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Abstract

While traditional MIS theory focuses on planned decision making as the main managerial activity, in this paper, we submit that improvisation is a frequent and ubiquitous process in economic institutions, such as markets and hierarchies. We argue further that improvisation is a much more grounded individual and organizational process than planned decision making. As a consequence, if information technology is used to automate structured, planned decisions, the risk is to automate ungrounded organizational processes. This may be an explanation of why many automated routines make little sense, or at best embed the knowledge of a novice, and subsequently have to be continually "worked at" by members in order to keep them viable. Finally, we suggest ways of harnessing information technology to support improvisation.

1. INTRODUCTION

Improvisation is situated performance where thinking and action seem to occur simultaneously and on the spur of the moment. It is purposeful human behavior which seems to be ruled at the same time by chance, intuition, competence and outright design. In improvising, features of a situation are "suddenly"[1] framed and combined by the actor, so that they become resources at hand for intervention. "During" the suddenness of the problematic situation, the problem solving strategy and the deployment of resources for implementation precipitate into a burst of action.

The study of improvisation can give us the opportunity to reflect in a new light upon key information systems (IS) concepts (Huber 1990), such as the structure of individual and organizational decision making; the nature of business processes in markets and hierarchies; the data versus information distinction; and last but not least, the scope for new generations of information technology (IT) to support or enable business processes of an improvised nature. The focus here is "smart" or "competent" improvisation, i.e., apparently extemporaneous action that contributes to individual and organizational effectiveness (Schon 1983).

The importance and frequency of improvisation for the everyday life of economic institutions such as markets and hierarchies are tackled first in order to prepare the ground for its analysis (section 2). Next, improvisation is explored and contrasted with rational, plan-driven decision making: the former shares with the latter elements of planning and design, oriented to the future, and the implicit reliance on an opaque stock of past experience. Though past experience is invisible in improvisation, and denied when not externalized (Käkölä 1995b) in planned decision making, it still exerts a wide-ranging influence on both processes. Ignoring such a background can lead to a mistaken discrimination between "planned" and "improvised" decisions and to a biased attribution of legitimacy, efficacy and rationality to the former style of decision making (section 3). In the next sections, we discuss key research and development issues. In section 4, we criticize current IS design principles, biased toward the idea of planned decision making, and show how they may lead in fact to the automation of incompetent decision making. In section 5, we point out new prototype applications and systems to support and enable improvisation in today's complex research arena. In the conclusions, we raise a few open research questions.

[1]One of the main characteristics of improvisation is to be "extemporaneous," i.e., outside the normal flow of time. The "ecstatic" (Heidegger 1962) nature of improvisation in relation to time will not be with dealt here.

2. THE IMPORTANCE OF IMPROVISATION IN ECONOMIC INSTITUTIONS

Far from being just an expedient to counter emergency situations (Weick 1993), improvisation plays an important role in the everyday life of the main economic institutions. In the following, we focus on the role of improvisation in markets and hierarchies. Original research on the role of IT and improvisation in teams is reported elsewhere (Ciborra 1996).

We examine some of the main facets with which the phenomenon of improvisation emerges in different economic institutions, and then we synthesize them in a preliminary model of improvised decision making, developed as a modification of the conventional human information processing model.

2.1 Improvisation on Markets

Hayek (1945) is possibly unsurpassed in portraying the functioning of the market institution, or price system. For the Austrian economist, the market is essentially a discovery process, where new opportunities and innovations are relentlessly found out, and the news of such findings is transmitted instantaneously through the price system. Decision making on markets is, as in any relevant economic process, linked to change: "So long as things continue as before, there arise no new problems requiring a decision, no need to form a new plan. . . . The economic problem of society is ultimately one of rapid adaptation to change" (Hayek 1945). In a market, one finds the key components of improvisation seen as a way of quickly adapting to change: immediacy; situatedness; idiosyncrasy; local knowledge; access to and deployment of resources at hand. Take, for example, "situatedness": adaptation occurs through decisions based on knowledge of the particular circumstances of time and place. Relevant knowledge is ultimately in the hands of those actors "who are familiar with such circumstances, who know directly of the relevant changes and the resources immediately available to them" (Hayek 1945). No such knowledge of the here and now can be efficiently communicated to a central planning board which, after integrating it, issues its orders. Also, the highly situated and fragmentary nature of knowledge which lies at the heart of improvised decision making on markets defies the efficacy of economic calculus based on "data." "Data" is never actually "given," but continuously "emergent." The existence of more or less "regulated" markets does not abolish by decree the role of situated and improvised decision making. Market decision making as a chaotic discovery process is able, most of the time, to overcome or bypass many rules and regulations. What was going on "below the surface" in the so called planned economies and the importance of the "black market" even in advanced, regulated economies are suggestive of the ubiquity of unregulated, *de facto* improvised economic activity.

