptation. These periods are called punctuations. The resulting process combining stasis with rare punctuations is punctuated equilibrium. While this theory is still controversial in paleontological circles, it has gathered substantial support in part due to the consistency of the predictions (rare, but large, change) with the existing fossil record.

Baumgartner and Jones (1993) saw in punctuated equilibrium theories a solution to the problems plaguing the dispute between incrementalists and their opponents. When Baumgartner looked at the various policy histories, they saw periods of inattention and stasis interrupted by periods of dramatic change. This pattern had been discussed at great length in policy theory before, but lacked a central organizing metaphor and theoretical vocabulary to empower analysis. Baum-gartner and Jones brought the theory of punctuated equilibrium to the study of policy change as

a way to resolve the dispute between incrementalists and their critics. Consistent with the incrementalist argument, large change is rare in a punctuated equilibrium process. Most of the history of any given policy is probably spent in a period of stasis. Consistent with the critics of incrementalism, policies can experience periods of dramatic change. While these punctuations are rare, they can be important parts of the development of public policy. Certainly these punctuations are the periods in policy history that people tend to study most carefully and the periods in which the policy subsystem gets the most attention.

Baumgartner and Jones took advantage of the ideal-typical nature of the punctuated equilibrium process to easily transfer the theory from its home in paleontology to the study of policy processes. The ideal-typical nature makes it possible to appeal to a broad range of phenomena — in this case, phenomena as diverse as speciation and the disintegration of policy monopolies. The appeal of the approach is that it synthesizes the previous existing theories under one theoretical tent. As a single theory, the punctuated equilibrium theory predicts the incrementalist/gradualist observation that large changes are rare while also predicting the existence of large changes in rare periods of punctuation.

## 8.3  A THEORETICAL MODEL OF PUNCTUATED EQUILIBRIUM THEORY

While the empirical support for the punctuated equilibrium theory is clear, the utility of the theory is not as obvious. Applying the work to policymaking, the theory made a statement about the relative frequency of different magnitudes of change. Small and large changes were supposed to appear more frequently than one should expect. Moderate changes were supposed to appear less frequently than one should expect.

Baumgartner and Jones (1993) hypothesized that the punctuated equilibrium pattern of policy change was the product of feedback processes in political institutions. This linked the punctuated equilibrium theory to parallel theories related to increasing returns and path dependence (Arthur, 1992) as well as the incrementalist tradition discussed above. However, the early research in the punctuated equilibrium theory focused less on the factors that were supposed to create the punctuated pattern than to verify that observed policy outputs were consistent with the patterns predicted by a punctuated equilibrium model.

The first question for the theory to address is how to define the baseline for comparison. One must be able to answer the question "more frequently than what?" True et al., (1999) contend that the proper baseline is the normal distribution with the mean and standard deviation defined by the empirical distribution of the sample of changes one is studying. If changes were truly random and not subject to a punctuated equilibrium process, the frequency of change magnitudes should follow the normal distribution by the Central Limit Theorem. One would see the frequency of small, moderate, and large changes arranged symmetrically around the mean based on the familiar bell curve. With this as the baseline, the expectations of the punctuated equilibrium model are that frequencies of large and small changes will exceed the expectations based on the normal distribution while the frequencies of moderate changes will be lower than expected.

The characteristic distribution of a punctuated equilibrium process is generally easy to identify with a look at a histogram of the change magnitudes (see Figure 8.1).

Figure 8.1 illustrates a typical distribution of data consistent with the True, Jones, and Baumgartner expectations for punctuated equilibrium.[*] The graph shows the density of observations at various magnitudes of change. For comparison purposes, a normal curve (with the same mean and standard deviation as the sample) is overlaid on the empirical distribution. At the small levels of

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[*] This figure represents yearly percentage changes in instructional spending per pupil by public school districts in Texas from 1989 to 2000. The figure omits districts with percentage increases greater than 100% for clarity. The data is available from the Texas Education Agency (www.tea.state.tx.us).
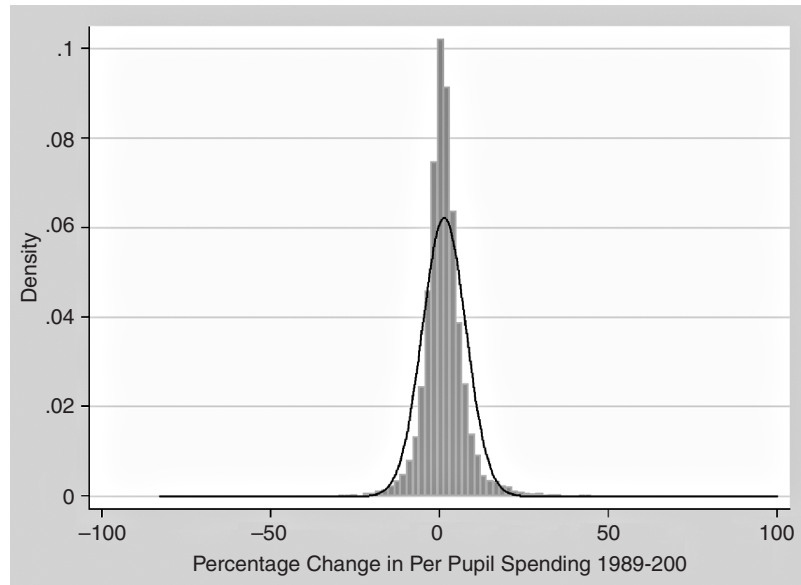
**FIGURE 8.1**  Percentage change in per pupil spending, 1989–2000.

