

Title	Knowledge Construction as Evolutionary Gaming
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Citation	
Issue Date	2005-11
Type	Conference Paper
Text version	publisher
URL	http://hdl.handle.net/10119/3926
Rights	2005 JAIST Press
Description	The original publication is available at JAIST Press http://www.jaist.ac.jp/library/jaist-press/index.html , IFSR 2005 : Proceedings of the First World Congress of the International Federation for Systems Research : The New Roles of Systems Sciences For a Knowledge-based Society : Nov. 14-17, 2136, Kobe, Japan, Symposium 6, Session 6 : Vision of Knowledge Civilization Society and Knowledge



Knowledge Construction as Evolutionary Gaming

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ABSTRACT

An institution-sensitive and learning-emphasising evolutionary-game theoretic perspective is explored that links social structure and human agency in a non-reductionist, non-conflating manner. Seen through this perspective, knowledge is continuously re-constructed by purposive actors taking reciprocally dependent actions via playing multiple, linked games that are full of complexity and uncertainty, resulting in transformation of both structure and agencies.

Keywords: structure, agency, action, evolutionary game, knowledge construction.

1. THE SIGNIFICANCE OF AN EVOLUTIONARY-GAME THEORETIC APPROACH

Social action and phenomena, e.g., organizations, projects, public policies, collective decision making, scientific research, technology development, knowledge creation and application, can be respectively seen as on-going games, or sets of games, multiple, 'linked', 'nested' and 'integrated' in complex ways, played at and across various levels and domains (Aoki 2001, Mouzelis 1995, Scharpf 1997) by individual as well as collective players with diverse interests and resources intentionally to advance heterogeneous courses via taking strategic actions reciprocally dependent on each other (Beckert 1996, Schelling 1978, Young 1998).

Following Crozier, we submit that the game concept is not a matter of a new vocabulary or one-more metaphor, but of a change of logic, of a reorientation of the way we understand and explain social reality and social action. In this approach, the game is not taken as a natural given to adapt to, to engage in, to withdraw from, but a human construct that purposive actors endogenously negotiate for and live within. Actors achieve accomplishments with social significance only through creativity and innovation via evolutionary games. '[N]o social action is possible apart from such

games; man has no other opportunity to assert his freedom' (Crozier and Friedberg 1980:151).

An evolutionary game is inherently cognitive and sociological in nature since, to play well, a player must learn, from experiences/observations, to discern and take into account other players' strategies and actions, and to appreciate and follow the rules of the game that are shared among players, because the success and failure of one's own strategy, i.e., the realization of desired payoffs, will depend upon not merely the quality of that strategy, but also the strategies adopted by other players (Aoki 2001), and upon how game rules are created, maintained and modified (Young 1998). Even the powerful and resourceful have to learn to observe rules and others' strategies, letting herself/himself to be, albeit partially, manipulated while manipulating others, if they want the game to continue and to realize desired payoffs (Crozier and Friedberg 1980, Schelling 1960).

Such a game concept accommodates and reconciles freedom of human agency and constraint of social structure. Players remain free, maintain irreducible, autonomous properties, capable of calculation, manipulation and choice, always possess a zone of uncertainty and liberty, but must, if they want to advance their courses effectively, adopt situationally rational strategies which confirm to the nature of the game and hence the irreducible, autonomous causal power of structure (Crozier and Friedberg 1980). The constraints situated in the game do not automatically or mechanically determine actions, as actors can always, innovatively or suicidally, choose to 'act otherwise', but rather authorize a diversity of possible strategies among which players choose, more-or-less consciously (Aoki 2001). The consequences, intended or otherwise, of such choices, i.e., settled equilibriums, induce modifications of the game itself, at the same time trigger and constitute transformations in both structure and agency in the long run (Young 1998). Through purposive actions, hence, choices are made within institutional constraints (Ingram and Clay 2000), whilst 'these choices in turn reshape the institutions' (Vogel 1996:9). Such an evolutionary-game concept allows us,

we suggest, to link, not isolate nor sink, structure, agency and action in a non-reductionist, non-conflating way, preserves duality within both structure and agency respectively (Giddens 1979, 1984), as well as analytical dualism between them (Archer 1995, Mouzelis 1995), transcends structure determinism and actor voluntarism that have trapped social discourses for too long.

