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Approaching a Model of Policy Change: A Challenge to Political Science

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Abstract:

Scholars in the theory of public policy have asked how can we understand the "incredibly complex" process of policy change? Though many answers have made important contributions to this understanding, they tend to rely on theory that is either 1.) very general in scope or very narrow and specific to a particular agency's decision processes, 2.) reliant on a single or several case studies that are often of limited utility, and/or 3.) derived from multiple regression analysis that usually disregards dynamic change and any element of feedback despite a foundation in an otherwise complex causal theory. In fact, scientific approaches to the study of policy making processes are ill-designed to confront the apparently tremendous influence of personalities and chance events, the unique features of policies, and the unique and diverse range of environments in which policy is made. But "noise" is not unique to political systems and the goal of policy theory must be to assist in understanding the role of causal elements in policy making whether irregular and diverse or uniform and predictable. This paper summarizes several important causal models in public policy making and suggests ways in which these conceptual approaches, previously the subject of limited testing via case studies or regression models, could be made more rigorous with the use of system dynamics modeling.

I.

Despite common talk of political systems, political scientists have done very little to utilize systems thinking. Although system dynamicists are often interested in public policy, few political scientists and policy analysts are trained in system dynamics. A review of the contents of traditional political science and public policy journals will reveal few, if any, works using system dynamics methods and my review of hundreds of papers presented at the 1999 annual meeting of the American Political Science Association concluded that there was no example of system dynamics to be found.

On the one hand, the absence of system dynamics methods in political science would surprise no one. System dynamics is not taught in political science graduate programs, but has thrived on business applications as a result of the continuing commitment of the Massachusetts Institute of Technology's Sloan School of Management. On the other hand, however, systems thinking, of a sort, and systems analysis began in political science and the social sciences more generally in the 1950s. Theory building and systems analysis generated substantial interest in academic political science through the 1960s, stimulated primarily by David Easton's final volume *A Systems Analysis of Political Life* (1965B). Easton's work was so influential that systems analysis is still presented, thirty-five years later, as one of a handful of primary approaches to the study of political science and public policy (Anderson, 1997; Dye, 1998; Susser, 1992).

Despite the development of this systems approach in politics and its continuing mention in texts, systems thinking is largely dormant in academic political science while system dynamics appears to be thriving. Some of the explanation is, I suppose, obvious

to practitioners of system dynamics. Though appearing at the same time, system dynamics originated in engineering and was then applied by Jay Forrester in the business setting and later to social systems (1961, 1969, 1971). It now seems likely that disciplinary boundaries kept political systems theorists from communicating with those working in system dynamics. A comparison of the literature in both fields reveals no interaction whatsoever. True, political scientists took note of the publication of *The Limits to Growth* (Meadows, et al., 1972), but they had the skills neither to critique the work nor develop models of their own adopting the same method.

Developments since 1972 have done little to change the situation. The absence of system dynamics in political studies is even more noteworthy because of it its appearance (admittedly by another name) in two works that gained substantial attention in traditional political science circles. Lave and March in *An Introduction to Models in the Social Sciences* (1975), for example, discusses diffusion models and Stokey and Zechauser in their widely cited *A Primer for Policy Analysis* (1978), begin with a chapter on difference equations including a discussion of models using stocks and flows.

Despite these examples of what appears to be system dynamic method in the politics and policy literature, and despite the appearance of mathematical modeling political science, the absence of true systems modeling in the political science literature may have even deeper origins. Political scientists, frankly, associate all academic discussion of system methods with the work of Easton. Since Easton is seen ultimately as a failure, someone who basically spent his life time translating what we all knew about politics into different terms, political scientists seem to believe that system analysis failed to reveal either anything new or a research agenda that could be developed after Easton's

death. After Easton, researchers became enamored of the related field of structural-functionalism and then the more powerful game theory and rational choice approaches. Efforts to build a science of politics turned from the study of behaviors broadly defined, to the study of decisions made by rational actors and modeled after research in microeconomics.

