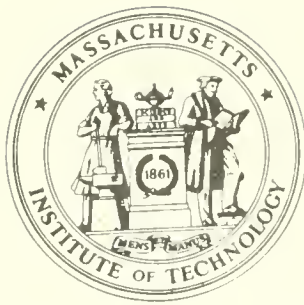


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SOME THOUGHTS ON THE CONTROL PROCESS

by

Kenan E. Sahin\*

374-69

Spring, 1968

MASSACHUSETTS  
INSTITUTE OF TECHNOLOGY  
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CAMBRIDGE, MASSACHUSETTS 02139



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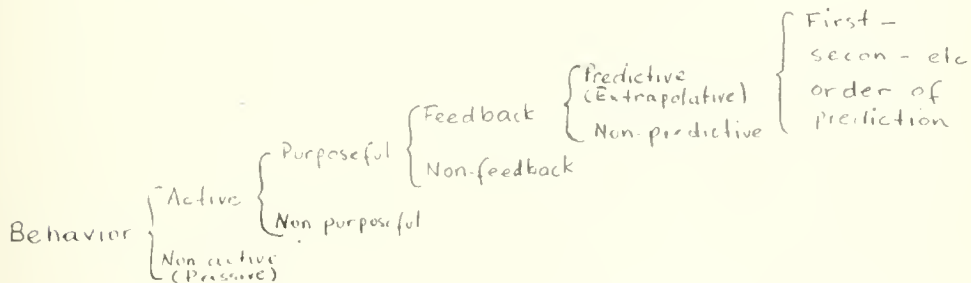


## Some Thoughts on the Control Process

Understanding the control process is essential for the study and design of management systems. This paper will provide some thoughts which may contribute to such an understanding. Control is guiding a system to a desired goal. It is a process in that it is "something going on" or it is "a series of actions or operations conducing to an end."<sup>1</sup> A system can be controlled by manipulating its inputs so that a behavior congruent with the desired goal is obtained. This type of control can be called behavioristic control. It is common when the system is complex and ill understood and/or fixed, which is often the case in social structures. Control can also be achieved by changing the internal functioning of the system and hence the name functional control. Both types of control are observable in a firm.

### Behavioristic Control

Behavior means any change of an entity with respect to its surrounding.<sup>2</sup> As such the term is too extensive. However, it can be usefully restricted through its classification. The following classification is offered as a reasonable one:<sup>3</sup>



If the source of the output energy involved is in the entity, i.e. if the input does not energize the output directly, then the behavior is

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<sup>1</sup> From the definition of control in Webster's Seventh New Collegiate Dictionary

<sup>2</sup> This part of the paper draws upon "Behavior, Purpose, and Teleology" by A. Rosenbleuth, N. Wiener, and J. Bigelow in: Philosophy of Science, Vol. 10, No. 1.

<sup>3</sup> Taken from Rosenbleuth, et. al.



active, otherwise it is passive. Purposefulness denotes directedness to the attainment of a goal and is based on the awareness of voluntary activity. It may be thought all purposeful behavior involves negative feedback. Not so. Consider a frog striking at a fly. Once the movement is started it goes to completion with no visual or other report from the prey.

Purposeful behavior with feedback can be extrapolative (predictive), or it may be non-extrapolative (non-predictive). For instance an amoeba merely follows the path of the source it reacts to; it does not extrapolate the path of the moving source. If only the path of the source is predicted, this is of the first order. Throwing a stone at a moving object involves second order prediction (path of the stone and the path of the object.) On the other hand throwing a sling entails third order prediction.

Other classifications of behavior are of course possible. Linearity and non-linearity forms the basis for another classification. However Rosenbleuth-Wiener-Bigelow scheme emphasizes concepts of purpose and predictiveness which are important to entities management deals with.

In designing behavioristic control processes it is very important that the behaviors to be controlled are properly classified. The danger in misclassification is that the control process may hide the misclassification. In other words the control system designed for a wrong behavior type may in time justify the error and bring about that behavior. The machine model of the firm which forms the basis of bureaucracy illustrates the point.<sup>1</sup> In this model it is assumed that the employees' behaviors are active, purposeful but non-feedback and non-predictive. Accordingly, the management provides

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<sup>1</sup>J. G. March and H. A. Simon, Organizations, New York: John Wiley and Sons, 1958, pp. 35-81.



