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Subjective Game Models and the Mechanism of Institutional Change

People play “silly” games because they are not quite so smart as we typically assume in our analysis. The rules of the game . . . are all akin to equilibrium expectations; the product of long-term experience by a society of boundedly rational and retrospective individuals. . . . [T]he inertia we see in institutions mirrors the inertia we see in equilibrium expectations, and the ways of groping for more efficient institutions—gradual evolution of institutions, the adaptation of institutions to sudden drastic changes in the environment, more conscious and purposeful breaking-out of well-worn equilibrium patterns and (perhaps) plunging into a period of disequilibrium, and everything between these—mirror similar sorts of changes to equilibrium expectations.

—David M. Kreps, *Game Theory and Economic Modelling* (1990:182–83)

The theme of this and the next chapter is the dynamic mechanism of institutional evolution. This involves two questions: one relatively easy and the other, notoriously hard. The first is the question of why institutions tend to be robust and enduring in face of some environmental changes in spite of possible suboptimal arrangements. The basic elements of an answer have been provided in the last two chapters, and we begin this chapter by succinctly summarizing these points (section 9.1). In the literature, technological economies of scale (setup costs) and network externalities are often cited as major reasons for the robustness of institutions or persistent patterns of doing (e.g., David 1985; Romer 1986; Arthur 1989). Instead we emphasize factors inherent to institutions conceptualized as shared-beliefs-cum-equilibrium-summary-representation. The second question is why and how institutions can nevertheless change. This question has hardly been satisfactorily dealt with in economics or in the other social sciences, and our exposition will be necessarily preliminary and experimental. By our definition of institutions, an institutional change may be identified with a situation where agents’ beliefs on the ways a game is played are altered in critical mass. This should be distinguished from mere changes in statutory laws and marginal changes in agents’ strategic choices in response to mildly changing environments according to chosen rules. Therefore, to deal with the second issue, in this chapter we focus first on the mechanism of systematic changes in cognition and learning, as well as that in strategic choices made by individual agents and their interactions. Essentially we will be dealing with the cognitive (subjective) aspect of the mechanism of institutional change. In the next chapter we will discuss the objective aspects of the mechanism of institutional evolution: how the diachronic linkage of institutions may affect the nature and course of their evolution.

Orthodox game theory, classical and evolutionary, defines its analytical framework in such a way as to regard the sets of choices by the agents fixed *a priori*. For both approaches there can be multiple equilibria. Then an institution, viewed as an equilibrium phenomenon, can be seen merely as a shift from one equilibrium to another.

What brings about change? In Nash equilibrium no rational agent will find it beneficial to change his or her strategy unilaterally. But one might argue that if agents' sets of all possible actions are objectively known and fixed, some rational agents could perceive the possibility of a "better equilibrium," either through deductive reasoning or by learning from best practices elsewhere, and thus become engaged in activity that makes its choice a focal point. Often such a rational role is expected from the government. However, the government itself is an agent, with its own incentives and limits in cognition and reasoning, as well as limited ability of persuasion and limited impacts. It is not clear at all that the government is able to, or even be willing to, lead the coordination necessary for a move from one equilibrium to another.¹ More important, the mechanism of institutional change seems to often involve a novelty or change in the agents' set of possible actions from which their strategy can be constructed.

In this chapter we develop a conceptual framework for understanding the dynamic mechanisms of institutional change that is consistent with and extends the synchronic conceptualization of institutions given in chapter 7. We visualize institutional change as a process by which the agents discover a new way of doing things in response to their own crises of shared beliefs caused by environmental shock, an internal crisis of the domain, or more likely, their combination. Through the agents' strategic interactions a new kind of equilibrium and its compressed representation become self-organized. In developing this framework, we depart from the usual game-theoretic presumption that the agents have complete (or incomplete) knowledge of the objective structure of the game. Instead, we believe that they have subjective views of the structure of the game they play in the form of what we call subjective game models. Particularly, we submit that individual agents subjectively activate only small subsets of technologically feasible actions and/or their combinations as "repertoires" (Dosi and Marengo 1994) of choice at any one time. Then the process of institutional change may be conceived of as one in which the agents are induced to re-assess and substantially revise their subjective game models, and thus possibly introduce a new repertoire of action choices. The reassessment and reconstruction of subjective models by the agents is not done in a random, mutually independent way. To generate a new shared system of beliefs—a new institution—this needs to eventually take on a mutually consistent form. What mechanism obviates their random re-constructions but generates eventual consistency among them? When this issue is discussed, we will see that the shared-beliefs-cum-summary-representation of the equilibrium view of an institution becomes highly relevant, for it is by this means that the synchronic and diachronic approaches to institutions can be synthesized.