2. KEY CONCEPTS IN THE EVOLUTIONARY-GAME THEORETIC APPROACH

Among the core concepts in our evolutionary-game theoretic approach are, in addition to structure and agency, game configuration and game model (analytical-differentiated entities), as well as operationalising, transposing, informing and activating (associational-linking processes) (Figure 1).

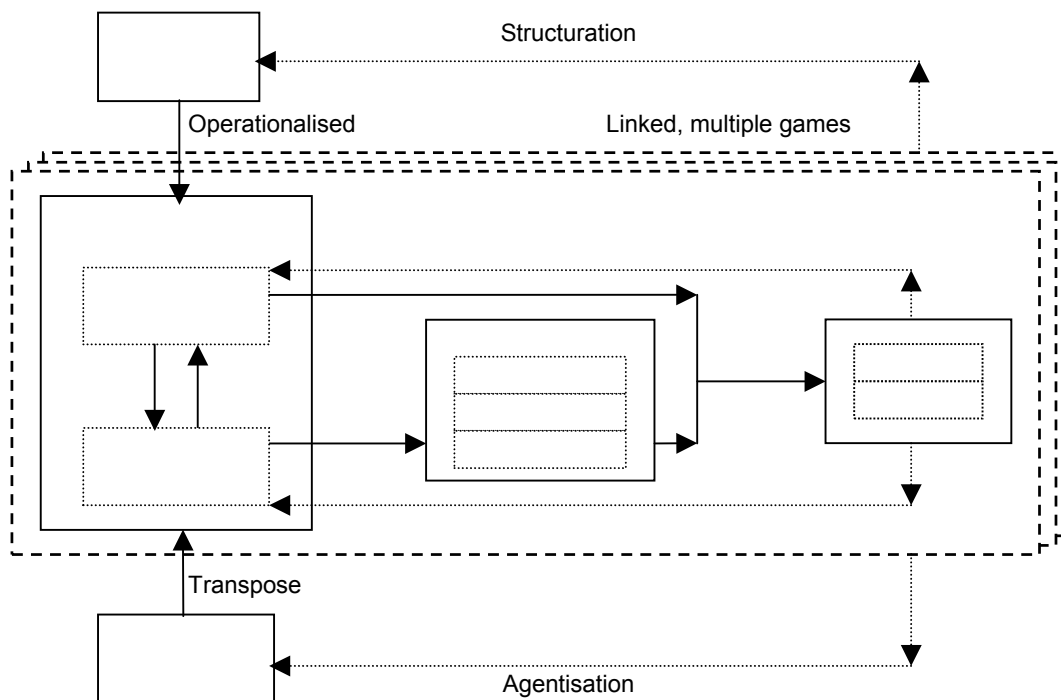


Figure 1. Key analytical-differentiated entities and associational-linking processes

Structure does not directly, across times or spaces, determine actors' action via abstract, general social positions, class status, professional backgrounds, grant ideologies, codified regulations, once-and-for-all norms, fixed roles, etc. Rather, it applies to specific, particular, empirically perceivable and analyzable games in which actors find themselves and find 'life-chances'. Simply put: structure applies 'not to men but to the games in which they play' (Crozier and Friedberg 1980:152). Seen in another way around, actors do not confront structure 'head on', they do so by playing here-and-now, concrete games, at dramatic historical moments such as revolutions and reforms as well as in myriad everyday activities such as conducting transactions, working in organizations and solving problems (Mouzelis 1995).

Social games therefore provide a concrete terrain within which the two different, irreducible, types of properties,

autonomies and causal powers, i.e., structural and agential, manifest and actualize themselves and jointly produce consequences via actors' action. Archer (2003:7) submits that 'it is essential to distinguish between the existence of structural properties and the exercise of their causal powers'. In other words, 'structures do not possess an intrinsic capacity for constraining or enabling in abstraction', their causal power 'can remain unexercised because it is a wholly contingent matter whether they are activated' (p. 5). In our WSR terminology, while structure properties are relatively enduring, always retain generative potential to exert causal powers, the real exercise of such powers, or the lack of it, is contingent upon actors playing concrete games upon which those powers can impact. Similarly, Stones (2005) makes a crucial distinction between 'ontology-in-general' and 'ontology-in-situ', with the latter denoting 'ontology directed at the 'ontic', at

particular social processes and events in particular times and places' (p. 8) wherein 'latent' structure capabilities 'are drawn upon by agents for whom they become temporarily relevant' (p. 22).

