UNDERSTANDING ORGANIZATIONAL IMPLICATIONS OF CHANGE PROCESSES: A MULTIMEDIA SIMULATION APPROACH

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Understanding Organizational Implications of Change Processes: A Multimedia Simulation Approach

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Abstract Executive Information Systems (EIS), groupware and other types of computer-based information and communication systems are increasingly used in companies to support major change processes leading to the redesign of work processes, information flows, responsibilities for resource allocation, and decision making. However, the high failure rate in implementing such systems is an indication of the resistance to change normally encountered in organizations and the limited skills of IS managers in the domain of change management. The "EIS Simulation", a multimedia business simulation, has been successfully used to increase managerial awareness of the dynamics and the problems arising when implementing information systems which have important implications for work processes and power redistribution within companies. This paper illustrates the innovative design of this multimedia simulation and the broader pedagogical value of such an experiential learning approach.

1. Introduction

Over the last decade, Information Technology (IT) has become a major catalyst and enabler for organizational change [Hedberg 1980; Keen 1981; Scott Morton 1991; Venkatraman 1994]. In order to continuously improve competitiveness and reduce costs, managers are increasingly expected to be able to analyze and rethink the way information is produced, processed and shared throughout the organization. this also includes the capability to select and introduce advanced IT solutions, e.g. Executive Information Systems (EIS) [Crockett 1992; Cottrell & Rapley 1991; Watson & Glover 1989], groupware, and Intranets [Gow 1996], in order to increase the performance of executives and teams. As documented both in the academic literature and in the popular press, embarking on such projects is a challenging task which requires managers to have a sound understanding of the organizational implications of implementing new technology-based systems [Leonard-Barton & Kraus 1985; Eason 1988; Tang 1991; Glover et al. 1992], and of the different strategies and tactics to be applied in order to reduce resistance to change [Eason 1982; Jick 1993].

This paper addresses the design and evaluation of computer-based pedagogical tools providing managers with realistic simulation environments in the field of organizational dynamics. The "EIS Simulation" [Angehrn 1995], a multimedia management simulation game allowing managers to experience the process of introducing a new EIS in an organization, is used throughout the paper to illustrate the design and impact of such advanced learning technologies on management development. The paper illustrates and discusses the 2 key characteristics of the *EIS Simulation*: (1) its innovative design (compared to more traditional computer-based simulations), and (2) its pedagogical value (in terms of increased awareness, introspection, and acquisition/ retention of knowledge and skills in the domain of change management and implementation). The paper concludes with a discussion of further research related to the design and application of advanced simulations in the field of organizational dynamics.

2. The "EIS Simulation": An Overview

The *EIS Simulation* is a computer-based multimedia business simulation which has been used extensively over the last 2 years with groups of management students and executives. The simulation's primary objective is to raise and discuss key issues involved in the implementation of organizational change, in particular when such change is driven, enabled or accompanied by technical systems such as Executive Information Systems, computerized accounting systems, or sales support systems. With this simulation, learners are challenged to gradually introduce an innovation in a fictitious company. They dispose of up to 6 months of simulated time to convince the members of the company's management team to adopt a new Executive Information System (EIS).

EISs are computer-based systems belonging to the broad category of Management Decision Systems [Scott-Morton 1971; Angehrn 1993; Angehrn & Jelassi 1994]. Introduced company-wide, they are intended to enhance top management efficiency and effectiveness by modifying, streamlining and hence improving information and communication flows [Rockart & Delong 1988]. The process of implementing an EIS has been selected for the purpose of this simulation as it represents a class of computer-based management systems which (1) are becoming increasingly popular in organizations [Main 1989; Irving et al. 1986], (2) provide a concrete example of innovative systems which have a tangible impact on the way managers work, gather, share and process information, and communicate [Friend 1990], and (3) are generally difficult to implement and likely to generate different forms of resistance [Tang 1991; Watson & Glover 1989; Barrow 1990].