9.1 Why Are Overall Institutional Arrangements Enduring?

Why do institutions tend to be robust to normal environmental change? Answers suggested by the treatment so far can be summarized as follows.²

First, if an institution is nothing more than a statutory law, then it may be easily changed by legislation or government decree. But let us recall that we conceptualized institutions as a shared system of beliefs about how the game is being repeatedly played and that it can be formed through the strategic interactions of individual agents. As a shared mind-set, institutions are stable and durable if environmental change is not drastic. A mere change in a statutory law is not an institutional change unless it simultaneously and systematically alters the perceptions of individual agents as regards how the pattern of their strategic interaction is formed and accordingly induces a qualitative change in their actual strategic choices in critical mass. In general, once institutionalization is achieved, marginal, random drifts of individual perceptions and associated strategic choices will have only negligible effects on the generally held beliefs of agents, because of the anonymity of individual agents and/or by the working of the law of large numbers. Further, as discussed in chapter 7, institutions not only transmit information to individual agents but also do so in specific compressed forms. In other words, one may say that an institution has its own “codes of communication” (Arrow 1974). The rules implied by particular market governance institutions, organizational conventions, and community norms may be explicitly or tacitly well understood only by agents in the relevant domain. Even if there are experimental or innovative choices of individual agents, they may not be transmitted to the great majority of the agents, or even if they are, their meanings may not be immediately understood to alter their beliefs and action-choice rules.

Second, the feedback mechanism between institutionalization and competence development of the agents, as mentioned in chapter 7.3, reinforces the durability of institutions. As said, an institution imputes values generated in the domain to agents’ physical and human assets in an institution-specific manner. In response the agents adapt their efforts to accumulate assets and develop competence in the direction to enhance their values, which in turn supports the expanded reproduction of the institutions. For example, the competitive labor market institution rewards agents possessing individuated functional skills that are valuable across competing organizations. The efforts of agents to develop highly rewarded skills facilitate the expansion of organizations following an organization-architectural convention relying on such skills. As discussed in the previous chapter, Buroway interprets that the workers at the factory he observed provide “consent to the capitalist exploitation of surplus

value" by developing individuated skills and traits that fit the workshop culture of "making-out." Within the liberal democratic state in which disputes over property rights and contracts are settled relatively more often through litigations, there are higher demands for educational services to train legal specialists. A third party who mediates a particular pattern of bundling of economic activities can acquire rents derived from created externalities (chapter 8.2) and use them to perpetuate that pattern of bundling, whereas those agents attempting a new pattern of bundling may not have the resources to finance the setup costs for doing so. In general, competition among the agents to develop institution-relevant skills and traits thus contributes to the accumulation of human assets instrumental for the reproduction of the institution.

Third, an institution also imputes political power to agents in a manner that is conducive to the status quo. Those agents that benefit relatively more from an existing institution may be endowed with resources and competence to perpetuate it, while the potential beneficiary of an alternative, potential institution may lack resources to realize it. For example, when the control of a representative system over the bureau-pluralistic state is weak, the bureaus are expected to, and subjectively seek to, play the role of elitist protectors of respective jurisdictional interests in the administrative process. With selective recruitment and bureaucratic competition, the exclusive ethos of the bureaus can be reproduced. In a collusive state, government officials can actively cultivate support from the collusive groups by side payments, and vice versa, but the victimized class may lack political and economic resources necessary for staging effective resistance. Some agents who perceive themselves to be at disadvantage in their political power and social roles may be discontent with an existing order. But under normal circumstances they may not be the ones who can afford, or are ready, to bear the costs necessary for new institution-building. These costs may include those of organizing effective political movements advocating a new system of normative beliefs in the polity domain, as well as experimenting with a new organizational form embryonic of a new institution, or various disequilibrium costs to be incurred during the transition, and so forth.