What follows is that not all constituent properties in *wuli* (material-technological), *shili* (mental-cognitive) or *renli* (social-relational) of the general structure are equally critical, indispensable or powerful to a focal game, or across games. General properties and causal powers of structure become operationalised and relevant, to various extents and in different patterns, to specific games in complex and emerging ways. In short, general structure exercise causal powers upon actors only through concrete games.

By the same token, components, properties and causal powers in actors' agency disposals, *wuli* (habitual-performative), *shili* (reflexive-imaginative) and *renli* (political-positional), are not always equally relevant, useful or effective across games. As our world is one full of complexity and uncertainty, lack of fixity and necessity (Beckert 2003), there can be no once-and-for-all interests, ahistorical individuality, context-free rationality, universal capabilities, transitive preferences, or timeless positional/relational powers (Crozier and Friedberg 1980, Friedland and Alford 1991:255). Actors need to transpose, i.e., select, adapt, rationalise and deploy skillfully their respective agential disposals into games subject to situational particulars of those games which are always unfolding and ambiguous. Giddens, although usually being charged of conflating structure and agency (Archer 1995) and of neglecting structure/agency *in-situ* (Stones 2005), is correctly, we think, concerned with the 'bounds of agents' knowledgeability in the shifting contexts of time and space' (Giddens 1984:328), stressing the criticality of agents' knowledge linked to specific 'circumstances of their action and that of others' (p. 375). Actors make use of agencies only through specific games. The more skillfully they do so, the more appropriate their strategies, the more robust their actions, and the better payoffs and more-intended consequences.

In summary, both structure and agency become effective only via being endogenously drawn upon by situated players in concrete games. Stones (2005) maintains incisively, although in a terminology slightly different from ours, thus:

What they [structure and agency] have in common is that they represent latent capabilities that remain just that, latent capabilities, until they are drawn upon by agents for whom they become temporarily

relevant as they engage in a particular activity [playing the game]. They are drawn on, and thus transported from the condition of latency or virtuality to that of the manifest or the actual as, to use Schutz's term, the agent makes practical use of them as they appear to her within the particular 'horizon of relevance' thrown up by a specific activity (p. 22).

The combined constellations of 'the manifest or the actual', i.e., operationalised structures and transposed agencies, we call the configuration of a game. It concerns here-and-now questions of which structures (or which parts of structure), what agencies (or what properties of agencies), when, where and how they are combined in shaping game strategies, moves, counter-moves, payoffs, structural as well as agential consequences. While game configuration is an analytical concept, the contingent nature, degree and manner of the 'relevance' and 'effectiveness' of game-specific structure and agency should be investigated empirically.

We stress that game configuration consists of more than merely rules of the game (rules are, after all, not necessarily neutral, and hence more-often-than-not politically interpreted, contested and promoted; see, e.g., Aoki 2001:201, DiMaggio and Powell 1991:11, Friedland and Alford 1991:254, also Ikenberry 1994 and Pierson 1993). Crozier argues correctly, we consider, that:

When thinking about games, however, people have been too obsessed by the problems of the rules. Rules are necessary to maintain the game, to make it possible for people to be sure that no cheating will jeopardize their stakes, but they do not command behaviour. People are channeled, oriented, and led not by the rules but by the structure of the game, which determines a range of possible strategies and results (Crozier and Friedberg 1980:7) [to avoid undue confusion, I, the author of this present paper, choose the word 'configuration', instead of 'structure', of the game].

Other, perhaps more crucial, constituent elements of a game configuration include, for example, the composition of players, i.e., who are allowed and willing to play and why. 'Players are not fixed' (Young 1998:6): different games involve different sets of actors, an actor may involve in multiple games stimulatingly, actors join in and drop out of the game for various

reasons, with or without their intended choice. Whereas conventional game theoretic approaches take this issue as an unquestioned given (e.g., the 'prisoners dilemma' simply assumes the two players already in, so does the 'battle of sexes'), our approach takes it as the priority of analysis. Other considerations in this regard, in our sociologically informed, qualitative game theoretic perspective, are situated legitimacy, identity, commitment, power, creditability, trust, solidarity, cooperation, creativity and innovation, capability and competence, in addition to new technology, new methods of production, etc. (Munch 1992, Sciulli 1992, Young 1998). Such an institution-sensitive and learning-emphasizing, 'thick' conceptualization of game configuration has come a long way overcoming the limitation of conventional game approaches that were based primarily on a kind of 'thin' rational choice model of the bounded, sovereign, individualistic, hyper-rational and fully-knowledgeable actor 'acting in a world with full information, independent decision making, polypolistic competition, transitivity, and fixed preferences' (Beckert 2003:769) (see also Axelrod and Hamilton 1981, Ferejohn 1991, Hechter and Kanazawa 1997, Kiser and Hechter 1998, Marini 1992, Thelen 1999).