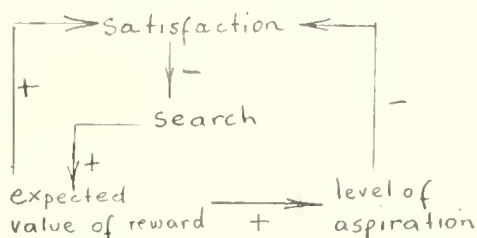
employees a set of stimuli to obtain a desired set of responses. Initially incongruence between intended and observed responses may occur because (a) a stimulus may evoke a different set of responses (b) a stimulus may include elements not intended by the organization and (c) the individual may mistake the stimulus for another, since much of the human behavior is of feedback and predictive type. The discrepancies result in a desire for reliability of behavior which means to the management accountability and predictability of behavior. Accordingly standard operational procedures are instituted and control consists of checking to see if these procedures are followed.

But notice what happens: 1) There is a reduction in the amount of personalized relationships. This reduces competition and creates an esprit de corps. Consequently defensiveness to outside pressures becomes stronger 2) Organizational rules are internalized. Rules designed to achieve goals assume a positive value and are followed for the sake of following. (3) More and more, decision making relies on categorization. Amount of search for alternatives to accomplish a task decrease. In short, behavior becomes rigid i.e. non-feedback and non-predictive, justifying the basic assumptions of the system. Government agencies tend to operate this way.

An alternative model is that of adaptive motivated behavior model where employees rely on feedback and actively predict the events about them. In one formalization of this model the important variables are identified as: satisfaction, search, expected value of reward, and level of



aspiration. The lower the satisfaction the more search for alternative programs; the more the search, the higher the expected value of reward; the higher the expected value of reward the higher the satisfaction and the higher the level of aspiration; but the higher the level of aspiration, the lower the satisfaction. Diagrammatically:



Control process implications of such a behavior classification would obviously be quite different than those of the machine model. The discussion so far should not be taken to mean that employee behavior is best describable as feed-back and predictive but rather that the behavior to be controlled should be appropriately classified if the goal is to be achieved efficiently.

Having acquired some understanding of behavior, let us now proceed to various techniques of behavioristic control of systems with feedback and predictive behavior in particular social systems.<sup>1</sup> To control such systems (i.e. produce desired behavior) usually one must act on their subjective field of awareness. There are four basic techniques of doing this.

1. Spontaneous field control (acting on the system's field without intending to do so.) Often when one system (e.g. a person) acts, as a by-product it produces signals for rewards and deprivations or the rewards and the deprivations themselves. These influence another person's field and he responds in an attempt to avoid the threatened deprivations or to secure the expected

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<sup>1</sup>This portion of the note draws upon "Some Social Processes for Control" by R. Dahl and C. Lindblom in R. Dahl and C. Lindblom, Politics, Economics, Welfare.





gratifications. This technique is strategically important to rational social action in economic affairs because it is the basis of a price system. But it is paradoxical because

- a. it is a basic, universal control technique yet it is not perceived so, because there are no commands or superstructures.
- b. it is tyrannical since it is hard to escape it
- c. being unintended, it can be perceived as the anti-thesis of planning. Yet it is one of the most important techniques of control.

2. Manipulated field control. It often starts as spontaneous field control. It is a deliberate action on another's field by means other than commands in order to secure a definite response by manipulating (signals of) deprivations and rewards.

3. Control through command ("do this or else"). It is insignificant compared to the other two. Law is in form of a command. Its effectiveness derives from spontaneous and manipulated control. Some may perceive a paradox here. If law is not supported by the mores of the community, it is ineffective; if it is, then law is unnecessary. This argument is false because law is catalytic and therein lies its effectiveness.

4. Control through reciprocity. When one system affects another's behavior, it is in turn affected by that behavior. In the real world control is rarely unilateral.