To increase realism, all the managers in the simulated company (the "change recipients") have been modeled to display different behaviors, characters, attitudes towards change, and patterns of resistance, typically encountered when trying to implement innovative projects in practice. The interactive and multimedia components of the *EIS Simulation* provide a realistic experience challenging learners to incrementally influence the attitude of the change recipients. This objective is achieved by:

(1) gathering information about the company's managers (see left hand side of Figure 1),

(2) gradually "discovering" the company's formal and informal networks (who are the "key people"? who is likely to resist? who is having lunch with whom? who might play a "gatekeeper" role? etc.),

(3) developing and implementing different types of change strategies (bottom-up, top-down, etc.), and

(4) selecting among many different Organizational Development tactics used to introduce and spread change in organizations [Beckhard & Harris 1978; Beer et al. 1990; French & Bell 1973; Jick 1993; Rogers & Shoemaker 1971].

At any moment during the simulation, learners (typically working in small "change agent" teams) can select and implement change tactics. For example, they can organize workshops, individual meetings or pilot projects, invite external experts to offer seminars, select managers to be sent to executive development programs (see right hand side of Figure 1), disseminate information through the company's newsletters or electronic mail, etc. Each tactic has a predetermined cost and its impact on the organization is conveyed immediately to the learners, in the form of a brief summary of its consequences. These vary depending on the tactic selected, the managers targeted, the timing of the tactic, and the overall situation (a given tactic might for instance not succeed unless key managers have been consulted and convinced previously). Learners can therefore continuously monitor all the attitude variations of the change recipients due to their direct intervention (e.g. a manager might become more interested in the innovation after having been involved in a pilot project). In addition, attitudes of change recipients are influenced by learner-independent events (e.g. some managers might continuously adapt their attitude to the one displayed by their superiors) taking place in the company during the 6 simulated months of the change implementation process.

Within the *EIS Simulation*, the attitude of each change recipient (e.g. the R&D Director Frank Scotti displayed in Figure 1) is modeled as a dynamic variable reflecting one of the four stages of *Awareness*, *Interest*, *Trial*, and *Adoption*. As Jick [1993] proposed: "Adoption of change moves in a series of well-defined stages. The first stage is *Awareness*, in which the individual is alerted to the existence of something new. Next is the *Interest stage*, in which the individual gathers information and an aroused level of curiosity. This is followed by the *Appraisal/Trial* stage, in which the new idea is tried out in a trial operation. The final stage is *Adoption*, in which the individual incorporates the innovation as a part of the resources he or she uses on the job. It is an orderly process through which all individuals must pass who become adopters."