Now instead of an active systems research agenda in politics, we have a situation in which a small number of policy analysts use difference equations or true system dynamic models in their work and academically trained political scientists are largely unaware of the developments in system dynamics methods.[1] This is unfortunate because it appears that system dynamics is an approach can that provide virtually unlimited avenues for political research. Political systems are dynamic, do contain feedback mechanisms and delays, as Easton explained, and political and policy problems can be understood in terms of stocks and flows. Furthermore, like all social scientists, political scientists continue to see the quality of their research questioned when they find their work confined to the measurement of objectively verifiable data. The ability of system dynamics models to use non-quantitative variables is, therefore, a distinct advantage in social system modeling.

For example, there are, in the politics literature, interesting models of policy change. These are models that attempt to illustrate how changes in a political environment may alter the outputs of legislatures or agencies. The work is significant, among other reasons, because democratic theory suggests that public decision makers should be both representative of public opinion and needs, and accountable to the public.

[1] Nazli Choucri's work in international relations stands out as a notable exception. See, for example, Choucri and Bousfield (1985) and Wils, Kamiya and Choucri (1998).

Plainly these decision makers operate in a complex political environment that includes many forces besides public opinion. Models of these processes can help to identify these forces and their relative influence. Unfortunately, these models though sometimes informed by systems analysis, are not informed by systems thinking.

II.

A brief literature review of theory in public policy research is sufficient to illustrate the substantial difficulties in this field. Some problems might be attributed to the youth of the discipline. Public policy as a recognized sub-field is barely thirty years old. Many problems, however, do not result from naive or undeveloped theory. Instead they arise either from complex theory with limited empirical value or theory limited to variables that allow traditional social science hypothesis testing. In both cases, there is a poor match between theory and method. Authors of complex theories tend to be disregarded by empiricists for obvious reasons and those writing empirical studies are thought, by traditionalists, to work with limited causal understandings artificially constrained by measurable variables. In sum, the existing theory of policy change tends to be either 1.) very general in scope or very narrow and specific to a particular agency's decision processes, 2.) reliant on a single or several case studies that are often of limited utility, and/or 3.) derived from multiple regression analysis that usually disregards dynamic change and any element of feedback despite a foundation in an otherwise complex causal theory.

One approach to the study of public policy is the "stages heuristic" as described by Paul Sabatier (Sabatier, 1991; Sabatier and Jenkins-Smith 1993, 1994). Derived from David Easton (1965A, 1965B) and others, this approach is evident in widely used public policy texts (See Anderson, 1997 and Peters, 1999). The stages, roughly agenda setting, policy formulation, policy adoption, implementation and evaluation, are process oriented and conceptually useful, but are not developed in the form of a causal model. Worse, from a testing standpoint, the authors who use such models take great pains to explain to readers that policy making is messy. It does not happen in stages. The stages are used, nonetheless, both for teaching about public policy and, more importantly, for setting research boundaries. The famous studies of agenda setting by Kingdon (1995) and implementation by Pressman and Wildavsky (1979) are obvious examples. The problem with the stages approach for public policy theory is that, like Easton's systems theory before it (1965A, 1965B), it is both too general and does not explicitly and adequately specify the causal forces that might move a policy through the stages toward adoption.

Easton's systems theory fills a three volume work but is generally represented in policy texts like Anderson (1977) and Dye (1998) by the diagram below. This is a gross simplification of such a lengthy work, but serves the purpose because Easton's longer work merely adds substantial detail to the basic concepts of a system located in an environment turning inputs into outputs. (See Figure 1.)