For behavioristic control to be effective, certain conditions must prevail: There must be consistency between the controller's and the subordinate's goals. Adequate rewards and penalties must exist. Also the rewards must be administered properly. Here one is reminded of Skinnerian rats.. It was accidentally discovered that if rats are



rewarded each time they produce a certain behavior; once the reward is cut, the behavior "decays" in an exponential manner. If, on the other hand, reward is periodic, that is if the rats are not always rewarded for the desired behavior, once the reward is terminated the behavior again decays exponentially but much much slower. Also a single reward will cause rats to resume the activity at its original level.

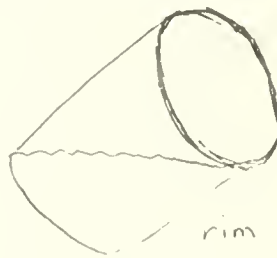
Again to be effective, behavioristic control should seek to internalize the rewards and penalties i.e. try to form a conscience. The conscience is useful as surrogate control. It is also useful in establishing legitimacy. Effective communication also constitutes an important condition for effective control. When dealing with people it should be borne in mind that people suffer from the illusion that they understand. Students often leave the classroom thinking that they have understood the lecture only to find out the opposite in an exam. Also information conveyed is not an intrinsic property of the individual message. The "meaning" of that message is determined by the receiver i.e. system to be controlled. The receiver chooses the context that interprets the message. That the same message or symbol may have quite different meanings in different contexts, can be dramatically illustrated by modifications of an ellipse as shown below<sup>1</sup>. Under each diagram the "meaning" of the ellipse as determined by the context is indicated.



ellipse



face of a thumbtack  
head



rim of a glass

<sup>1</sup>The idea was communicated to the author by Dr. A. R. Johnson, Lecturer at the Sloan School of Management, MIT.

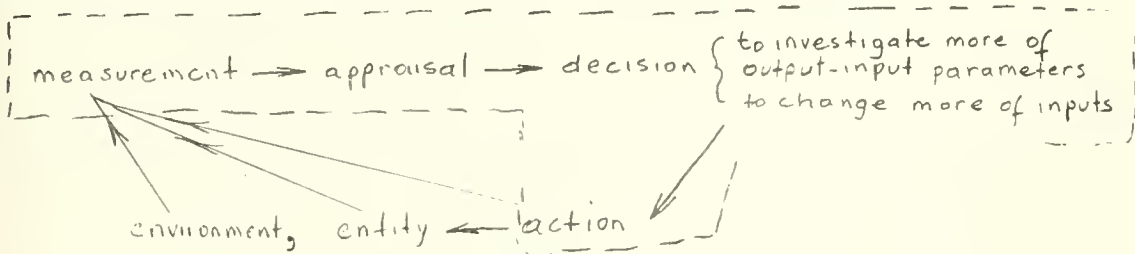


Another consideration for effective communication is the absorption of uncertainty which occurs when instead of evidence inference is conveyed and inference is taken to be an attribute. This may give rise to dogmas in the system to be controlled and impair future communication.

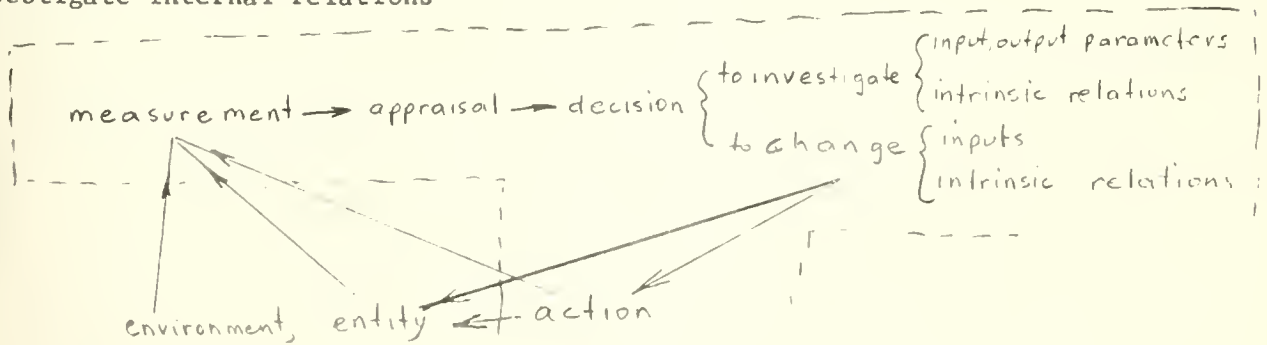
Functional Control

The control process described so far had a behavioristic approach: it aimed at manipulating directly observable changes in an entity (its behavior) by affecting the inputs to that entity, the entity remaining more or less intact. However, the control process may aim at altering the intrinsic organization of an entity or at imparting a new organization to that entity. Such control would be of functional type.

