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Heuristics of social process design

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Abstract

The notion of design is prominent in the fields of heuristics, learning and gaming. "Design" can refer to space (architecture or geography), time (music) and even to roles and perspectives (e.g. negotiation games); such is named "substrate of design". The understanding of one substrate of design could be helpful for others regarding useful structures, evolutionary generation of such structures and applicable quality criteria.
"Life" (including gaming) is considered a continuous learning process on (i) personal and (ii) societal levels.
Rhythmisation, multi-perspectivism, and underdetermined gaming frameworks are identified as helpful structural principles and procedural values. These three help to provide recurring opportunities for gaming learners and other creative workers to "glue into the process".
It is proposed to discern four components of any social (gaming or learning) process and to notate them graphically in a manner resembling music scores, symbolized by the voices soprano, alto, tenor and bass. Such notation is applied to cases of simple and complex learning frameworks. Structural rhythms (e.g. such as "STAB" proposed here) are proposed to optimize complex societal learning procedures.

Keywords: design of gaming procedures; educational design; evolutionary societal procedures; game based learning; graphic notation; multi-perspectivism; quality criteria; rhythmisation.

Do you think a multi-disciplinary perspective could be helpful for finding solutions of new kind? Then try this text! It outlines a concept and a notation for social process design in gaming. I suggest writing down gaming procedures by means of musical scores.

1. Introduction

1.1 Objective of this paper: how to note down gaming processes?

The aim in the context of this paper is to optimize the design of learning processes (or more generally social processes) for individuals, groups of individuals and society as a whole.

The main concrete interest of this article is: how to note down social learning processes such as gaming? Such notation could eventually visualize helpful temporal, communicative and social structures in learning processes.
Hence, the issue at the core of this paper is the "*notation of social processes for gaming and learning*".
The main question to be addressed and answered is: Which sequence of learning framework conditions delivers an optimal learning effect (understood here as change of behavior) independently of the initial stage of mastery of the learners?

1.2 Some definitions and key notions

In this text, learning is understood in multiple ways:

- learning = real change in behavior
- learning = creation of suitable and sustainable consensus
- life = a continuous learning endeavor
- living means learning; this creates reality.

- social process (sp) = element of SP (see Ahamer & Schrei, 2006: 226)
- societal procedure (SP) = compound of sp, can result in successful learning
- design = creation of helpful structures, can also be social design (= design of sp)
- mastery starts with "obeying rules", and progresses to "creating rules" (Ahamer & Schrei, 2006: 235).

In this article, we see "design" in a generalized way as an array of temporal, spatial and interindividual structures inciting to enact procedures.

- games: the stage for enacting
- traditional learning: is mostly defined by conveying content
- unconventional learning: sets out to integrate learners into a suite of sp designed to incite them to maximize their changes of behavior.

1.3 Twofold relevance of "design of gaming and learning"

Hence, it is a valuable task to ponder *optimal structural design for such learning*, be it "simulation/gaming", individual or societal learning.
Starting points are often attempts to "change the world" like interdisciplinary university courses, consulting in the public or municipal sphere, planning of sustainability measures such as climate protection or other complex learning endeavors.
The relevance of such questioning is only seemingly of purely pedagogical nature and relating "only" to learning individuals (micro-learning). Yet,

(1) if life as such is understood as a learning procedure (i.e. changing previous behaviors) and
(2) if "learners" are also entire societies and
(3) if tasks exist also on a global level,

such learning endeavor may even pertain to optimization of global society's answer to challenges such as global change (cf IPCC, 2007) or global warming (macro-learning).
To a certain extent, basic structural findings might be true for both orders of magnitude, namely for (i) individual and (ii) societal learning.

We therefore include the following examples:

(i) *Learning of individuals (defined here as micro-learning)*: Learning in academia or at university (e.g. interdisciplinary courses, needed in curricula like Environmental Systems Science ("Umweltsystemwissenschaften": USW, 2007), or Environmental Management (Mayer et al., 2004, 2005; JDR, 2006; Lourdel et al., 2006; Zermeg, 2007)

(ii) *Learning of compounds of individuals (defined here as macro-learning)*: Distributed design (MacGregor, 2002), Computer Supported Co-operative Work CSCW (Heaton, 2002; Jarvenpaa & Leidner 1988; MacGregor, 2002; Wodehouse & Bradley, 2006; Johns & Shaw, 2006; Lloyd, 2004), societal learning: national climate protection targets (Crookall & Bradford, 2000; Kratena et al., 1998) that are not adequately met (WegCenter, 2007), low-energy building standards (HdZ, 2007; IP, 2006), sustainable urban renewal (van Bueren et al., 2006), municipal sustainability plans and energy concepts (KEK, 1997; LRP, 1995), approximation of Central European Countries to the EU (Ahamer, 2005), the "European Constitution" or a revolutionary new monetary system (Rauch & Strigl, 2006; Daly, 1999) and other examples of complex societal learning.

"Success" in learning is seen as effective change in real-life behavior, be it of (i) individuals or (ii) of societies. In section 4 it will be discussed, which four dimensions of human action should be affected by such change. Regarding the example of climate change, the stakeholders could be seen as facing severe difficulties in *really* changing (i.e. really learning) – as proven by ever increasing CO_2 emissions in some countries (UBA, 2004).

1.4 Why a "notation for learning and gaming processes"?

Development of a "notation for structures in social gaming processes" could help

- to optimize the usefulness and effectiveness of "social design" in learning frameworks when using graphical analogies (cf e.g. Hofmeyer et al., 2006: 432)
- to improve dramatic frameworks proposed for learning and societal procedures in general (cf Johns & Shaw, 2006, Roth et al., 2001)
- to visualize and hence conceptualize various levels of action and various modes of building of consciousness (cf Bilda et al., 2006)
- to depict the design of learning frameworks in a transparent manner.