Playing the game, each player constructs and utilizes a unique model-in-mind of the game, more or less consciously (Aoki 2001). A game model denotes to a player's understanding of the game configuration, i.e., her/his 'conjuncturally specific knowledge' (Stones 2005) about the rules of the game, the possibilities and ways to negotiate, follow, enforce, maintain, manipulate and change the rules, about what resources are available and how they are structurally distributed, how to use and 'mis-use' them, about what opportunities are emerging and how they are differentially available, about who the other players are, what agencies they transpose in, what game-positions they occupy, what situated interests they assume, what game-role(s) they take, how they acted in the past and what strategies they are likely to generate and adopt, what expectations they hold upon 'me' which 'I' need to satisfy, how they, and I, connect with further other actors who are not directly involved in the focal game but might play games in other domains that are intricately linked with and ultimately influence the process and outcome of it, etc.

It is based on such a socially informed yet actor-specific game model, i.e., subjective perceptions, evaluations and judgments along *wuli* (inertial-natural), *shili* (projective-innovative) and *renli* (practical-evaluative) action orientations, we posit, that a player derives her/his strategy. In other words, game configuration does not dictate strategies or how the game is played. It

rather influences strategies and shapes game processes by informing game models that in turn make situated constraints, resources, opportunities and capabilities intelligible and actionable to players.

Due to the combined effect of structural and agential complexities (which we discussed in the first paper) on the one hand and bounded rationality (actors intend to be rational but can only be partially so due to limited cognitive capability) (Simon 1957), bounded memory ('players do not know (or perhaps do not care) about things that happened long ago; only recent events matter') (Young 1998:21), bounded legitimacy ('incomplete normative integration' of players) and bounded inter-dependence ('incomplete functional integration' of players) (Crozier and Friedberg 1980:6) on the other, game models can be more-or-less accurate, resulting in more-or-less appropriate strategies (Archer 2003:7). To put it in Giddens's terminology, game models tend to 'acknowledge' some aspects of a game configuration, while leave other aspects 'unacknowledged'. Furthermore, such 'acknowledgements', or 'interpretations', can be correct or faulty, to different extents (Beckert 2003:776). We also assume that players' game models can be more-or-less diverse due to differentially and intricately inherited, earned, distributed WSR agency endowments among players, i.e., their differentiated 'situations', 'resources' and 'competences' (Crozier and Friedberg 1980:8). As payoffs and consequences of a game are the co-function of objective game configuration (acknowledged or not) and intentional strategies (appropriate or not) generated by players' subjective game models (accurate or not), they can therefore be expected to be normally uncertain (Beckert 2003), largely open-ended (Young 1998), usually far from optimal (Akerlof 1976), even collectively suboptimal (Zucker 1986).

Game configuration and game models are further complicated if players, as they usually do, involve in multiple games across domains. This is because a player's situated role, disposal and payoff in one domain can be affected by the games she/he plays in other domains, which is due to that those games are usually 'linked' and 'nested' in complex ways that influence the construction and actual play of the focal game. As a result, suboptimal strategies for a player in a focal game may in fact be holistically optimal in terms of the linked games combined, and *vice versa*. Thus, players and investigators need to be mindful that '[t]he linkage of games may change information or/and incentive structures of games and thus make some strategic choices of agents credible that would not have been otherwise' (Aoki 2001:213).

The relationship between game configuration and game models is a 'dialectical' one. On the one hand, a game configuration is endogenously activated by game models held by players. To begin with, social games are necessarily 'peopled' and people are 'capable of resisting, repudiating, suspending or circumventing structural and cultural tendencies' (Archer 1995:195). Crozier and Friedberg (1980) put it this way: '[a]ctors are always free to maneuver and use this freedom to interpret, manipulate, and sidestep what the structure prescribes' (p.74) (see also Mouzelis 1995:110-116). In our WSR terminology, actors always have certain discretions in the conception, evaluation and rationalization upon structural properties as well as upon their own agential disposals in relation to situational, specific games.