The behavioristic control can be described as follows:

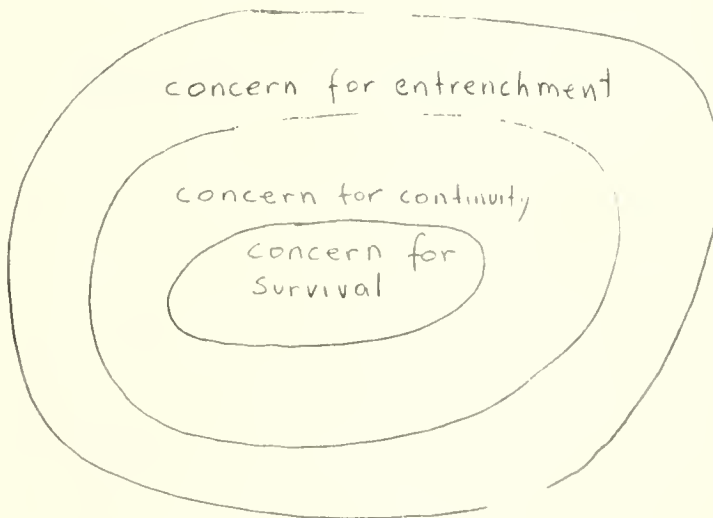


The functional control would essentially be the same except that it could generate a decision to change the entity's organization and also to investigate internal relations





A meaningful discussion of functional control must be preceded by a description of the objectives of an entity and of the basic processes in it. The issue of objectives has been attacked in innumerable ways. Perhaps the best description was given by Simon. He considers the objective or objectives a set of constraints which "define roles at the upper levels of the administrative hierarchy".<sup>1</sup> However this point of view is not wholly satisfactory. In entities exhibiting prediction, some, if not many, of the constraints are self-imposed. What is the process whereby an entity generates or activates constraints upon itself? Some may feel concern for survival determines the constraints. But this thesis would only partially explain the complex behavior of some social systems, in particular of the firm. As a basis for a more satisfactory answer a triplet of concerns will be posited here: concern for survival, concern for continuity, and concern for assurance of continuity (concern for entrenchment). These concerns are nested, survival being the inner most one, as depicted below.



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<sup>1</sup>H. A. Simon, "On the Concept of Organizational Goal" Administrative Science Quarterly, Vol. 9, No. 1, June 1964





Each concern implies a set of constraints (objectives). The constraints of an outer shell satisfy constraints of inner shells. At any time only one concern (hence one set of constraints) is active for an entity. Should the conditions (internal or external) change such that some constraints of an inner concern shell are no longer satisfied then attention shifts to that concern and a new set of constraints are developed. Hence an important step of functional control is identifying the active concern of an entity and the constraints implied by the active as well as non-active concerns.

There is more to an entity than its active concern. The concern has to be translated into operations. In fact we can identify five basic processes: 1) development (formalization) <sup>of</sup> constraints (or objectives) in congruence with the presently active concern, 2) dissemination of objectives, 3) development of technology, 4) dissemination of technology, 5) development of micro operations.

All of these processes may be going on simultaneously in an entity or only some of them. Also there may be time lags or leads with respect to the referents of each process. For instance while technology is being developed for a set of constraints evolved in the previous period, a new or a modified set of constraints may be emerging for the next time period.

Given various components that comprise an entity a major concern of functional control is determining and modifying the relationships of these components to each other vis-a-vis decentralization-centralization. We define decentralization as follows:

Consider two subsystems A and B with observed behavior of  $\alpha \beta$ . A receives signals from B on variable  $s$  or dimensions  $X_1, X_2, X_3 \dots X_n$ .  
Iff A can ignore signals on  $X_i$  (i.e. iff A can produce the same behavior



even when  $X_i$  has been changed by B) for a range  $X_i^L < X_i < X_i^U$  then system A is decentralized with respect to B on  $X_i$  for the specified range.