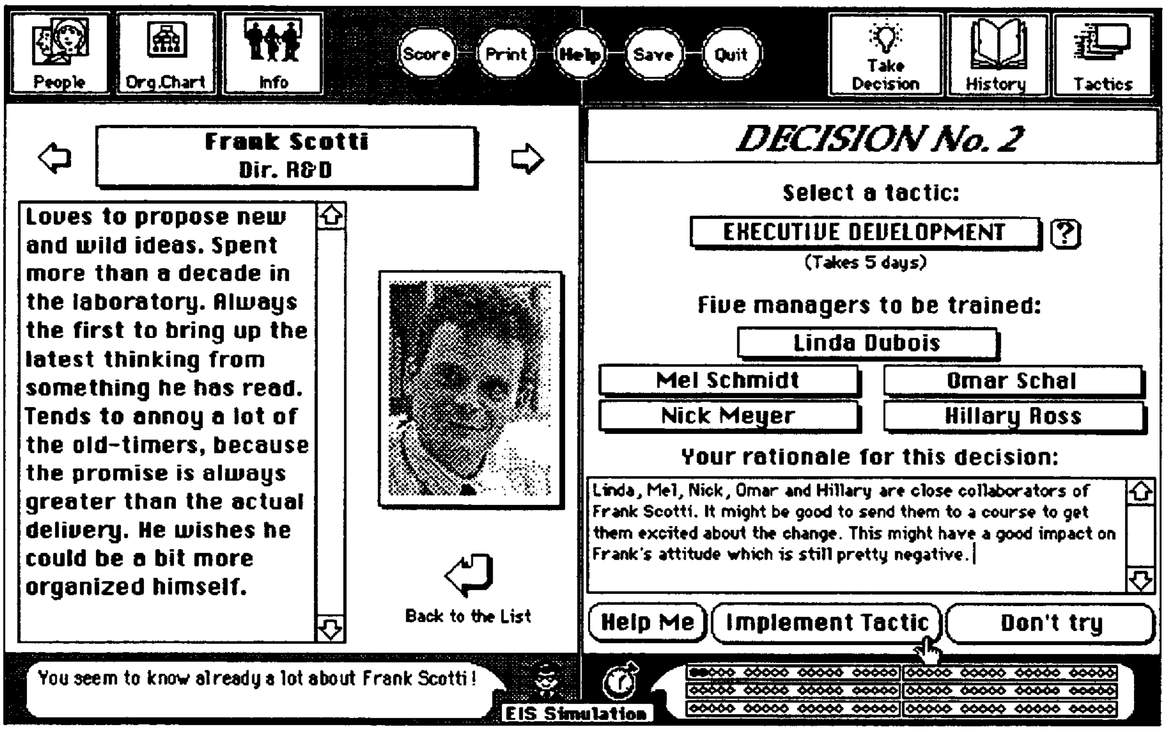

Figure 1: Gathering information and selecting organizational tactics in the *EIS Simulation*

Every targeted change recipient displays a different behavior and willingness to move through these four stages. The major challenges of the *EIS Simulation* is to develop an effective overall change management strategy based on a good understanding of the formal and informal influence networks of the simulated organization. The next challenge is to select the appropriate change tactics to maximize their impact on the change recipients, taking into consideration that attitudes can change over time (both in positive and negative terms) depending on actions the change agents take (implementation of specific tactics), as well as those they fail to take (e.g. low reinforcement typically leads to loss of interest).

Like pilots in a flight simulator, managers using the *EIS Simulation* are given the opportunity to test their change management skills in a highly dynamic and complex environment. After the actual simulation, which lasts approximately 3 hours, participants typically review and debrief their experiences, sharing and comparing their successes and failures, discussing the patterns of resistance observed in the simulated company, and linking their experience with actual change processes taking place within their companies.

3. Design Perspective: Towards object-oriented, multimedia simulations

Simulation models have been developed and used extensively since computer technology became available. Although the first applications focused mainly on the analysis of complex military problems [Thomas 1961], a number of formal models rooted in disciplines such as economics, politics, sociology, and engineering were translated into simulations [Maidment & Bronstein 1973; Guetzkow et al. 1972]. Such simulations were designed either for research purposes, or as effective, action-oriented pedagogical tools for acquiring specific skills, e.g. those of airplane flight crews [Adams 1962].

In the early 1960s, simulations started to appear in the management field, first as an aid to decision-making for governmental officials in fields such as transportation and health-care [Boocock & Schild 1968], and later as a management training tool. Since then, instructional simulations have been used extensively to teach managers at all educational levels, with a particular emphasis on the development of decision-making and business management skills and concepts [Graham & Gray 1969; Faria 1987; Keys 1990], marketing [Larreche & Gatignon 1990; Alpert 1993; Laughlin & Hite 1993], international relations and political decision making [Guetzkow et al. 1963] as well as other general management subjects [Keys & Wolfe 1990; Edge & Keys 1990; Hornaday 1990; Fischer 1991; Diehl 1992; Drew & Davidson 1993]. Today, management simulations have attracted the attention of a large number of researchers and educators and are considered a cornerstone of management development [Wolfe 1993; Lane 1995].