2.2 Improvisation in Hierarchies

At first glance, it is hard to imagine a role for improvisation in hierarchies. We exit the world of relentless exploration of new opportunities (the market) and enter the world of exploitation of the already known and carefully planned, the world of hierarchical procedures (March 1991). Thanks to the division of labor and specialization, work procedures are generated to freeze both the explicit and tacit knowledge necessary to make decisions and carrying out activities (Nelson and Winter 1982; Nonaka and Takeuchi 1995). Organizational structures are there to influence, possibly in the smallest detail, decision making at all levels of the hierarchy through sophisticated mechanisms of communication and authority (March and Simon 1958). At a closer look, this picture of decision making, which seems to rule out improvisation completely, is due to a bundle of assumptions embedded in a particular perspective of analyzing and designing organizations, the information-processing perspective (Galbraith 1977). The adoption of other perspectives (e.g., the one which looks at organizations as interpretative systems; see Daft and Weick 1984), coupled with a closer observation of the "organizing" processes which take place daily in any work organization, would delineate a quite different picture, where procedures are virtual and improvisation is for real.

In this respect, consider the empirical studies on the role of "practical thinking" in the execution of mundane, highly routinized tasks in diaries (Scribner 1984), offices (Wynn 1979), when using new technologies (Suchman 1987), and repairing them (Orr 1990). These studies indicate that "contrary to much conventional wisdom, people continually learn and improvise while working" (Brown and Duguid 1991).

In her studies of work routines in a modern milk-processing plant, Scribner found that, in a variety of jobs ranging from the manual assembly of products to accounting, picking delivery tickets and taking inventory, intricate forms of improvisation are successfully performed to meet production goals. In most instances, even preset problems are subjectively reformulated on the basis of experience or hunch. Actual problem definition is made to fit "good solutions," where good solutions are what emergent circumstances offer. For example, product assemblers may convert a loading problem, formally expressed in an *addition* of units to be sent out to the loading dock, into a *subtraction* problem: how many units should be subtracted from available cases in order to reach the desired amount of units? Or, inventory people are able to manipulate in a sophisticated way the physical areas where cases are piled up in order to translate an *adding/subtracting* problem in inventory taking into a *multiplication* of physical space problem.

Hence, improvisation is systematic in the sense that formal accounting procedures are reframed, and new calculus procedures are set in place by a quick registering of the situation, for example according to principles of "least mental effort" and maximum exploitation of the "affordances" provided by the physical lay out.

Another empirical feature of improvisation is the flexibility in which the same problem is solved "now one way, now another, each way finely fitted to the occasion" (Scribner 1984). Flexibility comes in handy: improvisation is deployed to fill the unavoidable gaps between the so called standard operating procedures (SOPs) and the actual events as they occur in the flow of daily work (Zimmerman 1973; Wynn 1979; Suchman 1983).

Improvisation appears to be a highly interactive process with social and "ecological" dimensions. Both Orr and Lave and Wegner (1991) point out that improvisation, understood as a process of making sense of incoming working events and developing *ad hoc* solutions, takes place within "communities of practice." Local, specialized language of work groups, often unintelligible to outsiders, is an important sign of the deeply social nature of work. Such an idiosyncratic language, which consists of jargon, slang and war stories, is the most adequate medium to support the development of emergent, novel ways of formulating problems and finding solutions.

Improvisation is embedded into the intricate ecology among problem formulation and implementation, and the environment (situation) where it takes place. For example, tools and artefacts that populate the task environment, such as workstations, pencils, desks, etc., are always annotated, if not "re-invented" (DeCerteau 1984) with personalized adaptations, such as "hacks," "macros" and a plethora of "add-ons." The annotations indicate the richness of the "inventive calibration, calculation and workarounds" (Brown and Duguid 1991). Scribner has also shown how practical thinking and improvisation take place through sophisticated processes by which the task environment and its affordances (people, artefacts, information) (Gibson 1977; Norman 1988) are internalized into problem setting and solving to the point that even written, formal instructions and SOPs are interpreted by experienced workers not as the (pre-planned) way to solve a problem or execute an action but as an "input to an, as yet, unspecified problem" to be addressed (Gerson and Star 1986).