An interesting point is underscored by the definition: functional control significantly deals with setting up behavioristic control processes in that decentralization, a major concern in functional control, is the decrease of behavioristic control exercised on subsystems by other subsystems. The extent of decentralization must derive from its advantages relative to centralization in a given problem setting. Some of these advantages were discussed by Zannetos.<sup>1</sup> Accordingly relative decentralization is indicated when

- a) economies of scale through specialization are considerable. This would be true when the environment to be learned or adapted to is ill-structured and/or very complex.
- b) cost of channels needed to sustain centralization are significant and the risk of errors in communication can be costly. The latter is especially true when the entity must make a partial adaptation very quickly.
- c) uncertainty, instability, and the risk of total failure because of partial failure are considerable. Under decentralization components are or can be decoupled so that the failure or the success of one does not adversely effect the others.

On the other hand, centralization is favorable when

- a) resources are complementary
- b) suboperations are interdependent.

What type of functional control system is appropriate for each of the five basic processes mentioned earlier can be determined in view of these considerations for centralization-decentralization. As initial hypotheses we will post the following:<sup>2</sup>

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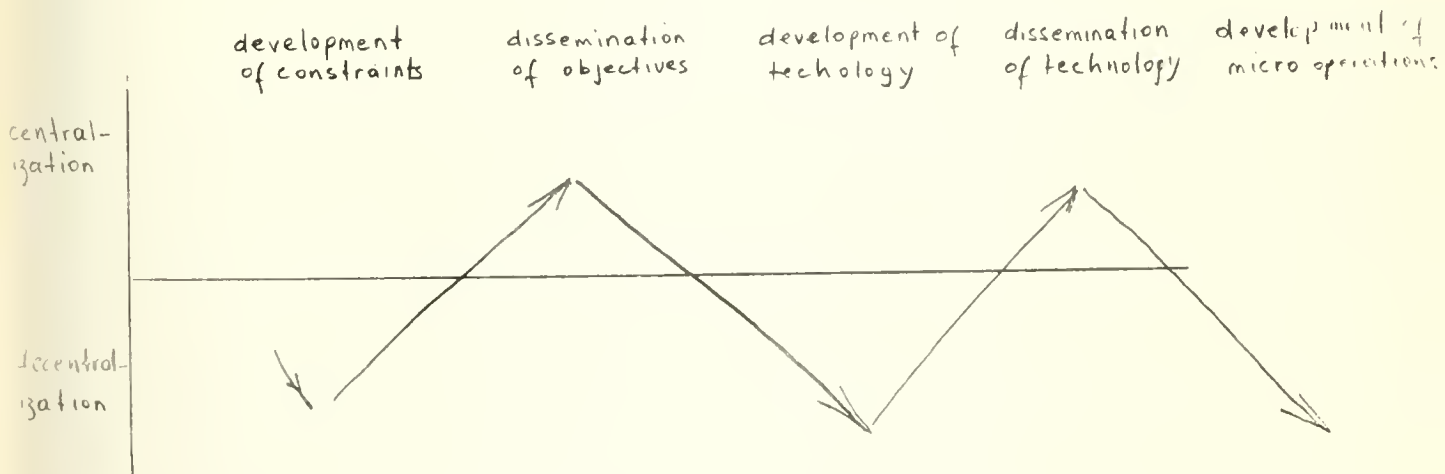
Z. S. Zannetos, "On the Theory of Divisional Structures: Some Aspects of Centralization and Decentralization of Control and Decision Making" Management Science, Vol. 12, No. 4, Dec. 1965, Series B.

<sup>2</sup>This portion of the note importantly benefited from conversations with Professor Zannetos.