The key step in the design of traditional instructional simulations is the development of:

(1) a formal model of a real system (e.g. a market, an economy, an ecological system, or an organization), and

(2) an algorithm reproducing the dynamics of this system.

Once these two components have been determined, an interface is added to display the current state of the system in textual or graphical format, and to allow users to iteratively manipulate a predetermined set of high-level system parameters (e.g. the price of a given product or the allocation of resources to a given process). Every time one of the system parameters is changed, the simulation algorithm is used to compute the resulting changes of the system state, and to feed it back to the user through the computer interface.

Over the last decade, different alternatives to the traditional algorithmic approach outlined above have been proposed. The objective of these alternative design approaches was (1) to enhance the flexibility, transparency, and extendibility of simulation programs, and (2) to enable the simulations of situations in which an algorithmic approach is not suitable given the complexity and the qualitative nature of the relationships between system components. The *EIS Simulation* described in the previous section belongs to the class of simulations which aims to recreate the complex dynamics of people interacting within an organizational context [Dutton & Stumpf 1991; Wolfe 1991; Kraus 1992; Lyles et al. 1992; Senge & Sterman 1992].

From a design perspective, the *EIS Simulation* is based on the Business Navigator method [Angehrn et al. 1993], a conceptual model guiding the development of so-called Virtual Interactive Business Environments (VIBEs). VIBEs are realistically simulated business contexts which can be explored incrementally in the course of a "virtual visit/experience". This approach differs substantially from the algorithmic approach used to develop traditional simulations. First of all, the formal model of the real system underlying the simulation is not defined in terms of a set of dependent or independent variables, but through the high-level specification of classes of objects. Such objects represent high-level system components (a person, a resource, a process, a location, etc.) and are modeled individually in terms of:

(1) their representations (i.e. the set of mechanisms determining how an object component can be displayed within a VIBE). For instance, an object of the class "manager", depending on the system state or on what the user wants to visualize, might be represented by its name and title, by pictures, video sequence, animations, etc., exactly as a thermometer might be represented by a graphic, a technical scheme illustrating the way it functions, the indication of the temperature it measures, or by a number representing its price, or weight.

(2) their behavior (i.e. the set of mechanisms determining how an object component evolves over time and interacts with other system components). Within a VIBE, object behavior is modeled by associated "methods". Such methods determine the type of events (environmental stimuli) to which a particular object reacts, as well as when and how this reaction takes place. For instance, an object of the type "manager" can have an associated "method" by which it regularly "observes" another object (e.g. one from the class "director", a class which represents a specialization of the more generic class of "managers"). Depending on the result of this observation, the method might then trigger a specific reaction, e.g. update an object's characteristic such as its "attitude towards change", or activate other system components (every system component included in a VIBE can send messages to other system components, which can in turn respond to this stimulus using their associated methods).

(3) their characteristics (i.e. the set of variables by which every object is described in a unique way). For instance, the characteristics of an object of the type "manager" can include variables determining its name and title, its picture, its attitude towards change, its seniority in the company, the amount of resources it controls, and its relationship to other objects (e.g. the "Boss" variable would contain the identifier of another object corresponding to the manager's hierarchical superior).

The set of all the objects included in a VIBE defines implicitly three levels at which the user is able to interact with the system ("navigate"): From the user's perspective, navigation takes place at the three levels illustrated in Figure 2: the Physical Network, the Organizational Network and the Information Network.