The literature so far provides enough evidence and descriptions to try out a characterization of improvisation. We can start from the ideal picture of rational decision making as portrayed by the human information processing view (Simon 1976; Galbraith 1977).

An actor makes rational decisions by first gathering information on the world, selecting alternatives, on the basis of goals and criteria. Once the alternative is chosen, implementation follows, while feedback about the outcomes is used to modify the initial objectives, range of alternatives, selection criteria and so on.

Improvised decision making differs from such an ideal model on various accounts. First, the problem that triggers decision making is framed in multiple and unstable ways, so that problem setting is not yet finished when problem solving starts: the two are kept open simultaneously. Second, the language in which the problematic situation is framed and the problem solved is highly idiosyncratic and differs from the standard organization language: this brings in further degrees of unpredictability (for the organization) about how the problem will actually be framed and solved. Third, implementation is a source of exploration and discovery, so that problem setting and solving continuously feed upon what implementation encounters along the way. Last but not least, feedback from the situation arrives before the decision is firmed up, and preempts the deployment of any pre-planned solution. Such pre-emptive feedback affects (a) the boundary between the decision maker (actor) and the

world of decision, so that features of the world may become part of the actor and vice versa (such as during jazz improvisation, when the music "is" in the fingers of the player [Sudnow 1978]); and (b) the internal clock that regulates the tempo and the sequence of phases typical of the rational decision making process.

However, such a model of improvisation, characterized by its extreme openness and "undecidedness" is in sharp contrast with the empirical evidence of the sudden "closure" and determination of the improvised act. How do we reconcile the two divergent processes? Or better, what puts an (almost instantaneous) end to the floating and indeterminate exploration of the world during improvisation? We submit that what precipitates improvised decision making is the fact that the decision/action makes ultimate sense to the actor. Such belief convinces the actor of the appropriateness of the action, even if on the spur of the moment, and represents the engine for his/her determination to act. While in rational decision making, there is a rational procedure to be followed step by step (Simon 1976) and such procedure gives legitimacy and ultimate sense to the decision maker, where does sense come from during an improvised decision or action?

3. IMPROVISATION AND THE MEANING OF A DECISION

In order to address the questions posed above, one needs to spell out the differences in terms of human information processing between improvisation and planned decision making. Specifically, the focus of our analysis must be the meaning of a decision, i.e., how and when are decision makers able to make sense of a decision, be it quick and extemporaneous or carefully planned? Since the use of IT in organizations is geared toward supporting and enhancing decision making of an explicit, planned nature, this will allow us to better understand the "logic" of present day IS design, its dysfunctional ramifications and the need for new applications able to accommodate the requirements of improvised decision making.

Improvisation surprises us because it makes little (no) sense within the context of events we expect. Analyzing it after the fact can help us in determining its sense and contribution to organizational effectiveness. However, such a *post mortem* analysis kills the very extemporaneousness of improvisation: we might get to its rationale, but we miss the heat of the action. Planned decision making, instead, since it can be externalized, is fully endowed with meaning: this is why we can intervene on it, improve it and ultimately automate it. How do we make sense of planned decisions, while improvisation seems to baffle our sense-making efforts? More dangerously, what if our selective attributions concerning which decision processes make sense and which not were misplaced?

Recall first that, although acknowledging the role of value premises, the study of rational decisions focuses on selection criteria, planning and choice processes, control and ensuing adjustments: all these items can be externalized (Weber 1964; Simon 1976). It is precisely such explicit objectives, plans, and criteria that make a decision a meaningful activity in the eyes of the decision maker. Since it is a conscious, future-oriented activity, decision making can be analyzed objectively, as the planned selection and deployment of means to achieve a goal, and eventually can be supported by IT.