What can be the role of "game based learning" (Prensky, 2001; Ahamer, 2004) for these targets? A short answer: A notation helps to better visualize the structure of learning games and negotiation games along time and with respect to expressible opinions. In order to safeguard high effectiveness of gaming, the "consumer" of such a designed "game" should be exposed to a sufficiently large number of changing surrounding conditions while flowing in the drain and train of the game.

In cases of suboptimal learning (e.g. in school or with climate change) a strong motivation arises to find means to improve learning procedures and strategies. Such is attempted here.

2. What can be designed at all? - Where can "design" emerge?

"The notion of design is prominent in the field of simulation/gaming. It has been a thread running through most work in the field." (Crookall, 2003: 485) This section allows the reader to regard the theme "design" from a distance when focusing on "what might be designed". Design pertains to various substrates (Table 1) thus resulting in diverse branches of design.

In this section 2, the following will be laid out: What is much needed is design (= structure in time, space, and human individuals) which facilitates the generation of the learning target, which is often the construction of a consensus – like molding an alloy of differing individual opinions.

Substrate of design	**Branch**	**Example**
***CLASSIC** / already known traditionally:*		
(I) space	architecture	façades, buildings, arrays of rooms
(II) time	music	symphonies, polyphony of several voices
(III) geometry	graphic design	icons and logos
(IV) physical structures	painting, sculptures, fine art	forms and patterns
(V) mental structures	science	theories, "world formulae"
(VI) functionalities	engineering	machinery, industrial design
(VII) communication tools	distributed IT	www and CSCW
(VIII) acting humans	theatre on stage	threads of human action in a drama, choreography
***NEW** / some are focused on in this paper:*		
(1) social processes	game play	free games, open learning (Ahamer, 2004; SiP 2004)
(2) individual interests	regulation by law	trial, jurisdiction
(3) effects of technologies on society and human environment	technology assessment = TA, environmental impact assessment = EIA	EIA procedures and laws (Crookall & Bradford, 2000; Aschemann, 2004)
(4) societal roles	Institutions, NGOs	politics, SGC (2006)
(5) rules for consensus building	Administration, diplomacy, UNO, ESD (2007)	spatial planning, Twinnings in EU accession (EC, 2007)
(6) self-optimization processes	economics, politics	policy measures (Vester, 1980; Pilch et al., 1992)
(7) perspectives of a case	constitution and legislation	legal processes in a state
(8) creation of games and their rules	rules in a role-play, game based learning	gaming business, children play; i.e. "play with rules"
(9) evolutionary patterns	Genesis of transnational institutions: UNFCCC, EU; political game theory etc.	e.g. evolutionary economics, Global Change Data Base (GCDB, 2001)

Table 1. A very broad understanding of "design" would embrace a multitude of "substrates of design" in several branches. A designer is a "structurizer".

Here we understand "design" in a generalized way as structuring a range of substrates (such as the ones in the left column of Table 1) that could be effective to incite and enact procedures.
It might be a helpful objective to investigate whether a useful necessary design of structures in several fields resembles one another. Contemplating various disciplines (and their respective design structures) could aid in such overall endeavor. The following list and subsections outline first attempts.

In this sense, it could eventually be helpful to conclude

- from the inner deep structures (Casakin, 2004) of the classic substrates and applications of design (= upper half of Table 1)
- to the inner deep structures of the new substrates and applications of design (= lower half of Table 1) and to apply potentially new ideas of general relevance.

Some of the classically known substrates of design (upper half of Table 1) are briefly explained below.

(I) Designing space: "architecture", see chapter 4.2 and Fig. 4; examples: (Popov, 2002, Corbusier, 2007; Hofmeyer et al., 2006).

(II) Designing time: "music", see chapter 4.3 and Fig. 5; examples: (Beilharz, 2004, Xenakis, 2007; Zographos, 2007; SonEnvir, 2007).

(III) Designing geometry: logos, see SGC logos in Fig. 3: convey condensed geometric information in a symbolic manner to denote mental structures; examples: (Schrei, 2006, 2007; Ahamer & Schrei, 2006: 239-242; Bouchard et al., 2006).

(IV) Designing physical structures: arrays of color dots in impressionism (e.g. van Gogh), entire history of plastic arts.

(V) Designing mental structures, e.g. theoretical mathematical concepts of mechanics:
(a) Aristotelian physics: force is proportional to speed in movement ($F \sim v$),
(b) Newtonian physics: force is proportional to acceleration ($F \sim a$),
(c) Modern quantum physics: a particle is a point in a space of possible states, concretely only determined after the act of measurement.

(VI) Designing functionalities: "engineering", e.g. of machinery: see journals such as Engineering Design. Functioning artifacts as products of "art", e.g. cars, engines, industrial products; examples: (Bianconi et al., 2006; Ono, 2006; Boujut & Tiger, 2002; Badke-Schaub, 2004).

(VII) Designing communication patterns: collaborating internationally and forming one product (CSCW, Wiki, e-learning: Herder et al., 2003; Ahamer, 2004), implemented from spatially and temporally distributed working places (Heaton, 2002).

(VIII) Designing acting humans, i.e. theatre: interlinked threads of action and responsibilities: e.g. tragic situations, classic Greek drama.

Some of the newer substrates of design (lower half of Table 1) are discussed in the subsequent subchapters.

2.1 Designing social processes

What does it mean to design social processes (sp)? Here we define it to aggregate simple events (like learning content, peer review, debate etc.) as general elements of more complex long-term societal procedures. Such design was described earlier (Ahamer & Schrei, 2006: 226). Chapter 4.1 will give a practical example.