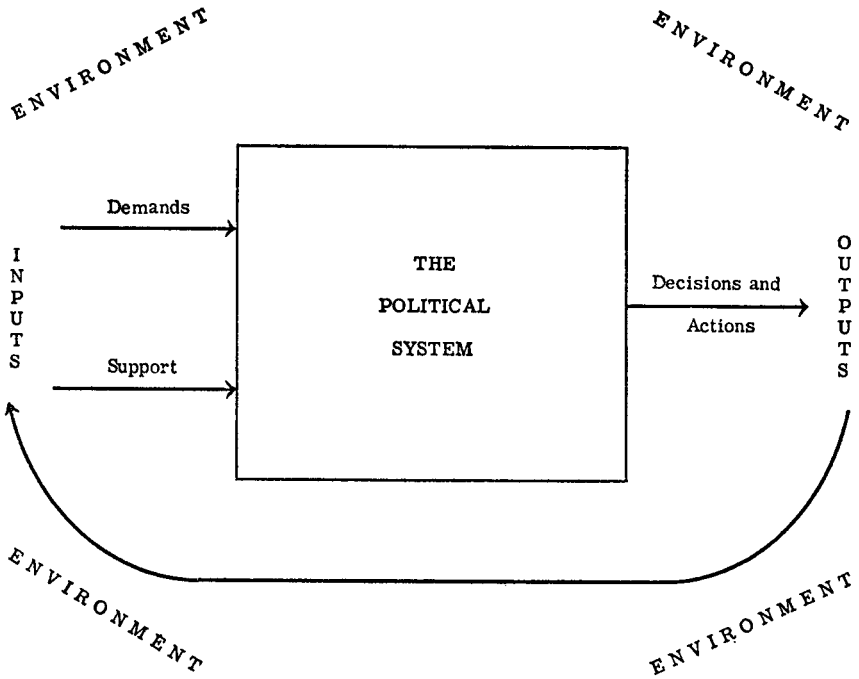


Diagram 3. A Simplified Model of a Political System.

(Figure 1. Easton, 1965A, p. 112.)

The obvious value of this view is that the political system is correctly portrayed as a dynamic feedback system. Though feedback in politics is apparent, for example, the success of politicians depends on public support and this support depends on the success of politicians, Easton was perhaps the first to use the term and explicitly provide for feedback effects in his general systems theory approach. Still, as the diagram makes obvious and as his more complex and rich exposition of his theory makes plain, Easton did not develop a model that could be formally specified or empirically tested. Contemporary political theorists have set it aside as unlikely to lead to further theoretical developments.

On the other end of the spectrum are studies which are overly narrow. These studies tend to focus on one act or one agency. Examples of non-formal, historical studies include Waldman's (1995) recitation of the origin and adoption of the national

service program Americore and Garvey's "insider's" look at decision making in the Federal Energy Regulatory Commission (1993). Despite limitations, these studies are of obvious value as they establish the rich contextual detail of political decision making and, in doing so, provide the foundation upon which more formal and general causal theory can be built. The authors, however, generally fail to take this next step and often fail to specify the more general hypotheses or lessons that might be revealed by their work.

A case study approach, especially when used as a method of testing hypotheses, can be advantageous for several reasons. The use of multiple case studies will place a work in the middle ground between overly general and narrow studies, and some authors take that important methodological step towards theory specification. Interesting examples include Mazmanian and Sabatier's (1983) implementation studies, Sabatier and Hunter's (1989) study of the mental models of the causes of pollution among environmental policy elites and Sabatier and Jenkins-Smith's (1993) study of policy change based on interest groups or "advocacy coalitions." This last work is of particular interest as the authors map out a policy system, use case studies to test hypotheses derived from their understanding of the system and then revise their understanding based on the data developed. The case studies are both qualitative and quantitative and cover a range of policy issues from education and environment to airline deregulation and telecommunications.

Though on the cutting edge of policy theory and more formal than many approaches, Sabatier and Jenkins-Smith's model is not designed to support simulation. (See Figure 2.)