change around zero percent (there is a small growth trend in the sample, so the distribution is centered just about zero) there are far more observations then expected based on a normal curve. Outside of the range of small range, there is a range of moderate change magnitude where there is lower than expected density. However, one sees spikes in the density function in the tails with much greater frequency than one would expect from the normal distribution. This empirical distribution of school district spending is illustrative of the general pattern that authors have found in areas as

Q5 varied as stock markets and federal policy making institutions (Jones et al., 2003) and local government spending (Jones, 2003).

The distribution is also easy to identify statistically with tests for the non-normality of a

Q6 distribution. One simple test is to assess the kurtosis of the distribution (Rice, 1996). Kurtosis measures the frequency of observations at the tails and near the mean relative to the frequency in the middle range. The kurtosis is measured as:

$$k = \frac{\frac{1}{n}\sum_{i=1}^{n}(Xi - \overline{X})^4}{\sigma^4} \tag{8.1}$$

High values of $k$ (higher than 3) represent an empirical distribution that has more observations at the peak and in the tails of the distribution than the normal distribution (which has a $k$ of exactly 3). Distributions with high values of $k$ are known as leptokurtic. Because kurtosis represents the relative frequency of low and high values of a frequency distribution, it serves as a test of whether a frequency distribution is shaped as one would expect from punctuated equilibrium processes.

The discussion of punctuated equilibrium theory in organizational decision making reveals an important limitation of the existing literature. While there is a lot said about the distribution of decision outcomes expected from punctuated equilibrium processes, little is said about the change processes themselves. While it may be clear that large change is rare, what mechanisms reinforce stasis to explain this rarity? What mechanisms lead to the rare periods of policy change?

Before venturing a theoretical model to address this lacuna in the literature, the next section will look at how the distributional theory has been tested and how hypotheses about the casual processes of punctuated equilibrium processes of organizational decision making emerged.

## 8.4  EVIDENCE OF PUNCTUATED EQUILIBRIA IN ORGANIZATIONAL DECISION MAKING

The argument that organizations (particularly policy making organizations) involve punctuated equilibrium processes has generated a lot of support but little testing. After the initial proposal of punctuated equilibrium models in Baumgartner and Jones, 1993 text, few people tested the hypothesis. While many scholars felt the argument rang true, there was no clear way to falsify the claim. Any individual decision, whether representing a large or a small change, would be consistent with the theory. No individual observation can disconfirm the theory. This left many scholars frustrated with a theory that seemed true, but may be a truism. Other scholars forged ahead looking for falsifiable hypotheses generated by the punctuated equilibrium theory that could be falsified.

### 8.4.1  Punctuated Equilibrium and the Federal Budget

True et al., (1999) found a way to test the propositions of punctuated equilibrium theory by developing a falsifiable hypothesis. Developing the approach discussed in the previous section, True, Jones, and Baumgartner argued that punctuated equilibrium theory made falsifiable predictions about distributions of organizational decisions that could be falsified. The reputation for a lack of falsifiability came from the mistaken focus on individual decisions. While individual decisions were not sufficiently informative to test the expansive theory, assessments of large collections of observations could do so.

To test the punctuated equilibrium theory, True, Jones, and Baumgartner gathered data on budgetary decisions by Congress in the post World War II era. For each policy area, they observed the magnitude of program budgetary change in each year. For each year, the authors found the percentage change in the authorizations for 62 budgetary sub-functions in the federal budget. The authors then plotted a histogram of the changes and compared the empirical distribution of budget authorization to a normal curve with the mean and standard deviation of the empirical distribution.

What they found was consistent with the expectations of the punctuated equilibrium theory. There was a greater than expected number of authorization changes around zero and in the tails of the distribution. In particular, there was a far greater than expected number of authorization changes of greater than a 290% increase. There was also a lower than expected number of authorization changes in the moderate range (for both positive and negative changes) (True et al., 1999, 110). The authors observed the same pattern in budgetary functions at a higher level of aggregation, dividing the budget into seventeen functions, but the results were not at stark (109).