Actors exercise such discretions always in the face of structural-agential complexities and ambiguities, of imperfect, incomplete and asymmetrically distributed information, more-or-less competently, more-or-less reflexively, more-or-less other-directed, more-or-less emotionally and affectively, sometimes arbitrarily and myopically (recall the structure, agency and action complexity continuums presented in the first paper), which, critically, prevents a specific game configuration being simply a smaller, recursive version of the general structure, or a 'neutral transmission belt' between society and actors (Crozier and Friedberg 1980), but rather results in variations among game configurations across times and spaces, as well as between concrete game configurations and the general, wider structure.

'Game configuration', such conceptualized, can be understood as equivalent to Beckert's (1996) 'situational structure', or Mouselis's (1995) 'interactive situation', rather than 'micro structure' as in contrast with 'macro structure' in some 'micro-sociologist theories', since, to WSR conception, game configurations can be fairly 'macro' at the one end, such as configurations of international games in and/or around the UN and reform games in contemporary China, or very 'micro' at the other, such as configurations of local games between functional divisions in a small-medium size business. 'Macro' or 'micro', or in the between, configurations are in common simply being emerging and situational to specific games.

Variable and uncertain though, Actors' discretions are nevertheless not totally random since they are guided by game models. Actors rely on game models to exercise discretions because they are purposive and intentionally rational (Simon 1957). Game models, in turn, are not entirely un-traceable but relatively stable, dependent on

the support of historically structured agency endowments (Aoki 2001, Archer 2000) on the one hand, and 'paralleled' (Douglas 1985) with 'higher-order' 'societal logics' (Friedland and Alford 1991) on the other. In other words, the ways by which players activate game configurations are 'patterned' since 'actors [are] themselves constituted by institutions' (DiMaggio and Powell 1991:14, Jepperson 1991, Zucker 1977), their 'improvisations' are 'regulated' (Bourdieu and Passeron 1977).

Given all the structural and agential complexities, there are always mixtures of deviations and variations as well as linkages and traceabilities in the operationalisation of structures and transposition of agencies, i.e., uncertainties and novelties in the activation of game configurations.

On the other hand, being activated by game models, a concrete game configuration obtains a life of its own, becomes 'self-activating' (Jepperson 1991:145), 'self-sustaining' (Aoki 2001:11), enjoys 'a certain autonomy and permanence' (Crozier and Friedberg 1980:63), changes over time upon its unique trajectory (Young 1998:149), capable of informing players to forge game models about the particular details and idiosyncratic exigencies they face. Game configuration imposes itself as constraint and enabler, helps or hurts players, facilitates some strategies while frustrates others, delivers some intended payoffs whereas refuses others. In this way, it commands game models respecting, discovering and mapping it correctly. If players get it seriously wrong, 'then they will pay the objective prices, which may give them occasion to correct their views' (Archer 2003:15).

Seen through the WSR multidimensional framework, game configuration induces threefold impact, permitting situated players to enlist the aid of material-technological power so as to pursue desired payoffs (*wuli*), to apply interpretative schemes to formulate appropriate ends and means (*shili*), and to deploy normative sanctions and rewards on the basis of mutually acknowledged social norms (*renli*). In particular, insofar as game models are concerned, game configuration supplies interests and intentions, structures needs and preferences, justifies rules and roles, focuses attentions on a limited set of issues and problems, legitimates solutions and answers, authorizes reasonable strategies and allows rational actions (Archer 1995, Friedland and Alford 1991, Thornton 2002, Thornton and Ocasio 1999, Zucker 1983).

Game models are subjective constructs-in-mind about a game configuration, whilst at the same time they

themselves constitute a part of that same-one objective configuration. Beckert (2003) posits, '[w]hat determines action is not the objective situational structure but the interpretation of it, which itself forms part of the situation and must therefore be included in any reflection on possible strategies', 'these interpretations themselves become parameters of the situation' (p. 776). In this sense, we can claim a duality of game models: they are knowledge about the game configuration of which they are a part. As a result, to change the game configuration is to change the game models, and *vice versa*, to transform structures is to transform agencies, and *vice versa*, to act upon the object is to act upon the subject, and *vice versa*.