2.2 Designing individual interests

What does "design of interests" mean? Here it is understood as arranging individual stakeholders and the representation of partial interests in such a way that their intercommunication yields the best result possible, e.g. in a lawsuit or trial at court. It could be attempted to measure such results from the standpoint of the "common good".

Design of interests can often be motivated as follows: if "fact-oriented" justice cannot be guaranteed sufficiently, at least a "best attainable solution", namely "procedural justice" should be developed as a proxy to the best but principally unknown target of scientifically sound judgment in complex matters.

Legislation for "civil procedure" is an example here.

2.3 Designing TA and EIA

Technology Assessment means to weigh the desirable and non-desirable effects of new technologies on humans and the environment (Decker & Ladikas, 2004; Bechmann et al., 2007; Decker, 2001; Grunwald, 1999;) by means of a structurally designed "value benefit analysis" or "utility analysis" (Zangemeister, 1970).

In many countries, the legal implementation of the "culture of TA" is the "Environmental Impact Assessment" (EIA) for projects and the "Strategic Environmental Assessment" (SEA) for policies and measures (Aschemann, 2004; UBA, 2007).

2.4 Designing societal roles: "role design" and "institutional design"

What is a societal role? Roles are conceived here as seizable condensations of interests in the entire network and fluid of all theoretically possible interests, in other words the most relevant points in the "landscape of interests".

"Design of roles" means to combine individual perspectives in a way that they form a potent and promising societal actor. For example, such analysis is exercised during coalition building for government or opposition in politics. One target is to reach a 360° panorama-like view of all possible perspectives; this facilitates consensus.

Designing societal roles and interests can lead to designing institutions. How is such "institutional design" performed? By establishing and founding concrete panels – such as for climate change, where IPCC (2007) was founded as scientific body and UNFCCC (2007) as administrative body – and clearly defining frequency and organization of their interaction and mutual responsibilities (e.g., UNFCCC each five years "commissions" an "Assessment Report" from IPCC which is then "acknowledged" by UNFCCC).

2.5 Designing rules for consensus building

What are rules? The borders restricting (potentially free) individual human action put forth in order to direct societal behavior in a desired way.
What is "rules design"? Making up one's mind what to allow, restrict, enhance and discourage in terms of social action under guidance of a societal target (e.g. defining measures in economic policy).
It means to devise rules in a way that maximal blossoming of the positive potential of the actors is attained (e.g. students, pupils, and a country's economy).
Principally, autopoietic development of rule design can also be hypothesized to occur as 4th generation of web based teaching (Ahamer & Rauch, 136), namely "to play with rules".
Deep understanding of "design" (Casakin, 2004) would also incorporate steps to design social and institutional procedures such as: the EU programme "Twinning" (EU, 2005) enhancing "converging" of two formerly fundamentally different economic and political cultures to the "Copenhagen criteria" relevant for EU accession. Twinnings helped all Central European candidate countries in acceding towards the EU by sharing the common body of legislation denominated as "acquis communautaire", and designed as a hierarchical system of dialogues (Ahamer, 2005; SI, 2007).
In this respect, the distinction made by Heaton (2002) between rule-based cultures (like the Danish in their experiences) and personality-based cultures (like the Japanese) is helpful and a contribution to intercultural cooperation (Hofstede, 1994; GS, 2007).

2.6 Designing self-optimization processes

What are self-optimization processes? We understand them here as positive feedback loops that enhance the effectiveness of an initial action (e.g. of a political measure).
Design of self-optimization processes means to make use of systemic (economic, political, social) circular feedback mechanisms in order to reach self-sustaining policies that remain effective in the long run (Vester, 1980; Bossel, 1994; Pilch et al., 1992). Examples for (at least intended) self-optimization processes in macro-learning are global trading schemes for CO_2 emissions (ACCC, 2007).
An example for such design with respect to global change is: how to arrange tools and measures pertaining to reducing global CO_2 emissions: CO_2 trading, clean development mechanisms and other flexible instruments (IPCC, 2007).

2.7 Designing perspectives

What are perspectives? We understand them as outlooks onto reality that are partly pre-determined by the standpoint of the beholder.
How are perspectives (and their interplay) designed? Legislation sets out to manage and mediate between diverse views on everyday incidents (e.g. a traffic accident). Civil law, process law and administrative law and their contained procedural rules allot speaking right and time to parties in an individual judicial process or in a societal decision process. Such can be reproduced in a negotiation game (e.g., this is the sense of the gambling procedure in SGC level 3).
A practical example is the Austrian political system of "social partnership".

2.8 Creating and designing role-play

What are roles? Based on the definition of perspectives above, roles are condensations in the patterns of perspectives, attached with the interest of persons.
Role-play (Corbeil, 2005; Prensky, 2001) can hence be designed in a way that gaming individuals develop a maximum of sovereignty and depth of action when striving for their interests. Many people slip in professional roles in the course of their lives and, in turn, are shaped by them.
Let us understand games as: The stage for such enacting of roles. Enacting means bringing to life. Giving it drama. Permitting ideas and perspectives to flow out of their containers and stream along the river bed of passing time. Logos (ancient Greek for "the word", "the idea") must be en-acted and incarnated. (equals also to: Ideas must be implemented in real life.) In extreme idealism (Moser & Moser, 2005) every individual's life is the physical manifestation of their mental values and consciousness.
Children during "free play" can often be observed to invent new rules, when they have "used up" the attractiveness of well-known games. – Both "homo ludens" and "deus ludens" (playing man and playing god) were conceived by Huizinga (1994).