The results of the True, Jones, and Baumgartner study were initial confirmation that the punctuated equilibrium theory was plausible as a description of the outputs of an organizational decision process. Because the study only looked at the characteristic distribution, there was no evidence as to what factors led to this distribution. Within this descriptive statistic approach, one could not test opposing hypotheses about the causes of punctuated equilibrium (related to, say, the factors that increase the punctuated nature of the process). However, the initial test was strong confirmation that the outputs of the federal budgetary processes were more consistent with a punctuated equilibrium model than with assumptions of rational decision making.

### 8.4.2 Punctuated Equilibrium and Local Government Budgets

The early work on punctuated equilibrium served to confirm the plausibility of the descriptive prediction of punctuated equilibrium theory. However, there was little discussion of the factors that influenced the decision processes. This gap in the literature is starting to be filled. The first attempt to test hypotheses about the relative degree of punctuation (the relative non-normality of decision outputs) in the policy looked at the influence of the politics surrounding specific types of budget functions on the distribution of budgetary outputs (Jordan, 2003). Meagan Jordan studied the distribution of local government budgets and found that budget decisions about some functions were more consistent with punctuated equilibrium than others.

As opposed to the True et al., (1999) method of pooling all budget functions into a single sample of budgetary authorizations, Jordan sought to compare the behavior of different functions. Jordan (2003) argued that not all budget processes are the same. Borrowing a typology of budget functions from Peterson (1995), Jordan argued that some budget functions "neither hurt nor help the local economy" (350–352). She categorized these functions as allocational and included budgets for police, fire, and sanitation. Other functions are designed to spur economic development. She categorized these as developmental and included parks and recreation and public-building spending. Finally, some spending relies heavily on intergovernmental transfers of funding. She categorized these as intergovernmental and includes spending on highways.

Each of these types of budgets involves a different political environment.[*] The allocational budgets are supposed to involve low levels of conflict—and therefore will be more stable—because they represent "basic day-to-day services" (Jordan, 2003, 350). Jordan then tested whether allocational budgets are more stable than non-allocational budgets, with special attention to the relative probabilities of large changes.

To compare the relative probability of change magnitudes, Jordan defined upper and low thresholds for change. Jordan elected to define a specific percentage change as large. For negative change, a decrease in a budget of greater than 25% below the average change rate is considered a large negative change. For positive change, an increase in a budget of greater than 35% above the average change rate is considered a large positive change (Jordan, 2003, 352). Each policy then had different thresholds based on the sample mean percentage change—but the gap between the thresholds is the same for all functions.

Analysis of the results suggested that allocational budgets experience lower frequencies of punctuations than non-allocational budgets (Jordan, 2003, 354) and lower probabilities of punctuations (356). The probability results were not sensitive to tests using other gap distances between the lower and upper thresholds (357). Together the results suggested that the degree to which a budgetary decision process experiences punctuations is related to budgetary function—and maybe to the politics surrounding each functional type.

This research is a substantial improvement over the distributional tests in previous work. Jordan initiated the use of punctuated equilibrium theory as a subject of hypothesis testing. The tests described above split up the distribution to ask which decision processes are more likely to experience punctuations. The key strategy, one that will be picked up again later, was to compare different sub-samples. If a scholar can identify a factor that should influence the degree to which a decision process is likely to be a punctuated equilibrium process, a researcher can compare sub-samples where that factor is present to sub-samples where the factor is absent. The ability to compare decision processes with different characteristics allows hypothesis testing within the punctuated equilibrium framework and moved the literature past serial tests of the consistency of samples with punctuated equilibrium predictions.

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[*] This way of thinking about the policy decision process is much like Lowi's (1964, 1972) famous statement that policies structure politics.

### 8.4.3 Punctuated Equilibrium and the Federal Policy Process

Around the time that Jordan (2003) published her hypothesis testing approach to the punctuated equilibrium model, Jones and his colleagues developed an alternative hypothesis testing approach. Jones et al., (2003) discussed the factors that make an organizational decision making process more characterized by punctuated equilibrium. Organizations face a number of obstacles to change. Jones and his colleagues contended that all organizations involve varying degrees of "institutional friction" (152).

This institutional friction can come from many sources. To discover relevant information for any decision, organizations may incur "informational costs." Once this information is available to the organization, the organization may pay "cognitive costs" to process the information. Once the information is processed, organizations may face "decision costs" representing the difficulty of reaching consensus within an organization on a decision. Organizations may also face "transaction costs" after a decision is made involving the costs of commitment, compliance, and oversight (Jones et al., 2003, 154).

These categories of costs have a broad range of potential application. The first two types of costs (information and cognitive) could affect individual decision as well as organizational decision making. The latter two types of costs (decision and transaction) can apply to just about any organizational decision. In this way, one could apply the friction theory of punctuated decision making to almost all decision processes. Linking punctuated equilibrium to this set of concerns integrates the theory of punctuated equilibrium decision making to broader concerns over bounded rationality and organizational decision making.