On the other hand, the phenomenological study of the choice process by Husserl (1962) and Schutz (1967) indicates that choice is intrinsically subjective and transient (in Hayek's words: "linked to the here and now"). Moreover, any choice process is constituted from preceding projects of acts and derives its sense from the range and scope of such projects. These are highly dependent upon the here and now of their formulation and evocation, so that the meaning of a decision is merely relative to a particular moment in time and the recollections the actor is able to perform in those particular circumstances (Schutz 1967). In other words, the meaning of the decision depends upon the intensity and direction of a (retrospective) beam of light (attention) thrown back to illuminate past experience. The "positioning" of the light beam itself is continuously shifting, making a decision highly subjective (i.e., tied to the subject at a given moment of time) and ephemeral (i.e., linked to shifting local circumstances).

How can the orientation to the future, which seems to characterize both improvisation and planned decisions, be reconciled with a view where subjective, highly circumstantial interpretation of the past gives the ultimate meaning to a decision?

According to Schutz, every decision is carried out according to a project, which contains a vision of the decision as if already accomplished in the future. The meaning of the decision is constituted by the image of that project: the decision maker is led by the vision of the accomplished project.

The meaning embedded in such a project and its constituent elements (plans, goals, means, etc.) represent what Schutz calls the "in-order-to" motives of action. Note that it is precisely the in-order-to motives that are the special object of the analysis and design of rational decision making processes in the fields of IS, AI, DSS, and MIS (Simon 1976; Vera and Simon 1993). However, the in-order-to component is just the tip of the decision making "iceberg" (Garfinkel 1974). Below it are the actor's past experiences — selectively evoked according to the existential circumstances valid at the moment of making the decision. Such a deeper and wide ranging bundle of motives is called the "because-of" component of the action. It is the latter bundle which conveys the ultimate meaning and motivational thrust to the devising and performance of the action. The in-order-to project deals with the actor's explicit and conscious meaning in solving a problematic situation (Newell and Simon 1972), while the because-of motives can explain the reasons why and how a situation has been perceived as problematic in the first place.

The asymmetry between the orientation of attention to the past and to the future, intrinsic to any decision or action, has important implications for the study of improvisation versus planned decision making. The because-of motives are tacit and lie in the background of the explicit project at hand. They fall outside rational, awake attention during the action. They could be inferred by an outsider, or externalized by the actor, but only as a result of a reflection after the fact. Note, however, that the very act of interpretation of the because-of motives may well be "improvised," for it is in itself based on still different bundles of because-of and in-order-to motives, some of which fall outside the awake attention of the actor while he/she is doing the planning. That is, the beam of light that can be thrown on the meanings of a (past) decision is also highly situated, and constantly shifting. The same action performed in the past may then reveal new meanings depending upon the circumstances in which the actor or the observer reconsider it.

We can now explain the empirical accounts presented above which showed how ordinary decisions on markets and in hierarchies are *de facto* improvised, no matter the extent to which rules and norms guide and constrain behavior. Certainly, the plans, the means–ends chain, are there and they matter, but they are just the tip of the iceberg. Even more relevant is the drifting mass at the bottom, which provides the raw materials, the leftovers out of which plans are put together, particular problem definitions are selected and the means–ends chains are assembled. The improvised component hidden in structured decision making comes from the highly circumstantial fashion in which the bottom of the iceberg is brought to bear on the situation at hand, the relevant problem formulation and solution chosen. Moreover, the bottom is there, but we are not aware of its selective influences on our plans and projects at the moment of action. Hence, even a carefully planned and explicit decision looks extemporaneous and pasted up, since it is based on motives that are opaque and remote.

Note, finally, that our discussion so far tries to avoid the conventional distinctions between procedures (SOPs) versus exception decisions. We look at procedures, methods and routines as concrete or abstract in-order-to artefacts that populate the world of organizations. Improvisation belongs to a different family of phenomena, the one of being and behaving in such a world. What in the conventional IS perspective is considered "for real," i.e., structured activities, methods, data and processes, is here looked at as the fragile result of a long chain of abstraction and cleansing activities, where if something goes wrong, as in the cold chain that delivers us frozen foods, such entities get "rotten," stand in the way and must be discarded lest performance degrade (Latour 1993).

We also stay away from those who admit a "dialectic" in organizations between formal procedures and exception handling. We would suggest, if anything, a hierarchy of phenomena: improvisation is fundamental, while structured methods and procedures possess a derived character. Formalized procedures embed explicit in-order-tos, but the way these are actually interpreted and put to work depends intimately upon the in-order-to and because-of motives of the actor and his/her being in the world "next" to the procedure, the rule or the plan. In more radical terms, and to anticipate, what is at stake here is not "objects" or "artefacts" but human existence and experience. Procedure and methods are just "dead objects": they get embedded into the flow of organizational life only thanks to the melange of human motives and actions that govern daily sense making. One cannot cleanse human existence and experience from ways of operating and the use of artefacts. Human existence is ultimately improvisational, if for no other reason that the certain but undetermined limitation posed by death (Heidegger 1962).