Fourth, various interlinkage of institutions as we saw in the previous chapter may make it difficult to change institutions in a piecemeal manner. The existing literature of institutions emphasizes that once an institution is set up, it will become durable, either because of increasing returns to scale (setup costs) or network externalities. However, these phenomena should not be viewed in purely technological terms but as endogenously emanating from the inherent nature of overall institutional arrangements. The various linkages of games discussed in chapter 8 are sustained by externalities they create by themselves. As the game form of the social-exchange domain is likely to change only slowly, it may embed various domains in a steady

manner. The linked contracts across trade domains may make a new entry difficult. For example, the landlord who possess loanable funds can fend off competition from other financiers by linking cheaper credits and sharecropping contracts (chapter 8.2). A new type of intermediated bundling of domains may be possible only when an old type of integrative bundling is unbundled (an example is provided in the next chapter). But agents who have vested interests in the latter might resist and try to block institutional innovation in the Schumpeterian sense of “new combinations.” Also complementary institutions are mutually supportive, even if they are suboptimal arrangements (chapter 8.3). Institutional complementarity is an instance of non-convexity (economies of scale): there may be many ways of arranging institutional configurations across domains, but their mixture (convex combinations) may not be viable. The situation is analogous to a jigsaw puzzle: it is difficult to replace one piece (an institution) without affecting the integrity of the whole picture (an overall institutional arrangement). However, these points do not by any means imply that a system is frozen. Rather, as we will see presently, institutional complementarity has significant implications for ways in which a systematic change can take place too. If a change occurs in a key domain of the economy and triggers a change in another related domain through the very complementary relationships, the momentum for new institutionalization may be created. To be sure, different systems may have different modes of institutionalized linkages, some being more tightly knit than others. Such differences may also have implications for the adaptability of overall institutional arrangements of different economies to the same environmental shock, whether technological or international.

9.2 Subjective Game Models and General Cognitive Equilibrium

Despite the various causes of institutional robustness described in the previous section, institutional change does occur. What is the mechanism for change? According to the equilibrium-of-the-game view of institutions, an institutional change may be identified with a shift from one equilibrium (sequence) to another equilibrium (sequence) associated with a systematic, qualitative change in the action-choice rules of agents as well as their common cognitive representations (beliefs) about them. At first, it may appear that there are two ways of realizing such a change of equilibrium in parallel to the dichotomy of institutions made in chapter 7.3: autonomous and induced. For one, it may be thought of as occurring as a spontaneous ordering out of the *decentralized experiments* of agents trying new strategies from the given sets of action choices. Alternatively, equilibrium change may be thought of as being introduced by the *collective design* of a law and/or a new type of agent—an organization

—equipped with a fundamentally different set of action choices from the ones possessed by incumbent agents.

However, we have repeatedly argued that the introduction of a law *per se* and an associated new regulatory agency is nothing more than a change in the data—exogenous rules of the game—in the game form that the agents perceive. We will discuss below how such a change in law or policy may affect the process of institutional change by providing a focal point for agents who are forming a new shared system of beliefs as well as altering individual strategies. However, in understanding the impacts of a designed change, we need to trace the process backward as well as forward. On one hand, we may ask: How can a statutory law be introduced or changed? How do agents come to (collectively) recognize the need for a new (regulatory) organization? On the other hand, we may ask: How does a new law and organization affect the beliefs of agents and accordingly their strategic choices? Do they always generate intended consequences?

These questions help us see that notwithstanding an apparent difference between spontaneous and induced institutional change (and that between autonomous and induced institutions), there is a common condition involved in bringing about a change by either route. The critical mass of agents needs to begin, even if gradually, to modify their cognitive representations about the internal state of the domain, as well as about the impacts of changing external environments, in a consistent manner so that they will generate a new equilibrium (sequence). If we think in this way, the distinction between the two mechanisms of institutional change become blurred. Even if there is a deliberate, collective choice of a new law and the introduction of a new agent (e.g., a regulatory agency) to enforce it, the accumulation of decentralized private experiments or a substantial agreement in policy-making through political discourse may precede this. On the other hand, a change in the game form (e.g., policy change) needs to actually induce a new equilibrium, intended or unintended, by facilitating the convergence of expectations among all the agents in a relevant domain.

But how do agents perceive benefits from a change in their own strategic choices and generate a new system of shared beliefs? Does change happen merely by chance (mutation)? If so, how can one expect that chance events will occur in a critical mass at once? Alternatively, should the adoption of new strategies by individual agents be regarded only as a rational response to an environmental change or preference change? If so, is institutional change uniquely and steadfastly conditioned by the course of environmental change? How does preference change occur? Or, even if the credibility of agents' common beliefs begins to be questioned, and thus the stability of an institution is shaken, will an institutional change evolve through a trial-and-error

process of cognitive reconstruction of individual beliefs? As a conceptual frame for dealing with these and other issues of institutional change, we now modify the classical and evolutionary approaches in one important respect and introduce the concept of subjective game models.