2.9 Designing distributed structures leading to evolutionary patterns

What are "evolutionary patterns"? Here we try to understand them as way and path, along which our (techno-socio-economic and political) evolution flows, determined by its inner structure. Prevailing global evolutionary patterns could be understood and conceived as exponential (classic growth theory: Temple, 1999), stepwise (Raskin et al., 2002) or saturating (Daly, 1999). The crucial idea of system dynamics is that the inner structure of an interacting system (i.e. the architecture of its internal interconnectedness) determines the system's behavior along time (Ossimitz, 2000).
For example, when combining structural design and space design, the important idea is "to include with the layout of space also the layout of basic structure." (Hofmeyer et al. 2006: 434). Each piece of architecture leads to the evolution of typical patterns of social behavior inside it, including a typical pattern of rules of behavior (e.g. kitchen rules in a hostel).
In a systems analytic approach, the generation of rules in a (social) system in itself is seen as a result of the system's state (Ossimitz, 2000). Adding an evolutionary approach, consecutive phases of system growth are producing different sets of rules along consecutive phases (compare chapter 4.5 or Ahamer, 2003: 8).
Examples could be: developmental policy, namely how to promote a country's autonomous growth and ability to help itself (GS, 2007).

To summarize chapter 2, *a "designer" can be a structurizer regarding a large variety of substrates.* Consequently, a designer's outlook is predisposed to reach beyond the contingencies of the prevailing substrate and to touch down to the patterns and principles construing the structures.

3. Three theoretical principles for the "design of social processes"

The task of a suitable learning framework (be it micro or macro) is to design along time suitable social, gaming and other structures that are intended to change real human behavior. This chapter proposes three principles that may aid in this designing task:

- Rhythmisation (3.1)
- Multi-perspectivism (3.2) expressed through roles
- Underdeterminism (3.3).

3.1 The value of rhythmisation

Rhythmisation offers an ever changing structure to the eye, ear or spirit of the individual who consequently is more easily able to "glue into", integrate or resonate with the offered structure. For example: a lecturer inserting short stories into a long explanation recaptures attention of students with more practically oriented learning profiles.

Rhythmisation as a theatrical means for structuring processes in time with changing speed of oscillation for the dramatic interaction of actors allows for various characters of spectators. The intrinsic time constant of each individual to act, react and allocate interest will be met with higher probability.

With a façade, rhythmisation allows the eye to better discern a largely perceived horizontal area, to pick up the pieces of the façade and to grasp the offered structure more conveniently, e.g. aided by baroque risalits or pilasters. The eye (symbolic for "pre-understanding") retrieves more easily a subsequence which addresses the spirit of the onlooker because it comes into resonance with similar mental predispositions.

In didactics, rhythmisation (of the elements of actions, "sp") is a necessary structure in order to provide recurring opportunities for learners and for other creative workers to "glue into reality" – according to the understanding „double interact" (as Weick (1979), or Klabbers (2003: 577) have put it.

3.2 The value of multi-perspectivism and its expression through roles

Multi-perspectivism means to be able to adopt and understand another standpoint. Multi-perspectivism is a crucial step towards the ability of reaching consensus and a means for locating, organizing and measuring perspectives while consciously abstracting from one's own position. Multi-perspectivism may be incited and aided by spatial and temporal segregation of views (e.g. each team is sitting at separate tables) which causes repositioning of perspectives.

For this paper, roles are facilitators for adopting different perspectives.

One possible application are resulting IT tools (e.g. CSCW: Heaton, 2002, MacGregor, 2002) where cultural preconditions shape the type of social processes occurring among stakeholders (see chapter 2.2). Multi-perspectivism is a key structure that learning tools/offers should provide in order to be helpful in a pluralistic society.

What are perspectives and roles in general? When reverting the direction of reasoning in chapters 2.4 and 2.7, they can be understood as enforced particularizations of the entire view (the contemplation of the whole), which are caused by our earthly restrictions of space-time structure. In Moser & Moser's opinion (2005: 221), on the ethical, humane or ontological levels, such restrictions can only be surpassed by forgiveness between human individuals,

who – despite their individuality – are seen as (singularized, i.e. colored) reflections and facets of (holistic) white sun light, just like in a prism.
In a similar understanding, game play is the intentional (i.e. for pedagogic reasons) demolition and fragmentation of a holistic world view into the facets of the single roles' perspectives. Such destruction and subsequent reintegration of facets into a whole is trained in negotiation games (Dong, 2007). It could be said that negotiation games deliberately deconstruct the dimension of "opinions and world views" and artificially map it into the dimension of "time during game play" or other mapping or framing.

3.3 The value of underdeterminism in game-play

Underdeterminism means that a system offers more than one degree of freedom (in physics) for the motion of a particle or (in games or real life) for decisions of an individual. As said above, roles in game play are the playable reification of such (underdetermined, hence) different worldviews and world perspectives.
Thus, it is appropriate to "oscillate" or "dance" between these world perspectives (e.g. using roles) in order to arrive at a consistent 360° panoramic view. Such "trial and learning" based motion is allowed (only) in underdetermined systems (see Fig. 1). Therefore, if suitably arranged (by a system of loose but enabling rules), underdeterminism can enhance learning (hypothesized again for both micro and macro levels).
A symbolic physical example for the value and appropriateness of underdeterminism in real life can be the bicycle rider who oscillates around an "ideal path" of trajectory when continuously correcting their body's lateral inclination through steering their handlebars.
Games can be structurally understood as a shimmering of situations, as an unstable balance with shallow local optima (mathematically speaking). Compare a football game: the direction of the game continuously changes, one instable state is followed by the other, and predictability is almost non-existent. As a result, the dynamic situation permanently balances on a knife's edge.
Continuous change of standpoints, viewpoints, perspectives, and strategic constellations occurs frequently. Football players break clear, change boundary conditions for others and open avenues for new tactic actions. By acting and running, players create the game plan for others. According to design literature, iterative oscillation occurs between the problem space and the solution space (Maher, 2000; Dorst & Cross, 2001: 434).