4. A CRITIQUE OF PRESENT-DAY AUTOMATION

We are prepared now to deal with some of the dysfunctional consequences of conventional IS design, due to its systematic disregard for improvisation. Namely, structured analysis and design methodologies focus on plans and decisions that can be analyzed and executed objectively. Such methods lead to the construction of worlds (e.g., the "enterprise models") made of deceivingly hard, objective "entities," "data," "processes," and "activities." However, decision makers who perform according to such visions are bound to meet surprises, and possibly be puzzled by the unpredictabilities generated by the gaps between abstract routines, programs and structures, and the practicalities of their use (Husserl 1970; Weick 1993). Specifically, the current practice in designing and building systems may lead to two paradoxes that capture in a nutshell the reasons why many systems may fail when they are put in use:

- the automation of incompetence, and
- the backlash of experience.

What is competence in markets, in hierarchies, and in work groups? In our perspective, it is a sustained ability to develop and implement a project of action most suited to a (changing) situation, to the here and now of the work flow, to the on-going cooperation with other team members, or to the unpredictable unfolding of market transactions. A competent actor is able to deploy knowledge of local circumstances, set feasible goals, come up with a plan and choose a satisficing alternative. Thus, competent decision making includes:

- effective registering of the situation,
- peripheral attention to local subtleties and nuances,
- development of an appropriate plan (or on-line modification of an already existing one),
- implementation that fully exploits local affordances,
- flexibility in generating and switching between alternative courses of action, if required by the changing situation.

Incompetence, on the other hand, may lead to technically sound plans and their orderly implementation, but the outcome of such efforts does not square with the circumstances at hand. Hence, the inadequacy, inefficiency, and general clumsiness of incompetent actions.

Recall now the distinction between the in-order-to and the because-of motives. What appears to the actor, or to the external observer, as competent decision making is a set of actions carried out in relation to one or more in-order-to projects. Such projects convey to the actor before and during the action the meaning about what is going on. Incompetent decision making is also guided by in-order-to projects, the difference being that they do not match the problem at hand. The projects tell very little, at the moment of action, about the internal process which led to the particular way of setting the problem or the selection of those resources which have become the means-ends components of the project itself. On the other hand, it is the because-of motives that underlie the perception and framing of the situation as problematic; establish the boundary between the world and the actor; direct attention to specific subsets of past experience; set the horizon and scope for the intervention; evoke a limited number of ways of formulating the problem, and so on. What distinguishes competent from incompetent performance is the tacit component (Polany 1962), the one "below the line," as well as the type of project externalized. Competent decision making is situated, i.e., it achieves a good matching (alignment) between the because-of motives and the registering of circumstances. Improving the competence level means to learn how to flexibly select relevant because-of motives and align them with the characteristics of the situation. In this way, the direction and thrust of the action is accompanied by an effective retrieval of relevant experience, a good framing of the problem, the development of a sound plan and a sensible implementation, so that it avails itself of the resources at hand, here and now.

The introduction of IS, instead, is currently oriented toward the formalization and the automation of the "tip of the iceberg," i.e., it deals only with the in-order-to component of decision making. What is missing in the design of many contemporary IS is an effective link between the planned, automated decision process and all those tacit aspects, such as the because-of motives, or past experience, which give meaning to the development and implementation of a decision. This is why automated procedures tend so often to be underutilized, for they do not match changing circumstances, badly mimic the know how of even a novice, feel unnatural and clumsy, seem to lack meaning and be out of context, and are full of loopholes which have to be filled by (improvised) human intervention (see the discussion of the "automating" strategy by Zuboff [1988]).

To introduce the second paradox, recall the textbook distinction between data and information. Data is just signs over a physical support, while information is data endowed with meaning. According to conventional wisdom, information needed for better decision making can be obtained by improving the quality/quantity of data, since (it is implicitly assumed that) the decision maker will be capable of providing enough meaning to transform the incoming data into new and relevant information. Realities of use suggest that this picture is a bit idealized: what happens frequently is that more data leads to information overflow, and incompetent use/production of information, so that, paradoxically, one is better off in relying on bounded, highly local knowledge. In other words, since the competence available is limited, if compared to the actual complexity of the task at hand, data gets associated to wrong or lacking meanings, and information thus generated may lead to errors in decision making (Heiner 1983).