Admitted, players cannot open each other's heads to see *ex ante* what strategies *a priori* are inside. They 'know' *ex post* each other's strategies *a posteriori* by 'observation-based learning' (Aoki 2001), after the fact, in action. A strategy in an evolutionary-game perspective is 'nothing more than the *inferred basis, ex post facto*, for the *empirically observed regularities of behaviour*' (Crozier and Friedberg 1980:25, *emphasis original*). Strategies are inferable and understandable because they are all rational, rational not in a context-free, pre-existing sense, but in that players generate intendedly-winning strategies based on concrete, although contingent and divergent, game models that are in turn informed by objectified, analysable game configurations as well as players' moves and counter-moves.

Together, game configuration and game models need to be treated as 'hard factors', enacted, activated and transposed though, that co-determine outcomes of games, i.e., consequences of social actions.

3. EVOLUTIONARY GAMING AS KNOWLEDGE CONSTRUCTION

We puts decisively knowledge and its construction at the centre of conceptualization and analysis in our evolutionary-game theoretic approach, which, we suggest, could be the key to break the deadlock in the persistent structural determinism vs. agential voluntarism debate, an old debate has recently become more heated but less enlightening (for an assessment of the debate see, e.g., Craib 1997:265-271).

To generate strategies and take action, actors need knowledge. Due to incompleteness, imperfectness and asymmetric distribution of information (Beckert 1996, Hechter 1992), actors' knowledge (and hence associated game models) are unavoidably partial, provisional,

fragile, ambiguous, more or less empirical vs. theoretical, plural and even conflictual, resulting in a zone of uncertainty within which actors find themselves. Put negatively, actors have no choice but to act, to play games always within zones of uncertainty, to reduce which institutions as 'working rules' (Commons 1950), 'common knowledge' (March and Olsen 1989), 'agreed conventions' (Storper and Salais 1997), or simply 'rules of the game' (North 1990), have to be socially devised. Put positively, 'zones of uncertainty' permit 'margins of liberty' (Crozier and Friedberg 1980) to skillful actors, i.e., scientific, business as well as institutional entrepreneurs, to conceive opportunities, to strategise innovation, to make favourable differences, despite existing institutional cages (Beckert 2003, Schumpeter 1934). After all, '[P]roblems without uncertainty are not really human problems' (Crozier and Friedberg 1980:7). In this sense, uncertainty guarantees both constraints upon and possibilities for creativity, innovation, strategy and hence agential liberty. It is such ever-present uncertainty and liberty, we posit, that conceptually eliminate undue structure determinism and excessive actor voluntarism.

Actors, with transposed agencies, 'expose themselves to the acquisition of further knowledge' (Archer 2003:253) through actually playing evolutionary games (Kreps 1990), learning from their own success and failure, from other players' strategic decisions and actions (Aoki 2001:11), in the context of immediate, realized payoffs, as well as temporarily settled yet far-reaching equilibriums which are, usually, by no means consciously designed or planned (Young 1998). Learning is always a messy enterprise, mixed with ambiguity, unlearning and mis-learning (March and Olsen 1984, Cohen *et al.* 1972), influenced by path-dependent lock-in/networking effects (Arthur 1989, 1994) and routines (Nelson and Winter 1982), moving between single-loop and double-loop mechanisms (Argyris and Schon 1978), engaging both 'knowledge-' and 'reflection-in-action' (Schon 1983), and, crucially, guided sociologically by the actor's perceived, stable expectations and judgments upon her/him from the 'generalised other' (Mead 1974), through which actors continuously re-construct individual as well as collective knowledge, revise game models, adjust strategies, refine competences and hence transform agencies (Dewey 1977, Joas 1996) – a pragmatic process we call agentisation.

Such a process, given that actors with differential agencies learn in different ways and to various levels of effectiveness (Cohen and Levinthal 1990), at the mean time changes competence distributions and hence power relations among players, thus disrupts and re-

constellates game configurations (Crozier and Friedberg 1980). Furthermore, although players most of the times, perhaps, take rules as the means (constraints and enablers) to ‘act with’ at a ‘syntagmatic level’, play the game in a Giddensian ‘reflexive monitoring’ manner, and hence reproduce structure (Giddens 1979, 1984); on other occasions, particularly when specific strategies and causes of action did not lead to expected payoffs, they do deploy what Sen (1977) calls ‘capacity for second-order reflection’, or what Habermas (1984, 1987) calls ‘practical rationality’, take the rules as the topic to ‘act upon’ at a ‘paradigmatic level’, critically distance

themselves from and consciously question those rules, search for favourable rule changes (Mouzelis 1995, 2000) or invent new games (Crozier and Friedberg 1980:11). When new knowledge becomes appreciated, diffused and shared by a critical mass among actors, achieves a ‘rulelike status in social thought and action’ (Douglas 1986:46-48), and when the search for rule changes/new games obtains momentum, both within and across different domains, the wider, general, containing structure is transformed, i.e., institutions get changed (Aoki 2001, Hall and Soskice 2001) – an experimental process we call structuration (Figure 2).