3.4 Both design and gaming need underdeterminism

Underdeterminism is characteristic for design as such (Restrepo & Christiaans, 2004) and needed for game based learning. Therefore, learners are best provided only a loose corset.
In gaming, how loose should structures be? Societal procedures need space and liberty to grow properly and fruitfully. "Games" seem to be a promising environment to allow for such liberty in complex human action and can be called a "stage": "Simulation games provide a safe, condensed and dynamic environment, based on reality, in which participants, either professionals or students, can experiment with decisions and negotiations" (Mayer and Veeneman, 2002).

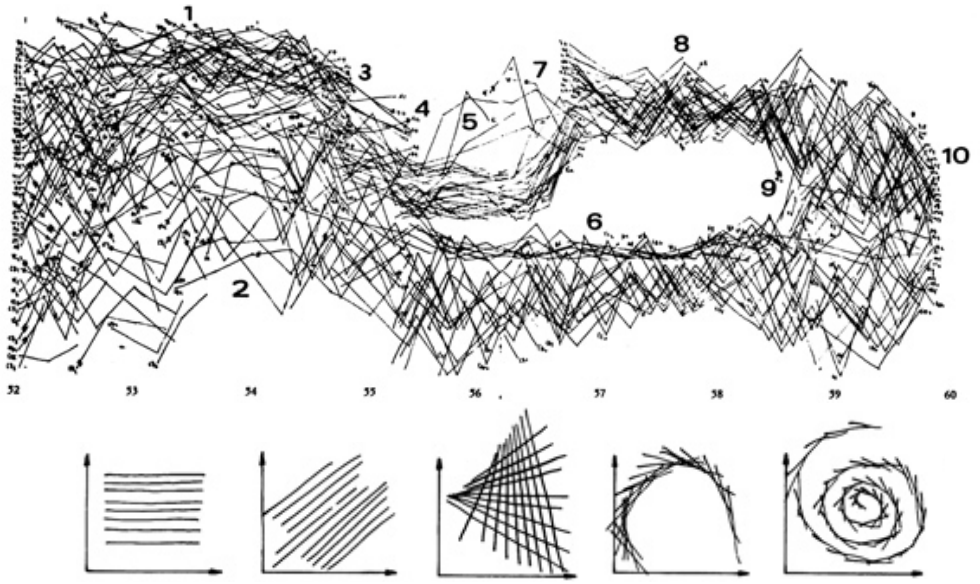

Fig. 1. Intentionally organizing "underdeterminism" in music (by Xenakis) means "playing". Source: (Zographos, 2007); Figure 11 in (Beilharz, 2004).

The stroke of the painter or violinist (Fig. 1) is essential for art and characteristic to the artist. For a painter, it may mean to intentionally decrease optical resolution or preciseness in order to allow for another reality to enter, additionally to direct optical and imminent physical reality.
"Freedom of an artist" is the deliberate deviation from what is considered "real". In didactics, this translates to more or less deliberate deviation from a standardized learning path. The innovative learner cannot always be kept on track on the ideal learning path (ideal only to a traditional designer). Such is another expression of underdeterminism.
Any notation in art is loose enough to allow space for interpretation of the performer.

Concluding chapter 3 and in the light of the above, facilitating (working) life (one of the aims of designers, see Heaton, 2002) – i.e. facilitating learning according to chapter 1.2 – can therefore be achieved by suitably structuring dynamic processes of enacting individuals' opinions.

4. How to note down multidimensional rhythms

4.1 Dramatic Rhythm: a negotiation game

The sense of "noting down" a rhythm is to distil out of it the crucial structures. As a first concrete example of rhythmisation in social interaction, an attempt to note down the dramatic procedure of "SURFING GLOBAL CHANGE" (© Gilbert Ahamer) is shown in Fig. 2. This negotiation game is explained in (SGC, 2006) and is taken here as an example because its activities (Fig. 3, central column) contain all three of the above principles.

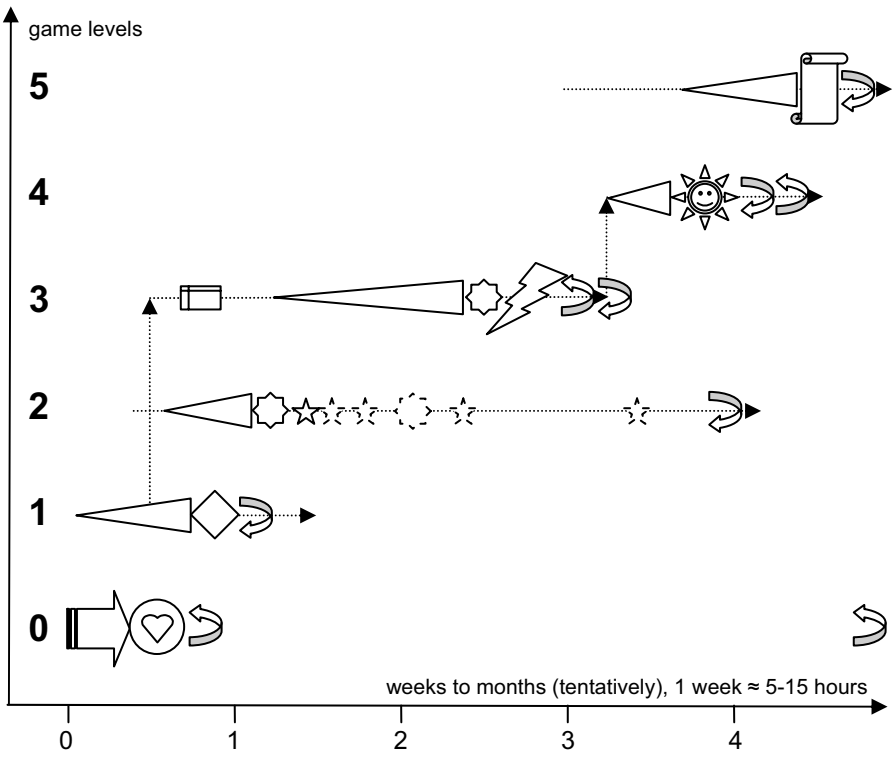

Fig. 2. Graphic representation of activities and time dynamics of the five levels in SGC (2003 style of SGC graphics).