Recall that, in the basic (objective) game structure as displayed in the COASE box in figure 7.1, the entry in cell *A* was the set of all technologically feasible action choices of an agent, while the entry in cell *CO* summarized relationships between technologically feasible action profiles and technologically feasible consequences, given various environmental conditions. Subsequently we incorporated the possibility that the consequence of the game may be affected by the equilibrium strategy profiles, and thus institutions in other domains (chapter 8.3). In any case, we assumed that given the exogenous rules of the game, as represented in the left column of the COASE box, and given an expectation (belief) about other agents' choices, as represented in cell *E*, individual agents make the best strategic choice *S* perceived by them. As an action-choice profile becomes stabilized, its substantive part becomes crystalized as institutions (i.e., as shared beliefs).

Now let us modify these presumptions and suppose that individual agents cannot have a complete knowledge of the technologically determined rules of the game, nor can they make perfect inferences about other agents' strategic choices or environmental states. Instead, we assume that at any point of time each agent is assumed to have a limited, subjective perception of the structure of game that he/she plays, constructed from the past experiences and to revise it in response to drastic environmental change and internal crisis. We call the agent's subjective cognition of the structure of the game the agent's *subjective game model*³ and visualize it in terms of the modified COASE box as follows. (Our intention is to define it on a generic level rather than on the basis of specific equilibrium concept, so we deal directly with agents' sets of strategic choices rather than construct them from agents' sets of action choices.)

Suppose a period of time in which the environment of a domain (e.g., technology, institutions outside the domain, statutory laws) is stable. This environment can vary within a limited range, but for simplicity we assume that it is represented by a single vector, *e*. Under this condition, suppose that the following four conditions hold:

- (A) Over a period of time, the agent may have only a limited repertoire of strategic choices from infinitely many technologically feasible choices. Technically the objective set of all "technologically feasible" strategic choices of an agent $\mathcal{S}_i (i \in \mathcal{N})$ may be represented in a space of infinite dimension, but only a finite-dimensional subset is activated for possible strategic choice. We may call this subset the *activated subset* of

strategic choices and represent it by \mathcal{S}_i (technically it is a hyperplane of the entire set of technologically feasible strategic choices).

- (E) Agents shares a system of common beliefs Σ^* —an institution—about the endogenous rules of the game. Besides, each agent forms private residual information $I_i(s)$ about the internal state of the domain, when the actual play (strategic choice profile) of the game is $s \in \times_i \mathcal{S}_i$.⁴
- (CO) Given perceived institution Σ^* , each agent has the subjective consequence function of the form $\phi_i(., I_i(.)) : \Sigma^*, e$, according to which physical consequence $\phi_i(s_i, I_i(s)) : \Sigma^*, e$ of his own choice $s_i \in \mathcal{S}_i$ is inferred, depending on his/her private residual information $I_i(s)$.⁵ Implicit in the functional form is also an agent's view or interpretation about the environment of the domain e , such as the state of technology, statutory laws, and institutions outside the domain. We refer to the functional form as the *subjective inference rule*.
- (S) The agent chooses a strategy from his/her activated subset of strategy choices \mathcal{S}_i that, given an institution, private information about the internal state of the domain and inference regarding the environment impacts, is predicted to maximize his/her own utility (payoffs). Namely the agent chooses s_i^* in \mathcal{S}_i that maximizes $u_i(\phi_i(s_i, I_i(s)) : \Sigma^*, e)$, where $u(.)$ is the payoff predictor. We call this operation the *best-response choice rule*.