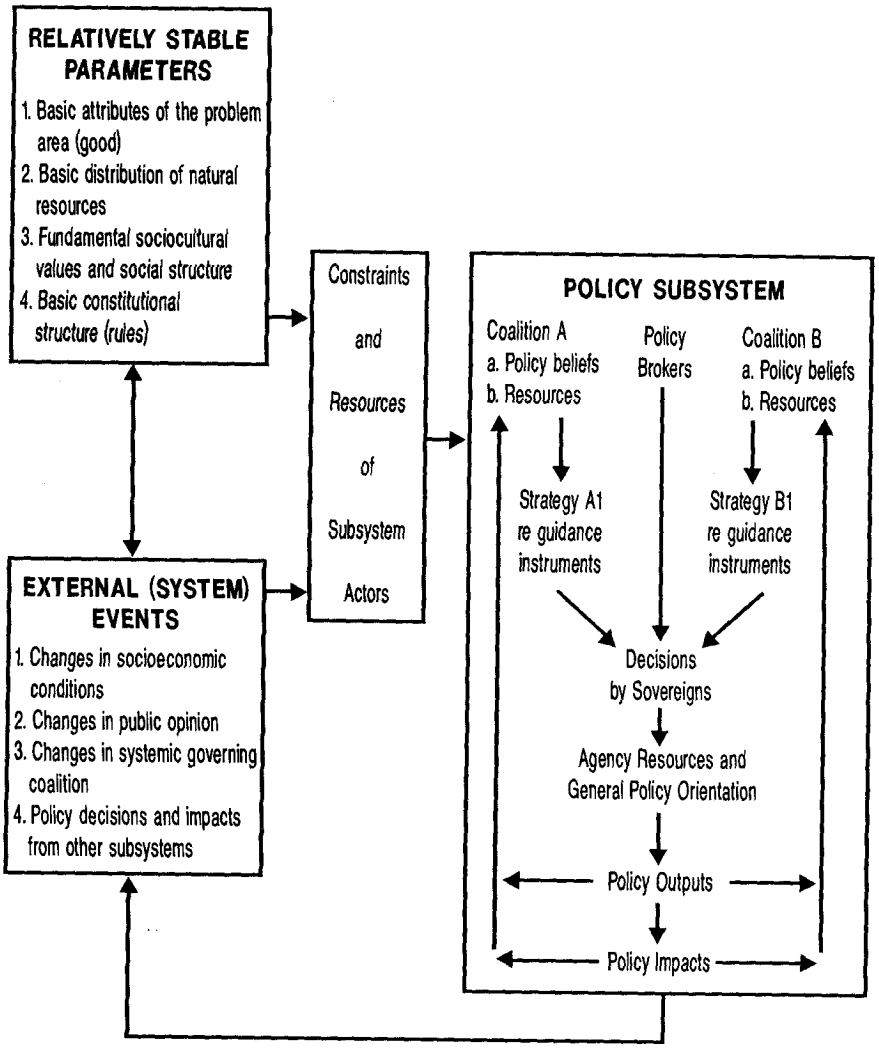


FIGURE 10.1 Revised diagram of the advocacy coalition framework

(Figure 2. Sabatier and Jenkins-Smith, 1993, p. 224.)

As evident from the diagram above, the authors envision a simplified model in which two opposing coalitions attempt to influence decisions with the assistance of policy brokers who manage conflict with an interest in resolving disputes. Decisions result in policy outputs and impacts that influence external events and feedback to the resources and strategies of the subsystem actors. The model thus includes both feedback effects and

dynamic changes over time. Both are elements often partially or completely missing from studies of policy change.

The weakness of this approach, especially from a system dynamicist point of view, is that the authors fail to specify variables that can be modeled even though the authors are clearly interested in the performance of a dynamic feedback system. By way of illustration, the following are two of many hypotheses examined by Sabatier and Jenkins-Smith:

> Hypothesis 4: The core (basic attributes) of a governmental program is unlikely to be significantly revised as long as the subsystem advocacy coalition that instituted the program remains in power.
>
> Hypothesis 5: The core (basic attributes) of a governmental action program is unlikely to be changed in the absence of significant perturbations external to the subsystem, that is, changes in socio-economic conditions, system-wide governing coalitions, or policy outputs from other subsystems. (1993, p. 34.)

The authors tested their hypotheses by asking independent coders to review the case studies to determine whether each hypothesis held true for each of the six case studies presented. In general, the hypotheses are supported, although, in conclusion, the authors revise several hypotheses in response to their data. Such case studies, therefore, represent an interesting, but plainly limited approach to empirically and qualitatively validating the causal theory presented.