Legend:

Solid symbols vs. dashed symbols = compulsory vs. optional activities
dotted lines = participants are informed about the phase
triangles with growing thickness = preparation phases
looped arrows up/down = feedback to facilitator/to participants for debriefing
diamond = quiz in Level 1
stars = declarations of points of view/reviews/updates in Level 2
matrix = convene on two themes & develop two discussion matrices for Level 3
flash = confrontational discussion in Level 3
sun = consensus oriented discussion in Level 4
document = integrative interpretation of global trends as 360° view in Level 5.

While using the numerous tools of web-supported learning, the online functionalities shown as logos in Fig. 3 are used for the rhythmized activities of the students.

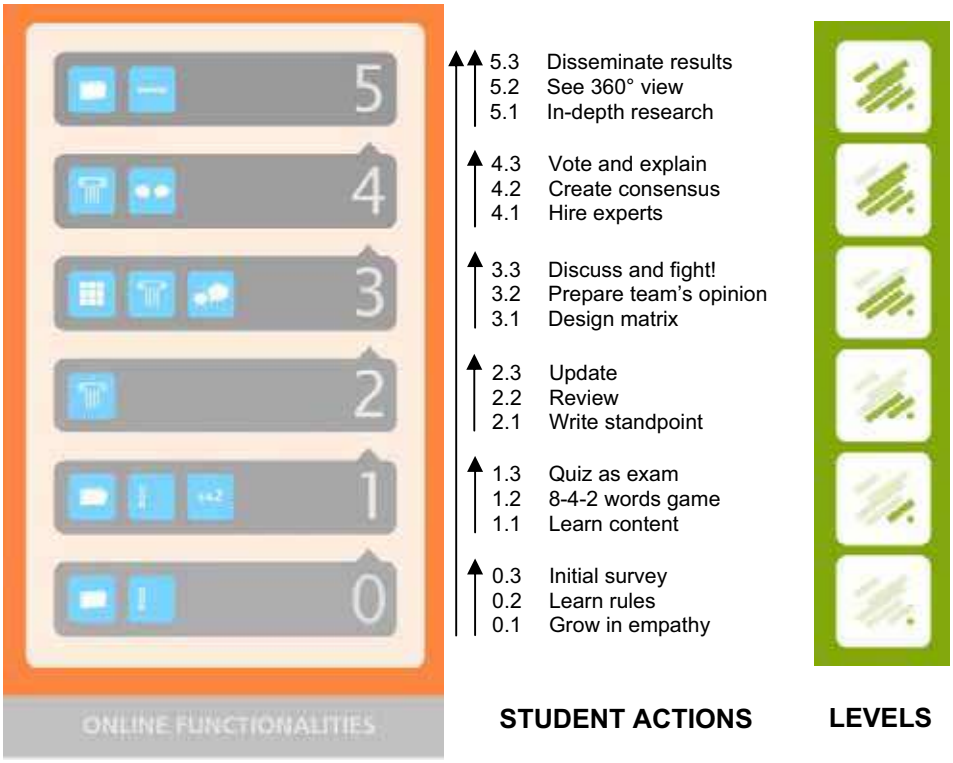

Fig. 3. Online functionalities and student actions in the five levels of the negotiation game SGC (2005 style of graphics by C. Schrei, cf Fig. 4 in Ahamer & Schrei, 2006).

4.2 Rhythm in space: a façade

After viewing the dramaturgy of "social processes", the rhythmisation of the façade of the *Couvent de la Tourette* by Corbusier and Xenakis (see lower image in of Fig. 4) could be regarded as structurally similar (in the sense of Table 1) to the intended rhythmisation of the different communicative procedures in SGC (Figure 6). Both, in fact, resemble a musical score (Fig. 4 above left, compare with center and right).

Rhythms in several "storeys" vary independently from one another, shown by varying density of vertical window pane delineations (Fig. 4 above centre).