The foregoing specifications may be summarized by the modified COASE box shown in figure 9.1. The agent's subjective expectations regarding others' choices in the *E* cell of the original COASE box is now partially replaced by institutions (the *I* cell) common to all the agents and thus perceived as the objectified reality by any single agent. This cognitive belief is incorporated into his/her inference about the consequences of his/her strategy choices. Accordingly, the *I* cell is made stretched to the region of parametric data (i.e., the left-hand side column) of the COASE box, although it is generated and reconfirmed endogenously in the domain.

	parametric data	endogenous variable
internal to the agent (micro)	(A) activated subsets of choices	(S) best-response choice rule
external to the agent (macro)	(CO) inference rules (I) institutions (shared beliefs)	(E) private beliefs

Figure 9.1
COASE box representation of the subjective game model of an individual agent

When the agent repeatedly uses the same set of rules for inferences, payoff prediction, and strategy choices, together with the same phenomenological perception of institutions, we say that the subjective game model is reproduced (or in *cognitive-equilibrium*) at the individual level.⁶ Note that the subjective game model thus defined roughly correspond to the notion of “mental models” in the induction theory of Holland et al. (1986). They conceive of mental models as “models of the problem space” that cognitive systems construct, and then “mentally ‘run’ or manipulated to produce expectations about the environment.” (ibid.:12). But, following the pioneering work of Denzau and North (1994), our conceptual framework emphasizes the interactions of such models with those of other agents so that the subjective game models of individual agents incorporate institutions that are constructed and perceived by all the agents.⁷

In chapter 7 an institution Σ^* was regarded as being generated and self-enforcing as a joint product—a summary representation—of the strategic choices of agents who play an objective game. We can extend this notion to the present case where the agents play their respective subjective games simultaneously. Let us assume that the following “fixed point” property holds at the level of the domain:

$$s_i^* = \underset{s_i \in \mathcal{S}_i}{\operatorname{argmax}} u_i(\phi_i(s_i, I_i(s^*)) : \Sigma^*, e) \quad \text{for all } i \in \mathcal{N}.$$

This is a Nash equilibrium condition. It represents the situation in which all agents perceive the institution Σ^* as a relevant constraint and act accordingly, and as a result the equilibrium strategy profile s^* and its summary representation Σ^* become consistent with each other and are sustained. When this condition holds, we say that subjective game models are in *general cognitive equilibrium* so that institution Σ^* is reproduced.⁸ The reproducibility of the institution may not necessarily require the rigid reproduction of all the individual subjective game models. As discussed in chapter 7, the agents might marginally and/or parametrically change their sets of rules for personal inference, payoff prediction, and (action) choice, or randomly experiment, but the preceding general equilibrium condition via information compression by Σ^* could still hold.

9.3 The Mechanism of Institutional Change: The Cognitive Aspect

When an existing set of rules does not produce satisfactory results relative to an agent’s aspirations, the agents may start questioning the relevancy as well as usefulness of their own subjective game models. They may try to substantially revise/refine the set of rules that they have used. In particular, they may search for and experiment

on new strategic choices (rules) involving the expansion of the repertory of action choices, namely that of the dimensionality of the activated subset of choices. But when such a gap between aspiration and achievement occurs in a critical mass, the situation may be called a *general cognitive disequilibrium*. This could happen when there is a drastic environmental change, along with cumulative dynamic outcomes affecting the objective structure of the game. We may think of the following events as environmental triggering conditions:

- New technological innovation occurs so that new action choices become feasible (hitherto inactivated dimensions of the choice sets can be invoked).
- Closed domains come into contact with expansive external market exchange domains.
- External shocks, such as the defeat of war, perceived productivity and innovation gaps with foreign competitors, or prolonged depression, compel agents to perceive a need for change in legal and organizational framework, improvement in productivity or other performance characteristics.⁹
- A large-scale institutional change occurs in a neighboring domain (including international domains) where strong institutional complementarity exists.

As internal cumulative impacts, we may think of the following:

- Cumulative consequences of repeated games under certain rules, exogenous and endogenous, have generated a change in the distribution of assets, power, and expected roles among agents, so the implementability or enforceability of those rules has started to become problematical.
- A substantial number of mutant action choices and associated competence that may be neutral, or slightly suboptimal, to the existing institutional arrangement have accumulated internally.¹⁰

External shocks alone may not be sufficient to trigger institutional change. Without the accumulation of the seeds for change, agents may adapt their subjective game models only marginally in response to external shocks without changing the substantive character of their action choice and other rules. In the worst case, absent any possibility of mutation, the economy will fail to generate effective adaptative strategies even when it is exposed to a large external shock (we will consider an example below in 10.1). However, as the model in chapter 5 shows, when the performance characteristics of the domain are relatively satisfying and no significant gap between aspiration and achievement is perceived by the agents, entrepreneurial mutation will have limited impact (proposition 5.4). It is rather a general sense of large disequi-

librium in the subjective game models, caused by the combined effects of endogenous and external factors as described above, that triggers synchronized searches among agents for a redefinition of their respective subjective game models. Any mutation (deviance) that is neutral or not profitable under the stable external environment and internal state may then be expected to yield higher payoffs, provided that similar choices or complementary new choices will occur in the same or complementary domains. There may also appear agents that start to re-examine the effectiveness of their own activated choice sets and “discover” novel actions or a new Schumpeterian bundling of domains, enriching the repertoire of strategic choices. Successful mutant choices or new choices will likely be emulated by other agents. The problem-solving incentives to search, learn, and emulate generated by the macro crisis are highly context-specific, and the feedback process can trigger further search, learning, and emulation. Thus the triggering conditions and feedback mechanisms can obviate random search and experiment.