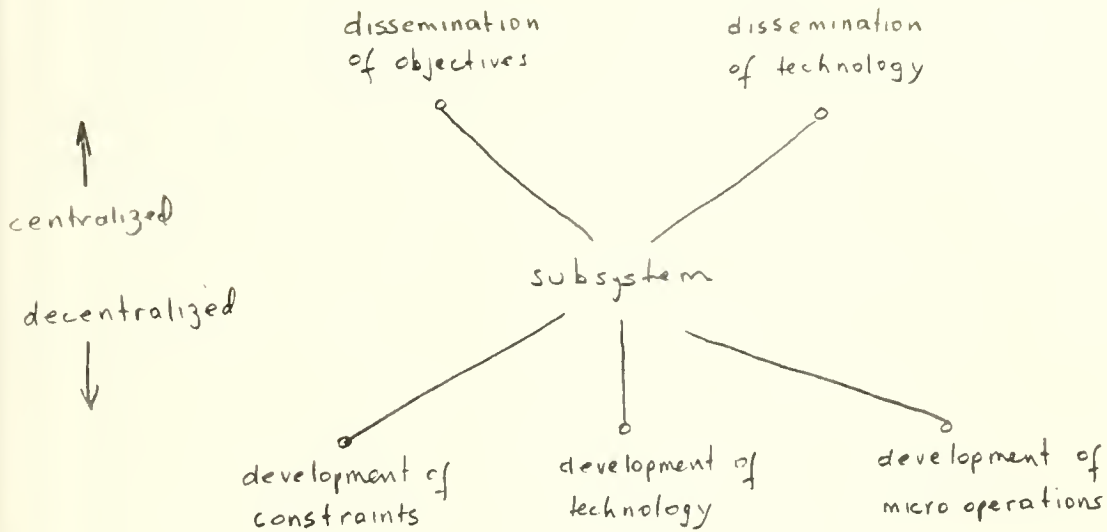


- a) development (formalization) of objectives will best be served by relative decentralization.
- b) dissemination of objectives will require relative centralization
- c) development of technology will favor relative decentralization
- d) relative centralization will be conducive to dissemination of technology
- e) and relative decentralization will be favorable to development of micro operation.

In other words the various subunits would alternate between centralization and decentralization depending on the process going on. If a subunit is involved in several of the processes, which would be the case in general, then on let us say "dissemination of objectives" dimension it would be centralized and on "development of technology" it would be "decentralized". Notice that such multidimensional and relative decentralization are quite in keeping with the definition. The cyclical as well as the multidimensional nature of decentralization is best illustrated by diagrams.







Whether the whole entity is relatively decentralized or centralized depends on what processes are currently the most pervasive ones. What processes are pervasive is in turn determined in large measure <sup>by</sup> what the on-going concern is. For instance if entrenchment (concern for assurance of continuity) is what pervades the entity in all likelihood development of constraints will also pervade and if the entity is an efficient one we would expect it to be relatively decentralized across the subcomponents.





### Summary

Control is a process in that it is ongoing. If it aims to modify behavior by manipulating inputs it can be described as behavioristic control. If, on the other hand, the functional relations intrinsic to a system are the focus of the process then it is best describable as functional control.

Behavior defined as any detectable change in output is very broad. The concept can be made more meaningful and operational by classifying its various types. The Rosenbleuth-Wiener-Bigelow scheme is an appropriate classification in that purposiveness and predictiveness concepts are clearly brought out. There are four basic techniques for behavioral control. The particular combination of them should in part be determined by classifying observed behavior. Attention should also be paid to certain conditions that should be met if control is to be effective.

A discussion of functional control should be preceded by descriptions of objectives of entities and of the basic processes that take place in them. It is useful to view objectives as a set of constraints determined by the current concern of the entity. There are three basic concerns: concern for survival, concern for continuity, and concern for assurance of continuity (or entrenchment). Although many ways of taxonomizing the basic process in an entity exist, we choose to describe them as development of constraints, of technology, of micro-operations and as dissemination of constraints and of technology. Extent of decentralization is a major focus of functional control. That functional control significantly deals with setting of and modifying behavioral control processes is brought out by the definition of decentralization.



Extent of decentralization can be determined by considering its merits and demerits in general and also in relation to a given situation. Its various advantages lead us to hypothesize that development usually will bias the entity to relative decentralization, and dissemination, to relative centralization.

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