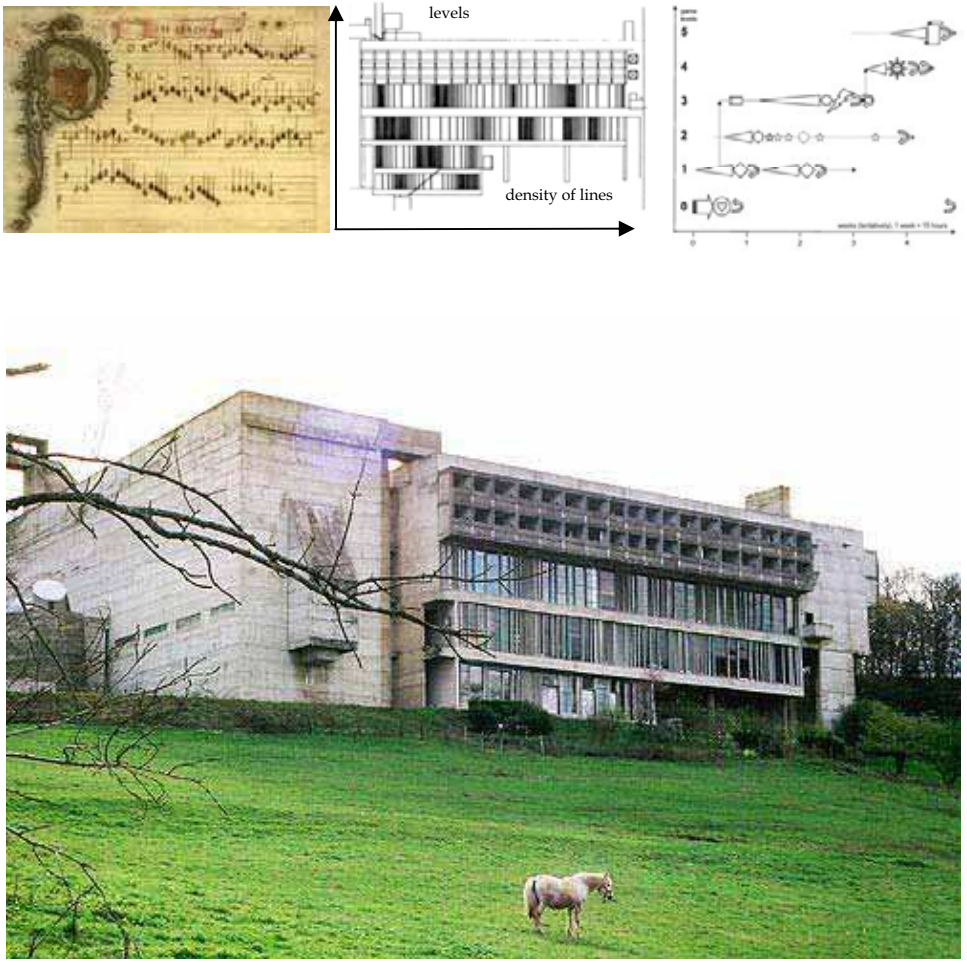

Fig. 4. Rhythmisation in space (above centre, façade by Xenakis: photo below) and in time (above left: music; right: symbolic notation for SGC's five levels dramaturgy: above right). Image sources, starting from left: (Vocal Consort, 2007), Figure 16 in (Beilharz, 2004), (Couvent de la Tourette, 2006).

4.3 Rhythm in time: music scores and flow charts

The historical and a modern type of musical notation are shown in Fig. 5 (left and right). Most often, different human voices are represented by different layers or levels in the notation.

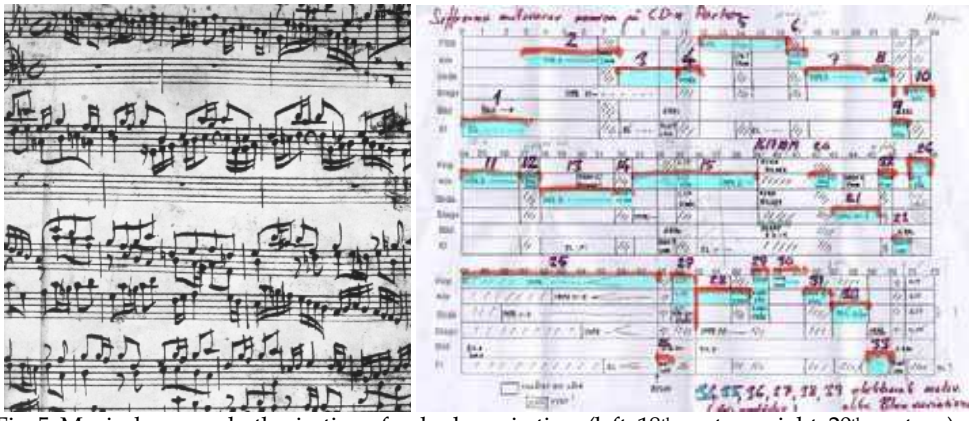

Fig. 5. Musical scores: rhythmisation of polyphony in time (left: 18th century; right: 20th century).

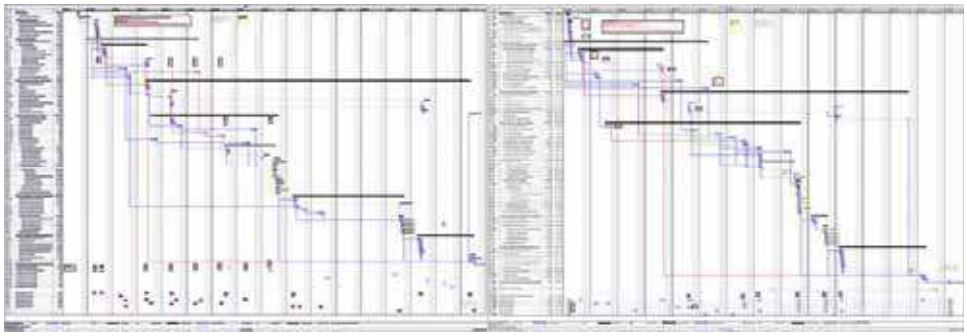

Fig. 6. The sequence and structure of two SGC implementations at Graz University in 2003-2005 as mirrored by the software for project organisation "MS Project". Each course lasted one semester and included 3 to 5 lecturers.

The composition of a project plan of SGC (Fig. 6) comprises several lecturers from various disciplines whose contributions are blended into each other. Its organisational structure resembles the above notations.

4.4 Structural similarities between music and gaming

When en-acting (e.g. a composition of music), the temporal structure follows a detailed poly-rhythmic sequence – just as in Xenakis' façade (Fig. 4). If adding the comparison between singers' voices (soprano, alto, tenor, bass) and the stakeholders' perspectives on the issues (e.g. using the roles industry, ecologists, administration, citizens), namely "polyphony", it could be hypothesized that a suite of games such as SGC resembles a structured choir with changing roles of carrying and varying the musical motives and melodies.

As can easily be seen from baroque scores, music has progressed to polyphony already quite early in history. Such might serve as symbol for "orchestrated polyphony of views".

Music is characterized by strict enforcement of coherence of the single voices. This hints to the importance of coherence (or at least good timing) of the different "social voices" in a societal learning procedure.