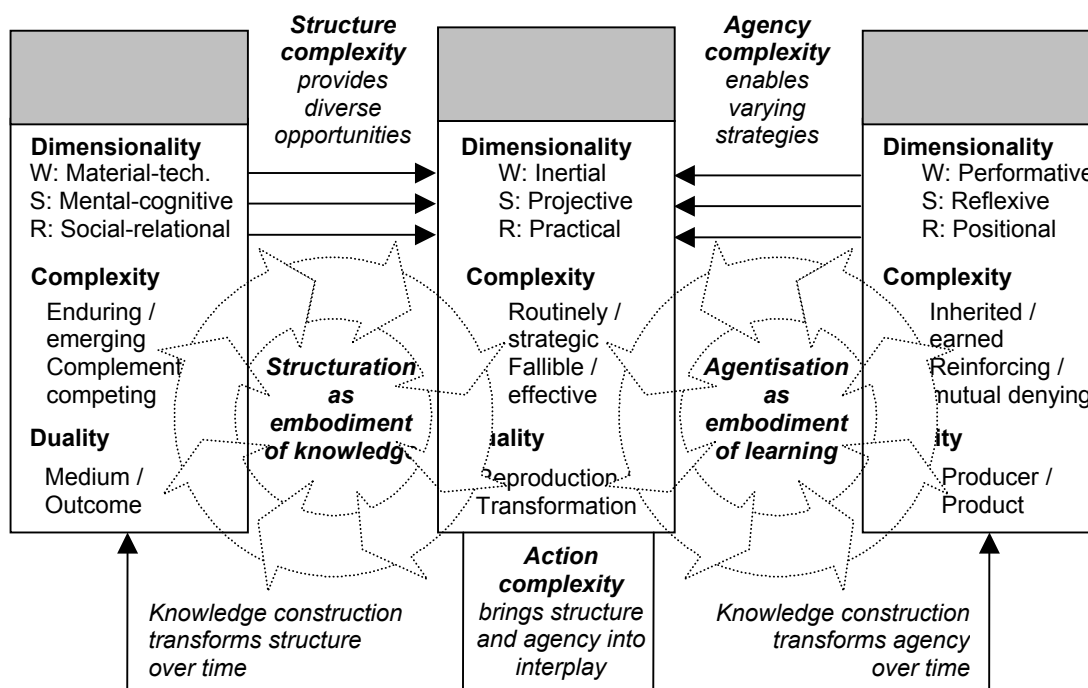


Figure 2. A WSR-SAA conception of social processes

4. CONCLUSION

In this paper we explore an interactive-situational perspective by incorporating into KM a sociologically reformed evolutionary-game theoretic approach that is institution-sensitive and learning-emphasising. Particularly, we elaborate concepts such as game configuration and game model, as well their processual relationships with WSR structure dimensions, agency disposals and action orientations. Knowledge is, seen through this perspective, continuously reconstructed by socially informed, purposive actors taking situationally rational, reciprocally dependent, strategic actions in multiple, linked games across domains.

The explored evolutionary-game theoretic approach contributes, we believe, useful inputs also into the persistent structure determinism vs. agency voluntarism debate in social discourses. Putting knowledge construction at the core of analysis allows us to link structure and agency in a non-reductionist, non-conflating way. Via evolutionary games, both structure and agency retain their own irreducible property, relative autonomy and causal power, whilst manifest themselves contingently in the face of ever-present uncertainties which stem from inherent structural as well as agential complexities. It is such uncertainty that produces, paradoxically, both constraints and

possibilities for innovation. And it is actors' learning capabilities and activities, however imperfect, fallible and power-biased, that makes actual innovations, that changes on-going games, that enhances actors' competences. The knowledge-focusing evolutionary game is therefore an inherently transformative process upon both structure and agency that is full of novelty and traceability, continuity and discontinuity. In this sense, the theme of knowledge construction could be a useful avenue for moving beyond the institutional constraint vs. strategic choice controversy.

[A full list of references is available on request to the author]