Jones et al., (2003) tested the general hypotheses that increased friction leads to increased punctuated equilibrium behavior by arranging a series of organizational decision outputs in an increasing order of friction (156–157). They argued that as one moves though the policy making process, a process that combines in parallel and serial fashion a variety of organizations, one should see increased punctuation equilibrium behavior. The list of organizational decision processes range from political input processes like the stock market, electoral outcomes, and media coverage to policy output processes like budget outlays, budget authority, and public laws (157).

Jones et al., (2003) used two methods for measuring the punctuated equilibrium nature of each of these decision processes. First, they measured the kurtosis of the output of each of the organizational processes, as in True et al., (1997). They found that political input distributions for elections, media attention, and the stock market had kurtosis measures ranging between three and ten. While this is an indication of leptokurtosis,[*] this is a low level of kurtosis compared to the previous studied budget distributions. Intermediate processes like hearings had kurtosis values in the 20 sec. Policy output processes had a wide range of kurtosis values with the public law distribution having a kurtosis of 24 and the budget distributions have kurtosis values in ranging from 60 to 85 (158).

The results of the kurtosis analysis were roughly consistent with Jones and his colleagues' expectations. With the notable exceptions of executive orders and public laws, the policy output processes had higher kurtosis values than the intermediary processes that in turn had higher values than the political input processes. The values of each group were statistically distinguishable from the sequentially prior group. The results were consistent with the institutional friction theory of organizational decision making.

There is not a lot known about the distribution of kurtosis statistics, so Jones et al., (2003) supplemented the analysis of the kurtosis of the various output distributions with other diagnostic tests. Jones and his colleagues tested the distributions against hypotheses that each distribution is normally distributed, exponentially distributed, and Pareto distributed. They found that the budgetary data were distributed along the heavy-tailed Pareto distribution as they expected while

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[*] In all cases, the kurtosis of the distribution was greater than the normal distribution based on the asymptotic standard error of the kurtosis statistic.

other distributions were close to the moderately tailed exponential distribution (160). These distributional tests provided supporting evidence for the conclusions reached in the kurtosis analysis. Together the tests provided strong evidence linking the temporal order in the policy process to punctuations in organizational decision making.

Jones et al., (2003) played an important role in raising awareness of the punctuated equilibrium theory and proposing a theoretical framework within which one could employ the punctuated equilibrium theory. The theory of institutional friction linked the discussion of punctuated equilibrium to well-established literature on transaction costs, organizational decision making, and bounded rationality. At the same time, the hypothesis tests in the article were unsatisfying. The ordering of the organization processes along the lines of the policy process was not tied to institutional friction well. It was not clear that as one proceeds along the policy process that one necessarily encountered more friction. In fact, the outlier they observed (executive orders) was accounted for by reference to their relatively low friction (158). Furthermore, there was no way to sense the magnitude of institutional friction. If one accepted the rank order, one still had no sense of the magnitude of the changes in friction or the magnitude of the changes in punctuated equilibrium behavior. The article pointed in the direction of the relevant hypotheses to test within the punctuated equilibrium theory but did not itself provide a clear test.

### 8.4.4 PUNCTUATED EQUILIBRIUM AND ORGANIZATIONAL BUREAUCRATIZATION

Jordan (2003) and Jones et al., (2003) had pointed the way to hypothesis testing within the punctuated equilibrium model. Jordan provided a method of sub-sample comparison to facilitate hypothesis testing. Jones and his colleagues situated punctuated equilibrium theory in a broader tradition of bounded rationality thus creating a fertile ground of potential hypotheses. Robinson (2004) followed these leads to test hypotheses within the institutional friction theory of punctuated equilibrium using comparisons of sub-samples. In doing so, Robinson also addressed a large question looming over education policy debates for over a decade.

Earlier Chubb and Moe (1990) argued that bureaucratization reduced a school organization's capacity to respond to change. In their view, bureaucratization made change more costly and increased the influence of entrenched interests. The result was that bureaucratized school districts lacked the capacity to address changing problems in education and the districts' performance was lower than the performance of leaner, less bureaucratized districts.

While the microdynamics of Chubb and Moe's argument are not obvious, there is an assumed story about the effect of bureaucratization on schools and policy change. Chubb and Moe argue that bureaucratization represents the addition of new layers of management to schools. These new layers may include specialized curriculum directors or district liaisons. Each of these new layers adds either a veto point (a person who can stop change) or at least a delay point (a person who can slow down change by demanding to be consulted in the change process). The result is that as school districts become bureaucratized, they are unable to respond to new challenges. Each change in policy must work its way through all of these hands. The result is an organization that is slow to respond to demands for change.