As simultaneously implementation of new choices begins, the existing institution will cease to provide a useful guide for individual choices. It will be incapable of providing an effective summary representation of newly emergent choice profiles and thus cannot be helpful in informing agents’ expectations. This is what is meant by an *institutional crisis*. The taken-for-grantedness of the old institution are called into question. Agents need to be confronted with larger amounts of information regarding the internal state of the domain than they did when the institution was intact. In particular, they have to process more information and form expectations regarding emergent patterns of choices by others that may be relevant to their payoffs. In this connection agents need to revise their rules for inference, payoff prediction, and action choice. In the end, all agents need to reconstruct their subjective game models.

Now the problem-solving search under an institutional crisis may involve various kinds of information that may anticipate the emergent rules of the game. For example, agents may try to emulate practices that they see operating effectively in other domains (including those in foreign economies). In polity domains there may be a few alternative “discourses” (Lehmbruch 1999)—a set of cognitive and normative ideas—that compete with each other for hegemony and that may help in designing new policy. A political leader or entrepreneur may try to signal a desired direction of change by a symbolic action (e.g., Deng Xiao Peng’s visit to a free economic zone in Shengzheng in 1992, signaling the liberalization of markets in the centrally control economy). Even the sensational public disclosure of some untoward behavior that was tolerated under the normal state may have a decisive impact on agents’ perception of what is or is not a proper choice of action. So a few *systems of predictive and normative beliefs* should emerge¹¹ and compete with each other. Competition among

these beliefs characterizes the transitional process. Which competing system becomes a focal point where the expectations among agents converge, and thus a candidate for a new institution, will depend on how learning, emulation, adaptation, and inertia interact across economic, political, and social exchange domains and become stabilized. In next chapter we will discuss some of the basic interactive mechanisms that influence the direction of institutional change and provide some cases.

A new model of subjective game becomes cognitively equilibrated for each agent when (1) the system of predictive and normative beliefs that has guided the learning of (dominant) agents becomes perceived to be consistent with emergent internal state of the domain, (2) the application of new inference rules for predicting consequences of action choices does not yield a big surprise for almost all the agents, and (3) the choice from a new activated subset of choices generates a satisfactory payoff. The transition process will come to rest when the continually revised subjective game models of agents become consistent with each other and simultaneously equilibrated in the sense defined above. The system of beliefs that become mutually consistent, and thus shared, will then become self-enforcing and established as a new institution. The transitional juncture of the process of institutional evolution comes to an end and another spell of relative stability over periods is initiated. Figure 9.2 summarizes