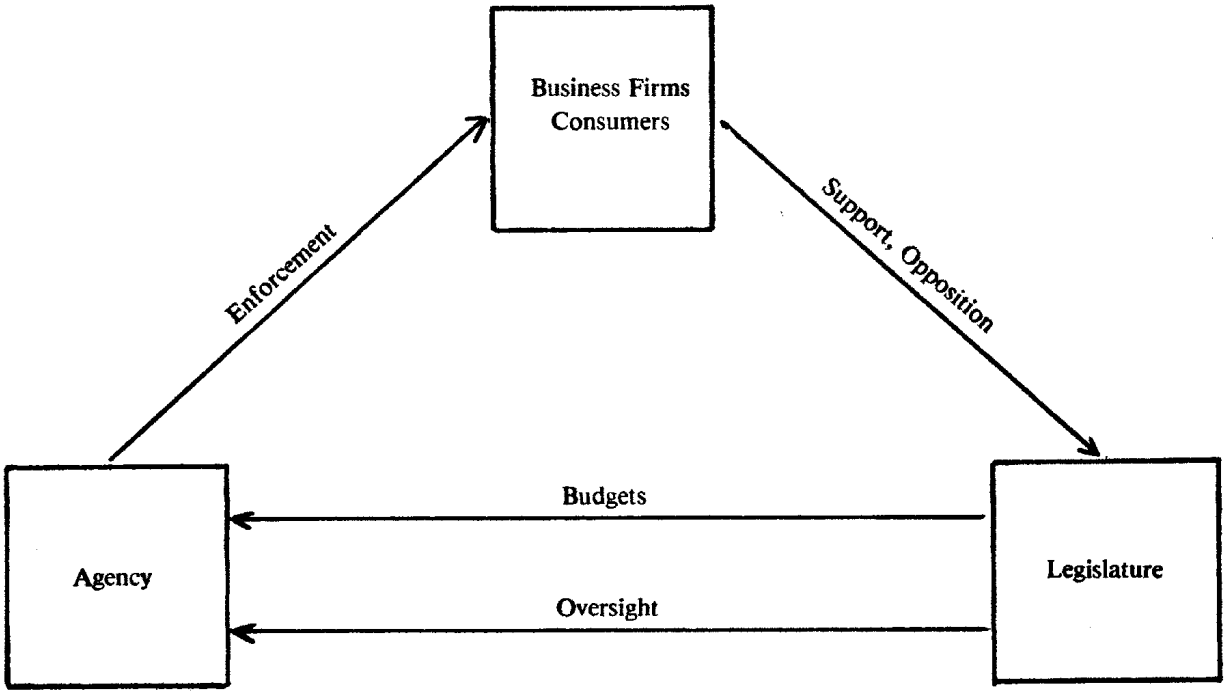
It is too bold and beyond the purpose of this paper to claim that Sabatier and Jenkins-Smith's model of policy change could be re-written as a system dynamics model that would remain true to the authors' concepts, theory and causal understanding of political processes. Still, it is apparent that one could recast much of this model using the concepts of system dynamics. For example, using the hypotheses presented above, one

could specify the core attributes of a program in several ways. This variable might be defined in terms of changing (increasing or decreasing) agency staff, delegated powers, program operations, budget, grants funded, population served, enforcement actions taken or regulations promulgated or repealed. Without trying to construct a definition of "core attributes" that matches the authors' usage, it is evident that it is possible to define government functions using variables that represent changes in these functions over time. One might represent the growing (or declining) power or influence of an advocacy coalition in similar terms. Hypothesis 5 refers to "external perturbations" in the system such as changes in economic conditions. Such conditions are often elements in system dynamics models. Changes in governing coalitions could be represented by changes in party representation (strength in a legislature), in the resources of opposing interest groups, or in public opinion on questions regarding the role of government or more specific questions like support for public assistance programs or tax cuts. By listing a number of alternative ways of specifying variables, I obviously make no claim regarding a single best method. The point is more general: that causal models of policy change like those presented by Sabatier and Jenkins-Smith can be tested in ways other than by examining a set of case studies. It is at least logically possible to revise these models using variables suitable for simulation modeling.

Most models used in political science are constructed using regression equations. Coleman (1999) is a recent example. He uses a number of variables representative of party control of governmental institutions to determine whether unified or divided government is more productive. The analysis is repeated several times using different measures of legislative productivity. Although Coleman uses a number of other

variables, such as the size of budget deficits and the "activist mood" of the public, the result is still a model in which all the variables are assumed to be independent (Ostrom, 1982) and there is no provision for feedback effects among the variables despite the use of time-series data.

A few mathematical models of policy adaptation are more sophisticated in approach. For example, Bender and Moe (1985) use an adaptive and dynamic model to determine whether and how agencies, legislatures and business or interest groups interact to adjust agency enforcement budgets and enforcement activity in response to previous agency actions and public pressure. They developed the model further to apply it to agenda setting (1986). The problem with this approach is that the model includes limited feedback assuming that, for example, agencies only influence legislatures by means of the public and not directly. The model also assumes that the public is incapable of influencing the agency directly. (See Figure 3).