Meier et al., (2000) countered that Chubb and Moe had the causal story backwards. Meier and his colleagues argued that poorly performing school districts developed response programs and thereby developed more extensive bureaucracy. Their analysis found that poor performance preceded bureaucratization and that low test scores did not follow bureaucratization. The authors interpreted this evidence to mean the bureaucratization was not the cause of low test scores but may serve as an instrument of change rather than an impediment to change.

A central point in this dispute is whether bureaucratization is a barrier to change or a tool increasing the capacity of an organization to change. Chubb and Moe's view of bureaucratization was that it represents institutional friction reducing the ability of the organization to change. Bureaucratization multiplied veto points and delay points in the system. Meier and his colleagues,

view was that bureaucratization increases the organization's ability to overcome institutional fric-tion. For Meier and his colleagues, bureaucratization represented an organization's efforts to increase its capacity to handle challenges. This may come in the form of new expertise or new information processing capacity. What neither study tested was how bureaucratization was related to rates of change in organizational policy.

Robinson (2004) addressed this conflict by looking at the relationship between bureaucratiza-tion and policy change. Robinson separated school districts into bureaucratized and non-bureaucratized sub-samples. He then compared the kurtosis values of the two sub-samples to see which exhibited greater evidence of punctuated equilibrium—a byproduct of institutional friction. The analysis revealed that bureaucratized school districts had a distribution of budgetary change with a substantially lower kurtosis than non-bureaucratized school districts. The bureaucratized school districts had a distribution of budgetary changes that more closely resembled the normal distribution (with lower levels of small and large change, larger levels of moderate change) than the non-bureaucratized school districts. Robinson interpreted the evidence to suggest that bureaucra-tization reduced institutional friction in school district budgetary processes. The result was that bureaucratized school districts exhibited decision outputs less consistent with punctuated equili-brium than non-bureaucratized school districts.[*]

### 8.4.5 Assessing the Evidence

The preceding studies illustrate the evolution of punctuated equilibrium research in the study of the policy process. In the early stages, scholars were limited to assessing whether aggregate distri-butions were consistent with the predictions of punctuated equilibrium theory. Recent developments have pushed the study forward toward hypothesis testing. Starting with Jordan (2003), scholars have begun to ask a new set of questions. Rather than assessing whether any distribution of decision outputs is consistent with the predictions of punctuated equilibrium theory, scholars now ask what factors make a decision process produce outputs more or less consistent with the predictions of punctuated equilibrium process. Jones et al., (2003) theory of institutional friction established an ambitious agenda for research. Researchers can now assess the specific contributors to punctuated equilibrium behavior such as information, cognitive, transaction, and decision costs, as Robinson did (2004).

## 8.5 FRONTIERS OF PUNCTUATED EQUILIBRIUM RESEARCH

For all of the strides in the study of punctuated equilibrium behavior in organizational decision making, a great deal of work lies ahead. This section will discuss some of the limitations of the existing approaches to studying punctuated equilibrium in organization decision processes. I will conclude with a short discussion of the opportunities punctuated equilibrium research presents to improve our understanding of decision making generally.

### 8.5.1 The Statistical Challenges of Punctuated Equilibrium Research

The study of punctuated equilibrium presents many challenges for those wanting to apply statistical tests to hypotheses. The primary challenges stem from the focus of the existing hypothesis testing procedures on the analysis of distributions of decision outputs. The Jordan (2003) research compared samples of local government budget expenditures. Jones et al., (2003) research compared samples of organizational outputs in the federal policy- making process (2003). The Robinson

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[*] However, it is important to note that all of the samples Robinson analyzed exhibited a higher level of kurtosis than the normal curve and thus all samples were distributed as one would expect by punctuated equilibrium theory. The difference was in the degree of the punctuation behavior.

(2004) research compared samples of different types of school districts. In each case, the comparison was between samples of decision outputs.

The focus on sample characteristics severely limits the sort of hypotheses that scholars can test related to punctuated equilibrium. Rather than having to assemble sets of observations, researchers adopting the current hypothesis technology in the punctuated equilibrium literature have to assemble sets of samples. Each sample has to be sufficiently large enough to allow for the analysis of fourth moment characteristics—if not kurtosis than some other analysis of extremes. Each sample can be thought of as an observation of punctuated equilibrium behavior. In the largest set of comparisons to date, Jones et al., (2003) compared less than a dozen distributions. This is similar to a study with 12 observations. There is not much you can do with such a set of observations.

The focus on samples constrains researchers to univariate tests. The Jordan (2003) research focused on a univariate test of the effects of a dichotomous variable (policy type). Jones et al., (2003) research ranked the samples in order of institutional friction. The Robinson (2004) research compared two sets of school districts based on a dichotomous variable. The comparison of school district budget changes may be particularly illustrative of the limitations of the sample-based procedure. The independent variable under investigation was bureaucratization, measured as the percentage of resources devoted to administrative personnel. This original measure was actually a continuous variable. Robinson was forced to collapse the continuous variable into two categories to make a discrete comparison. One cannot analyze the effect of a continuous independent variable without transforming the variable into a discrete variable—with the associated loss of information.