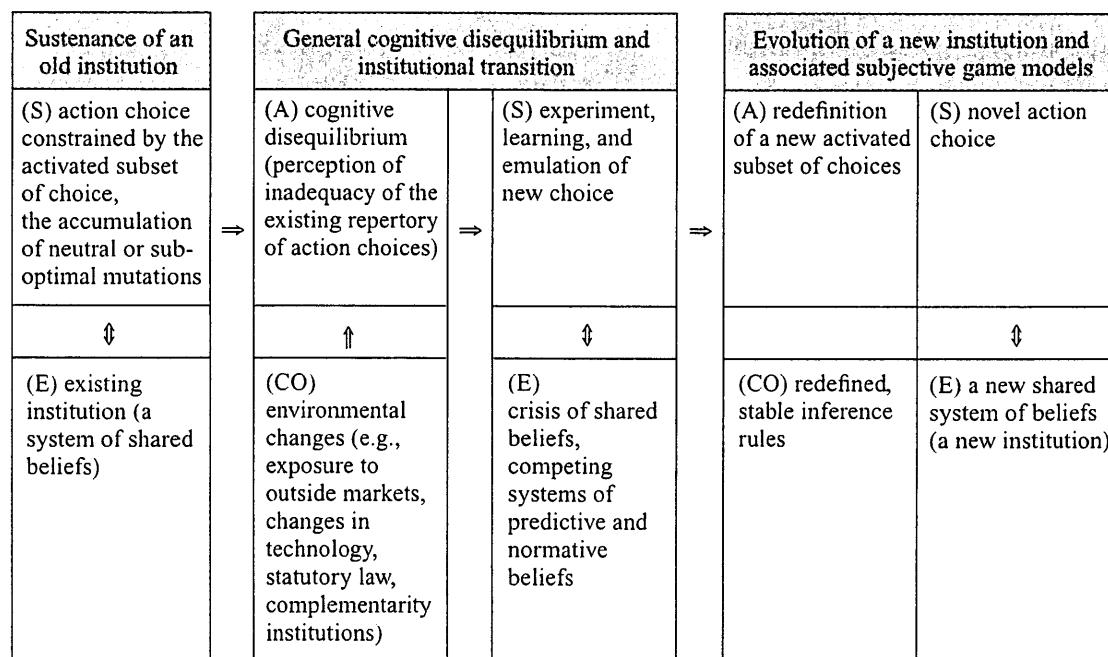


Figure 9.2
COASE box representation of the mechanism of institutional change

the mechanism of institutional evolution in terms of the modified COASE box. From the left it deals with the choice of endogenous variables in the “old” subjective game model, the initiation of search for their revision in response to environmental change and cognitive disequilibrium, the possible impacts of competing, symbolic systems of predictive and normative beliefs, and finally the emergence of a new institution and an associated new subjective game model.

An important question is how long a period of transition take. Since we are still working within the diachronic framework ordered by logical time rather than real historical time, we cannot answer this question simply in terms of long or short. Also it is unrealistic to presume that there is a clearcut separation between the transition period defined above and the period during which institutions become stabilized. An institution may emerge only gradually after the general cognitive disequilibrium arises and continue to evolve until it becomes ruptured by the next round of turbulence. Further complications arise if we consider changes in the overall institutional arrangement in the economy rather than a change in an institution in a rather limited domain. Institutions in some domains may change at a faster speed, while those in other domains may have much more inertia (chapter 10.1). Thus, depending on which domain is our focal point, the process of institutional transition may appear short or long, as well as radical or gradual.

However, one hypothetical conjecture could be that the transition period can often be further divided into two subperiods: the relatively short, turbulent period of institutional crisis in which a drastic environmental change (or internal crisis) triggers a cognitive disequilibrium among the critical mass of the agents, and various new, or hitherto mutant, choices are “started” as experiments on a greater scale, on the one hand; and the subsequent period in which these choices are placed under the “evolutionary pressure of selection.” The latter subperiod may eventually become intermeshed with the period of institutional stability as some choices become evolutionarily dominant.

If we focus our attention on the subperiod of institutional crisis, we may perceive that the process of institutional evolution is punctuated by occasional juncture points. On the other hand, if we extend our horizon to cover the second subperiod of evolutionary selection, institutional change may appear gradual. If this conjecture applies to many instances of institutional change, then institutional evolution may be more analogous to the biological evolutionary process that biologists Gould and Eldredge (1977) conceptualized as *punctuated equilibria* instead of a steady, gradual, Darwinian process (possibly in terms of a vulgar interpretation of the Darwinian theory).¹² An evolutionary process characterized by punctuated equilibria is one in which long periods of stasis are broken by short (in geologic time) episodes of rapid

speciation. Although biological metaphors and analogies are not perfect, nevertheless, these concepts are suggestive to some degree. Once a particular system of choices/selections (phenotypes or choice repertoire) is placed under evolutionary pressure, the fittest may eventually be selected. However, a change in the system itself is more likely to be initiated by a large external shock rather than something continual and gradual.

The reconstruction of subjective game models during and subsequent to the time of institutional crisis imposes constraints on future possibilities (path dependence). However, it is not certain whether the transition to the subsequently emergent institution was the only possible trajectory from the initial state of disequilibrium. How the subjective game models come to an general cognitive equilibrium may depend on the complex process of interactions between environments (e.g., technology) and (accidental) clustering of complementary choices across various domains, as well as intentional designs, emulation, learning, and experiments of individual agents.¹³ Thus institutional evolution may be characterized by path-dependence and novelty, as well as by critical junctures and evolutionary selection (equilibrium).¹⁴