Interestingly, the way computer specialists attempt to fix the problem may be worse than the departure point. To avoid the faulty matching between meanings and data, they narrow down the margins for interpretation. For example, company-wide data dictionaries and enterprise models are created to decrease ambiguity in definitions and interpretations of data performed by the users. The result is that very few data, events or situations appear to have meaning. On the one hand, variety and speed in the change of business circumstances lead to an increasing number of exceptions to the existing definitions; on the other, actors are incompetent in dealing with such exceptions, since these occur outside the narrow repertoire of events/situations/actions endowed with meaning by their past experience. In the artificial, closed world defined by the data dictionary and enterprise models, any event that falls outside the precoded meaning may be difficult to interpret and handle. In such a world, incompetence is bound to occur more, not less, frequently.

The phenomenological study of decision making would show instead that behind meaning lies experience, and the span of attention toward past experience (Schutz 1967; Langeførs 1993). Thus, behind the notion of information there is nothing other than experience and attention. The past lurks in the back of even the latest information we can get on-line, while the intrinsically open nature of the future defies any attempt to capture beforehand those micro and macro surprises and breakdowns that punctuate the everyday life in organizations.

By restricting the meaning that can be attributed to data as it emerges in situations, one reduces the sources of past experience that can be tapped by decision makers to come up with an interpretation, i.e., one multiplies the chances of generating poor or wrong information. Moreover, opportunities for learning and effective knowledge transfer may also be restricted, thus endangering the further building up of competence. In sum, by wiping out the roots of interpretation and action, the backlash of experience may condemn decision makers to the incompetent use of the surplus of data made available even by carefully designed (according to conventional methods) IS.

5. RESEARCH AND DEVELOPMENT PROTOTYPES

One need not be purely critical or destructive when contrasting improvisation and planned decision making as two different reference models for IS design, of which the former is simply ignored, or even worse repressed. If one looks carefully at the variety of IT applications being developed and in use in a few research and development labs, one can find already functioning systems able to support decision making and action, conceived as improvised processes. A theory of improvisation (still lacking today) would help establish a common framework among what at present may seem scattered experiments or peculiar applications. Given the limitations already mentioned, we cannot do justice here to the diversity of technological solutions, or to the complex, and varied design rationales. We limit ourselves to linking a few key aspects that emerged from our study of improvisation with new, emerging prototypes:

- ***Situatedness***: systems for the Here and Now. These systems, such as the various devices included into the "ubiquitous computing" research program at Xerox PARC (Weiser 1991), the electronic badge of Olivetti, the "Forget-me-not" application developed at Europarc (Newman, Eldridge, and Lamming 1991) aim at capturing electronically, for future use (unspecified at the moment of collection [Robinson 1993]), location and time of events in the life of a person, a document, an artefact (e.g., a picture), or a conversation. They register "the Here and Now" and make it accessible for later use, in general as a "time and place" labeling of more complex events (an action, a decision, the writing of a document). These systems help by indexing events for fast retrieval of documents, decisions and conversations, so that they can be directly accessed when one needs to have a better grasp on the because-of motives which lie behind documents, decisions, or actions. Such systems can also augment the scope and range of peripheral awareness (Lave 1988; Brown and Duguid 1991; Goodwin and Goodwin 1993).

- ***Organizational memory***: systems that access and retrieve experience. Such systems, which go under the label of organizational memory (Stein and Zwass 1995), allow the actor to index, store and retrieve in a variety of ways (e.g., full text retrieval) distributed (over networks) fragments of past experience (again, documents, e-mail messages, images; conversations). Programs such as WAIS (Press 1992) enable a flexible and focused search of information, thus enlarging and strengthening the attention which underlies improvisation. Data warehouses (Cronk 1993) can also be harnessed for similar purposes, although their link with legacy systems may reduce the chances for truly improvised access and use. Systems that in one way or another assume that data has a fixed meaning, or should be used according to a limited (pre-planned) set of criteria, are not well suited for improvisation, a process whereby the meaning of data, or any other resource for that matter, depends heavily upon the conditions of use (Weick 1993).