4.5 Structural similarities with evolution

Similar to the graphic impression of Fig. 1, the dynamics of global techno-socio-economic evolution show highly underdetermined behavior. Fig. 7 above shows the average development paths of the annual growth rate of energy consumption, plotted against a proxy for "economic stage of development", namely per capita economic activity (GDP/cap), for all countries in the last 30 years (Ahamer, 2003) (1 red line = 1 country).

The more countries develop, the closer they seem to gather around a path that leads from slightly positive to slightly negative energy growth rates – the latter projection would actually help climate protection. *Evolution "heads for different targets" during consecutive phases*, such interpretation might be possible (see chapter 2.9). Initially, civilizations develop ever increasing hunger for energy, which saturates later on.

A different graphic impression confirms Fig. 7 below, which for each continent plots vertically "the level of mechanization in agriculture" versus horizontally "land needed per unit harvested". Lines are moving leftward while mainly affected by annual weather changes that affect harvest. Again, the *target of development depends on the phase*.

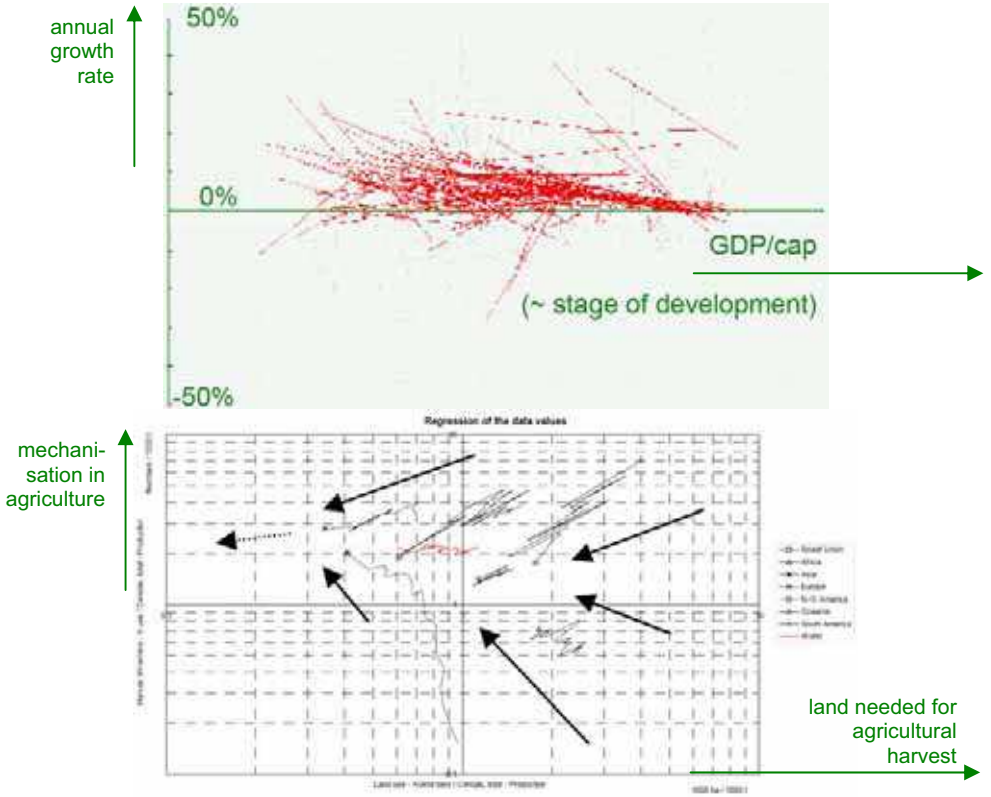

Fig. 7. Above: per country growth rate of energy demand plotted against per capita economic activity (GDP/cap), this growth rate apparently decreases along evolution (Ahamer, 2003). Below: per continent "machinery per crops harvested" versus "arable land needed per crops harvested", these evolutive paths could be continued as dotted.

Note: in the next chapter, the structural similarity between 'music' and 'societal learning procedures' does not mean "a voice equals a stakeholder" but pertains to structural characteristics of social procedures. This hint is given for better understanding of the following type of notation!

5. The notation of social processes

In this chapter, a new notation for social processes (elements sp) will be proposed which resembles musical scores. The notes in music represent elementary "social processes", the melody an entire "societal procedure" like learning, designing or even protecting global climate.
The resulting "social scores" sketch the communicational structure along time in various communicative dimensions.
For this paper, a new and original type of notation is developed.

5.1 Which basic dimensions exist in social processes?

When designing societal procedures, the intensity of social characteristics may vary along time. Once the emphasis is placed on teamwork, sometimes on individual work, here on understanding, there on confrontation. Can we invent a set of very basic and fundamental "dimensions" prevailing in any societal (gaming or learning) procedure? This chapter tries to do so.
Remembering one's own experience in singing, the reader might figure out that often soprano carries the melody and the reader may enjoy looking for other structural similarities. Table 2 attempts to introduce an order of fundamental social dimensions which in this paper will be symbolically called "voices".
Inspired by the examples in chapter 4 an attempt is made to split up the different components of human behavior into distinct levels in a graphic representation.
These four different components of human action are discerned based on practical experience with SGC for several years. They are thought to be organically independent (mathematically speaking: linearly independent) characteristics and components of overall social and societal behavior, be it learning, working, teaching or even politics (Table 2).

voice in music	**structural functionality**	**gaming in education**
S = Soprano	Leads the melody	Logical *information* conveyed
A = Alto	Follows the melody	*Team* building
T = Tenor	Counterfigures to melody	Debate & discourse, *dialoge* of facts
B = Bass	Longstanding cord basis	*Integration* with others' experience

Table 2. Suggestion for structural similarities between music (left) and gaming in education (right).

In Fig. 8 this systematization is depicted, including arrows for a first orientation.