The focus on samples also raises questions about the qualities one needs in the various samples under investigation. Jones et al., (2003) and Jordan (2003) sampled pool data across time. Jordan (2003) and Robinson (2004) sampled pooled data across space as well. The effects of these pooling exercises are not at all clear. The assumption of pooling across space or time was that the characteristic under study is constant across all of the units within the sample. In Jones and his colleagues' sample, for example, the authors assume that the kurtosis of the federal budgetary process is the same throughout the sample. The pooling across time assumes that there were no years that were any more likely to exhibit large changes than any other years. The data generating process (or the punctuation generating process) is assumed to be the same across all of the years in the sample. A similar problem lurks in the pooling across space. Jordan pooled all city budgets together. Jordan's pooling of city budgets assumed that all cities are as likely to experience punctuations in any given year as all of the other cities (within a specific policy type). The specter of omitted variable bias looms large. This is particularly problematic when the measurement or ordering of the independent variable is controversial.

The obvious solution to the focus on samples is to focus, instead, on individual observations. Focusing on individual observations (classified as small, medium, and large change) opens up a number of options. Most importantly, such a shift matches the empirical unit of analysis with the theoretical unit of analysis. The punctuated equilibrium theory focuses on individual decision making units and the individual outputs of the process. The focus of the theory is on the factors that make large, medium and small changes more and less likely. The theory does not focus on the distribution of outputs. The statistical test should similarly be focused on the size of the individual decision output.

Second, a switch to the individual unit of analysis allows one to test multivariate hypotheses including continuous independent variables. The sample focus limited the effective number of observations (for purposes of hypothesis testing specifically) to a small number. With samples of observations, one could not test multiple hypotheses simultaneously and could not test for the effect of continuous independent variables because the number of samples quickly becomes too small to serve as the basis for more advanced tests. As discussed above, continuous variables simply could not be tested using comparisons of discrete samples. Even if one wanted to test for the effects of multiple independent variables in the sample-focused system, the number of sub-samples need would proliferate quickly. If one were only testing for the effect of dichotomous variables, one

would need $2^n$ sub-samples where $n$ is the number of independent variables to be studied). As one can see, the demands on the data expand exponentially in the number of simultaneous variables.

An individual observation approach makes these sorts of tests realistic. Once one categorizes individual outputs as indicating small, medium, or large change, one can test for the effects of various independent variables using traditional regression technologies.[*] With the traditional regression framework, one can assess the effect of, say, bureaucratization (measured as a continuous variable this time) and organizational size simultaneously. The opportunities this hypothesis testing approach opens up are countless. With the regression framework, one can test for the effects of specific information, cognitive, decision, and transaction costs as well as comparing for the relative importance of each.[†]

Moving to the individual decision output level of analysis leaves a number of estimation problems. The first is the nature of timing in the theory of punctuated equilibrium. Many of the theories (as vague as they are) suggest that punctuations should reduce the stress on the decision system. The punctuation should return the decision maker to equilibrium with its environment. A key factor influencing punctuated behavior should be the history of the decision system. None of the tests have included history in the analysis. This is not just simply because of the rush to test so many other propositions. In part, this is because of the limited nature of the data available. In the sample-based studies, pooling of organizations across time prevented the inclusion of any time-based variable. Even a test using the individual decision as the unit of analysis is likely to find testing the historical hypothesis difficult. The large data sets that provide the scale of data needed to address questions of punctuated equilibrium have limited time periods. Ideally, one would need a data set with a large set of organizational decision outputs observed yearly for a long period of time. Not many data sets have these qualities.

The most fundamental problem facing the statistical testing of hypotheses derived from punctuated equilibrium theory is the difficulty of studying rare events. All of the most common statistical technologies focus on providing information about the central tendencies of observations. The reliability of such estimates becomes questionable when one starts to apply the results to the extreme values in the sample. However, punctuated equilibrium studies need to assess rare events—punctuations. Data sets have to be sufficiently large to provide some leverage on questions related to rare events. Every included independent variable increases the number of rare events one would have to observe to get leverage on the hypothesis. The result is a need for staggeringly large data sets. Furthermore, one needs data sets that are free of errors. An error may well turn up as a large change. If large changes are rare, each one will have substantial leverage on the results. In this case, errors may play a large role if determining the result if one is not careful in the analysis.

Together these challenges to the statistical testing of hypotheses related to punctuated equilibrium theory suggest the difficulty of such research, but not its impossibility. Researchers must be careful in designing the hypothesis tests of punctuated equilibrium hypotheses, but such tests are possible. More attention is needed on the hypothesis testing technologies available to researchers in this area of study, but the challenges are not insurmountable.