(Figure 3. "The Flow of Influence," Bender and Moe, 1984, p. 758)

The approach was severely criticized by Krause for these very reasons (1999). Krause's study of bureaucratic politics is, perhaps, the most sophisticated to date as it uses vector auto-regression to examine the same questions of institutional outputs employing a dynamic model with multiple feedback loops. The weakness in this study is that, after developing a relatively complex mathematical model, Krause is limited to using that model to study the forces that affect the number of agency enforcement actions in two agencies. Although this is one approach to understanding the relationship between the Congress and agencies, it omits many other aspects of this relationship, for example, programmatic activity which might be more important in many agencies than enforcement actions. He also fails to acknowledge that the number of violations or violators present in the environment or estimates of illegal activity might by an influential

factor in agency enforcement activity. Nonetheless, Krause's effort is perhaps the most sophisticated and complete study of change in administrative and legislative policy to date. It is interesting to note that though he is apparently not trained in system dynamics, Krause's main criticisms of the literature relevant to his book is that prior research did not accomplish what the system dynamics method was designed to accomplish: develop testable causal models of complex, dynamic systems with multiple feedback loops.

III.

Throughout this discussion of theory and research in policy outputs and policy change, I have suggested that a system dynamics approach to these questions might solve many of the conceptual and methodological problems apparent in the literature. There are reasons, however, to think that system dynamics is not appropriate for research questions of this nature.

Frohock, for example, raises the more general question of whether politics is an appropriate subject for systems methods (1979). He suggests both advantages and disadvantages. In reference, again, to Easton, Frohock writes:

> The advantages of a systems model are these: (a) the *process* character of policy is easily caught, thus avoiding the mistake of seeing policy as a static, random, or totally disjointed collection of activities; and (b) a high level of generality is maintained, persuading us to see a more total picture of policy than partial models or simple case studies permit. (1979, p. 17, emphasis in original.).

But Frohock also suggests that the systems approach can lead to two important mistakes. The first is to suggest that politics is "a smooth continuum of *actual* policy activities," (1979, p. 17, emphasis in original.) and the second, related mistake is to substitute the

generalities of a theory for the "particulars of real-life experiences" (1979, 18). Frohock suggests that we need to develop secondary theories to "connect systems models to real-world politics" (1979, 18). The problem for Frohock is that politics must be understood as consisting of both patterned and recurring activity, *and* other events or perhaps dominant personalities that are difficult to place in a causal model of patterned activity. He offers assassination as an example of the these other events (1977).

The argument here is, of course, not the simplistic "politics does not contain systems" or "politics can completely be understood in terms of systems." Rather it is the more complex idea that 1.) systems approaches are appropriate tools if their limitations are recognized and 2.) there may be times or circumstances in which the apparently messy, random or arbitrary nature of political outcomes may justifiably overwhelm attempts to identify general causal theory.

With this caution in mind, however, it appears that system dynamics might still be the best approach for moving beyond a journalistic diary of political personality and history toward a social science of politics. There are two reasons this is true. To the extent that modelers are working with historic data and events, system dynamic models can be built to accommodate changes in the environment or the system itself over time. The method allows the introduction of new causal factors or decision rules part-way through a simulation. Secondly, in a similar manner, it is possible to introduce shocks into a system that might radically alter the system's performance. In a political setting that might be, for example, a declaration of war that radically and fundamentally alters public opinion on a key variable for an extended period of time. To the extent that one is using a model to forecast outcomes, more substantial problems remain. The modeler can

propose scenarios in which, to follow the example above, public opinion shifts dramatically due to some external event. But one would obviously make grave errors if such a scenario were to be understood as a prediction of events that will happen.

With those cautionary words in mind, system dynamics has much to offer the study of politics and policy. Political scientists might do well to recognize the important contribution system dynamics has made in business management where "politics" is also evident in apparently random events, seemingly arbitrary decisions, the inter-play of committee members in reaching a result, and the interaction of multiple actors with different powers and abilities in a company or industry. Despite the messiness of politics in public or private life, there are still important institutional structures; traditional, habitual or legislated processes; consistent or changing, but identifiable decision rules and patterns of behavior that are worthy of study. System dynamics can be a powerful tool for this work.

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