- ***Communication and shared context***: systems constitute a shared context for interpretation. Improvisation in organizations is based on acts of interpretation supported by a shared context (Daft and Weick 1984). Context is created through sharing views, opinions, or stories between members (Orr 1990). Improvisation reflects a changing set of competencies and resources, which are recombined in continuously novel fashions. Availability of such competencies and resources needs to be communicated and exchanged on a permanent basis. Groupware systems, conceived as "common artefacts" (Robinson 1993), enable (highly dispersed) individuals to establish or reinforce shared meanings as organizational resources for individual or group improvisation. Groupware can be looked at not only as a coordination tool (Malone and Crowston 1994) but also as a means for collective memory and consensual validation of experience (Ciborra 1993). Groupware applications can become a collective repository, where members can access vast collections of because-of motives on a shared basis.

- ***Reflection and learning***: systems can support reflection-in-action (Argyris and Schon 1978) and learning for smart improvisation. These systems, such as Answer Garden (Ackerman and Malone 1990), gIBIS (Conklin and Begeman 1988; Käkölä 1995a), or Grapevine, keep track of *ex post* reconstructions, by an observer or the actor, of the rationale of performed actions or any organizational move (Pentland 1992). They establish precedents endowed with interpretation. They constitute another form of memory that can be looked up and deployed at the moment of new deliberations and actions. These systems allow users to build maps of situations, convey, in a somewhat stylized form, compact interpretations that can be utilized to share the meaning of past experience, and as platforms for simulating future events. More generally, simulation software can be utilized to accumulate substitute "past experience," that is, to enlarge the pool of because-of motives that can be tapped for new projects of action.

The systems mentioned so far can support the trade of functions between mind, body and task environment, that emerge in the study of improvisation. They mainly support the externalization of functions from the mind (memory) and the body (movement in space and time) into electronic artefacts. Note how the design of these systems is regulated by criteria that go beyond the issues of efficiency. The "answers" one can get from these systems are open and point to a multiplicity of meanings. They do not convey a single meaning, nor do they comply to a single efficiency criterion. Rather, they deliver a variety of possible meanings and criteria out of which, in the here and now of the action, one can select a criterion best suited for the circumstances.

6. CONCLUSIONS

The increasing complexity and rate of change of circumstances put strain on and limit planning and structure in decision making. Correspondingly, we have pointed to a practice that does not consist of "more sophisticated methods" or "more structured systems": improvisation. Such a practice plays an important role in complex economic institutions. Instead of trying to eradicate it through automation, we should more modestly appreciate its flexibility and effectiveness, and thus try to support/enable it, albeit indirectly. The challenge which improvisation sets for our conceptions of decision making, information and systems consists of abandoning the neat, but artificial world of models, structures and univocal meanings and entering the world of the ordinary, sense making and experience in the everyday life of organizations.

If we want to improve the effectiveness of IT in organizations, and society at large, due consideration for the role played by improvisation in human affairs advises us to stay closer to those everyday micro-practices and means developed by mankind over the centuries to survive (Moran, Anderson 1990). Indeed, behind smart improvisation one can find work practices or operational logic that go as far back as the age-old ruses of fishes and insects, of fishermen and sailors (De Certau 1984).

The perspective raised by this paper cannot deliver a fully fledged theoretical framework at this time, but it triggers a number of intriguing research questions.

- Can the externalization of knowledge provide a more robust basis for improvisation and intuition (as Zuboff's "informating" concept seems to suggest)?

- How can IS researchers and designers shift their focus to the tacit, opaque, and remote because-of motives, so that both types of motives receive equal research and design emphasis?

- Actions based on the because-of motives are very difficult to support within the explicit realm of computerization: if a user needs to enter a set of because-of motives in the computer system, before taking computer-supported actions, does the user have to externalize these motives before they can be entered, in which case the motives would no longer be tacit because-of motives?

- Do the prototypes mentioned above provide solutions that fully avoid formalization and knowledge externalization?

- Whose because-of motives should be focused on by researchers and designers? End users'? Designers'? Researchers'?

- Should designers start reflecting on their own because-of motives before trying to understand users' motives and take them into account in their designs?

- Should IS researchers start reflecting on their because-of motives to understand why they have not adequately addressed the social and organizational importance of the because-of motives in their research?

These questions, stemming from the comments of a reviewer, seem to provide the best, though definitely improvised, ending of our exploration, at least for now.

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