## 8.5.2 THE THEORETICAL CHALLENGES OF PUNCTUATED EQUILIBRIUM RESEARCH

Punctuated equilibrium theories face theoretical challenges in addition to the statistical challenges reviewed above. As may have been clear in much of the discussion above, there are a number of points where the theory of punctuated equilibrium is unclear. Many of the variables associated with punctuated equilibrium theory are unclear and difficult to make operational. Furthermore, the

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[*] Jordan (2003) could have done just this once she created arbitrary cut points for small, medium, and large change. She stayed with the comparison of samples of observations by policy type-but she did not have to.

[†] For an example of the utility of this approach, see Robinson et al., (2004).

linkage between the variables and the decision processes are unclear. A clear theoretical model of punctuated equilibrium decision making would go a long way toward resolving some of the ambiguity.

The absence of a theoretical model stems from the descriptive orientation of some of the original work on punctuated equilibrium. The intuition of the punctuated equilibrium model was based on the observation of (rare) large changes and (common) small changes. This intuition does not provide an explanation for why one observes this pattern, but the pattern itself became evidence for the theory. Baumgartner and Jones (1993) initial work suggested the sorts of mechanism that might be at play. They focused on the interplay of positive feedback and negative feedback. The negative feedback supported the equilibrium that emerged from the occasional episodes of positive feedback. Together, these feedback mechanisms hint at the causal mechanism behind punctuated equilibrium organizational decisions. However, the theoretical development has not progressed far from that point.

A strong attempt to elaborate a causal theory of punctuated equilibrium can be found in Jones' book *The Politics and the Architecture of Choice* (2001). Jones argues that punctuated equilibrium stems from systematic under-reaction and overreaction to environmental stimuli. Under-reaction is a product of negative feedback whereas overreaction is a product of positive feedback. This argument then focuses on the role that adaptation plays in decision making. While this provides some clarity on what can cause a positive or a negative feedback process, there is still a lot of work to be done to integrate the various factors discussed in the literature on punctuated equilibrium.

To take one example, the language of adaptation and feedback does not assist in sorting out the hypothesized effects of bureaucratization on decision systems. It is not clear whether to expect bureaucratization to create systematic under-reaction, as Chubb and Moe suggested (1990), or to expect bureaucratization to reduce under-reaction and overreaction processes, as Robinson found (2004). The limitations of the adaptation metaphor are clear in Jones and his colleagues (2004) discussion of the institutional friction theory. While in some sense the institutional friction theory is an organizational version of the individual adaptation theory in Jones' earlier work (2001), the discussion of the sources of friction reveals how sparse the model is. There are four different potential sources of friction. Each of these sources of friction represents a large literature of research. There is no attempt to integrate the various components of friction or to model how they affect decision making—except to say that they make change costly and may lead to punctuated equilibrium.

Future theoretical work must take seriously the need for a model of punctuated equilibrium that integrates the various types of costs identified by Jones et al., (2003). This work should consider the components of each source of friction. What increases transaction costs? What decreases informational costs? How do the various costs tradeoff and interact? Are there nonlinear interactions of certain types of costs? All of these questions illustrate the need for theoretical development.

A threshold model of decision making may provide the starting point for such a synthesis. One can begin by imagining change as the product of some demand. That demand may be internal or external depending on the situation at hand, but without demand for change—change is unlikely. The metaphor of costs suggests that decision makers must overcome some barrier to change. That barrier may be the product of any of the four sources of costs discussed by Jones and his colleagues (2004) As the costs of change go up, the barrier goes up. When the demand for change is below the critical threshold for change, nothing or very little happens. One can imagine that the organization changes only incrementally while demand is below this critical threshold. Once demand builds up to pass the threshold, positive feedback/overreaction mechanisms take over. Large changes are contemplated and likely chosen. Among organizations facing a demand for change that exceeds their critical threshold, the distribution of changes is likely to have very heavy tolls and may not have much probability mass around the zero change.

The threshold model provides a metaphor within which it is easier to theorize about the effects of bureaucratization, for example. Bureaucratization may play a role in raising the change threshold

by increasing the number of people that must be consulted before any change can be enacted. The result would be longer periods of building demand during which change would only be incremental. Demand would have to reach a higher threshold to motivate a larger number of people (veto players or time-consuming players). Only after this higher threshold hold is reached is non-incremental change possible. This is very much the image that Chubb and Moe (1990) provide for bureaucratization in school districts.

The threshold model suggests that great attention should be paid to the exact change brought about by bureaucratization could have a different effect on the threshold. Bureaucratization may increase the organization's capacity to assess and respond to new demands. New bureaucrats may be able to collect more data and better assess the new data for the sorts of signals that should motivate non-incremental change. This is the motivation behind the reactive bureaucratization described by Meier et al., (2000). School districts seek more information to respond to initial signs of difficulties. If there is evidence of problems in math instruction, the districts may create a bureaucratic position that is supposed to collect information on math performance and design new math curricula. This informational capacity may lower the threshold by better assessing the demand for change when that demand exists. The result is a process that can more easily overcome the change threshold when needed.

The threshold model suggests that great attention should be paid to the exact change brought about by bureaucratization (or any factor hypothesized to influence the rate of change in an organization). Bureaucratization, for example, may increase veto players and it may increase demand-assessment capacity. The threshold model suggests that greater attention should be paid to the meaning of bureaucratization so that these faces of bureaucratization can be assessed separately. Scholars need to consider whether bureaucratization actually does increase the presence of veto players. They must also consider whether bureaucratization increases demand assessment capacity. Then, the scholars must consider the relative magnitudes of each.

The existing empirical research only assesses the aggregate effects of bureaucratization. The Robinson (2004) research, for example, suggests that the demand assessment influence is greater than the influence of any created veto players. This research, however, cannot assess the independent effect of each. There could be a strong veto player effect outweighed by a stronger demand assessment effect. There could be a weak veto player effect outweighed by a moderated demand assessment effect. Without disaggregation, such questions cannot be answered. The future lies in using a theoretical model of organizational change (like the threshold model of punctuated equilibrium) to figure out which aspects of an organization are likely to affect change processes (such as veto players, time-consuming players, and demand-assessment capacity) and match the measurement and testing to these aspects.

The threshold model, while a simple application of much of the verbal theory of punctuated equilibrium, suggests some very complicated dynamics. Any large sample of observations is likely to include a mixture of the pre-threshold incremental decision outputs and the post-threshold non-incremental decision outputs. Looking for characteristics of the sample as a single distribution (rather than as a mixture of distributions) may be problematic. Furthermore, this theory suggests that the relationship between any of the sources of institutional friction (which determine the threshold) and the size of the change will be nonlinear—may be dramatically so. The threshold model, in fact, suggests that the probability of a large change changes from nearly zero at a point just below the threshold to substantial (though still maybe small) at a point just the other side of the threshold. These nonlinear relationships may elude the linear assumptions of most regression-based approaches.

Still, the threshold-based approach provides a firmer grounding for theorizing about institutional friction (as well as a more realistic assessment of the difficulty in testing for the effects of the sources of institutional friction). Future researcher should consider what effect an organizational characteristic (like bureaucratization) or individual characteristics (like information processing capacity) will have on the threshold separating incremental from non-incremental

response processes. Such a framework may provide a clearer model for future development of punctuated equilibrium theory.

## 8.6 CONCLUSION

While still in its infancy, punctuated equilibrium theory promises to offer insight into to decision making. Punctuated equilibrium theory provides a way out of the theoretical logjam between incremental and non-incremental decision theories. The model of decision processes as producing punctuated equilibrium focuses our attention on the factors that contribute to decision stasis and punctuation. Within various settings, theoretical and empirical work can advance as we begin to study the factors that contribute to the varying degrees of stasis and punctuation in different settings.

The existing research has focused on organizational decision making. It should be no surprise that it is in organizational decision making that the punctuated equilibrium has then had the greatest effect. The work of Jones et al., (2003) in particular has pointed to the potential contributions that punctuated equilibrium theory can have to a theory of organizational decision making. Their analysis illustrated the importance of institutional friction in shaping the distribution of organizational outputs. Though not studied directly in their research, Jones and his colleagues also linked punctuated equilibrium to broad areas of organizational decision making such as collective action, coalition building, and transaction costs. This suggests that punctuated equilibrium theory could potentially serve to integrate diverse fields of study in organizational decision making by focusing attention on the factors that affect the rate and magnitude of change in organizational behavior.

These contributions are most obviously relevant to the study of organizational decision making, but could also apply to individual decision making. While understudied to this point, many of the factors thought to affect organizational decision making could also affect individual decision making. While transaction and decision costs are not relevant to individual decision making, information and cognitive costs are key components of individual decision theories. The punctuated equilibrium theory suggests that as these costs rise, individual decision outputs should resemble the outputs of organizations facing institutional friction. This area is understudied, but could provide great insight to the punctuated equilibrium theory just as the punctuated equilibrium theory could serve to integrate models of change in individual decision making.

In both of these circumstances, the threshold model of decision making may provide assistance. Individuals and organizations are likely to stick with incremental decisions until the pressure to change passes some critical threshold. The factors affecting the level of this threshold may differ at the organizational and individual level, but the basic model may be helpful. The key to future development of this theoretical perspective is to identify the relationship between various individual and organizational characteristics and the threshold separating incremental from non-incremental decision processes.

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