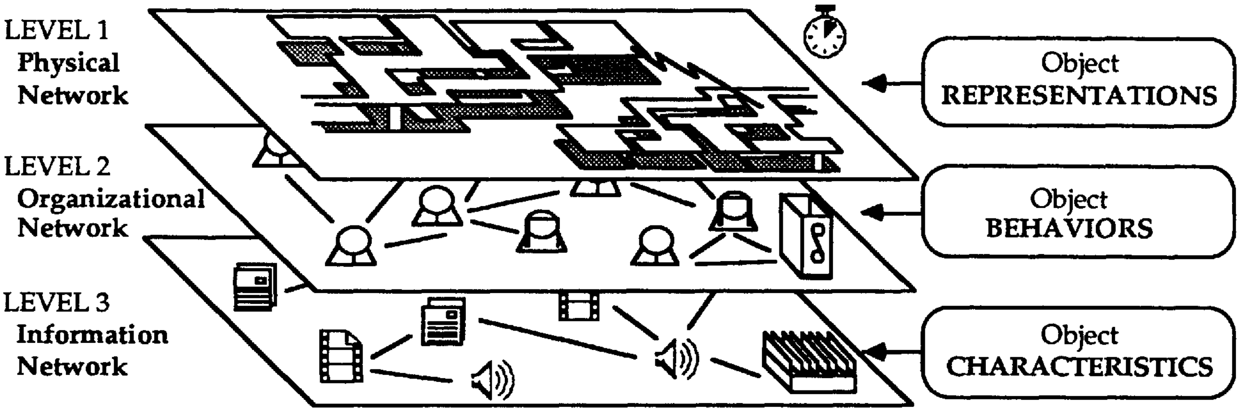

Figure 2: Structure of a Virtual Interactive Business Environment (VIBE)

The concept of navigation on the first level (the Physical Network) is straightforward. The user "moves" in the space defined by the set of all the representations associated with the system components, manipulating and interacting with them. As described in [Angehrn et al. 1993], organizational simulations can profit from representations based on 3D, "navigable scenes", and virtual reality technology, which provide the impression of being immersed in a physical business environment, walking through corridors and public spaces, entering offices and attending meetings. The Physical Network determining the user interface of the current version of the *EIS Simulation* does not reach this level of sophistication (illusion of physical "presence") but enables the user to easily display and operate with different types of object representations, including pictures (e.g. of individual managers), textual descriptions (e.g. of tactics the user can activate), graphic representations of relationships between objects (e.g. organizational charts and informal networks) and of important state variables (e.g. a "control panel" displays dynamically changes in the managers' attitude described in terms of awareness, interest, trial, and adoption, as explained in section 2).

At the second level, all the system components (managers, tactics, networks, etc.) are described in terms of their dynamic behavior. From the user's perspective, navigating at this second level (the Organizational Network) corresponds to interacting with individual system components (e.g. the managers or the tactics) and observing the resulting feedback generated by the methods associated with the activated objects. For instance, a specific tactic can be used in the *EIS Simulation* to try to meet one of the managers. In this case, the object representing the tactic will "send a message" to the object representing the targeted manager. A method associated with the manager will determine the reaction. Such a reaction can range from not accepting to attend the meeting, to triggering a positive (or negative) cascade of events. For instance, involving the Human Resource Director early on in the change process can have indirect consequences, as this particular manager will proactively influence other managers. The dynamics taking place at the level of the Organizational Network is hence determined by the locally defined methods and takes the form of dynamic "message sending" between objects and the generation of new events. These events determine changes in the characteristics of the system components (managers will, for instance, change their attitude over time) as well as the information accessible to the user via the Physical Network.

Finally, the third level illustrated in Figure 2 represents a structured repository for the data associated with the system components modeled in the Organizational Network. All the object characteristics are hence included and stored in the Information Network in form of static or dynamic data such as video and audio tracks, documents, organization reports, and database files. To guarantee logical and physical independence, data stored at the Information Network level can be accessed only by activating corresponding methods defined at the Organizational Network level. For instance, in the *EIS Simulation*, the Information Network includes data on all the characteristics of all the system components, including the attitude of each manager, the information accessible through the activation of a given tactic, the characteristics of different networks managers can belong to, etc.

The set of all the objects included in a VIBE also defines implicitly the dynamics of the global system, which results from the (locally defined) behavior of its individual components instead of relying on an algorithm or on a similar global control structure. From an implementation perspective, organizational simulations based on the Business Navigator method can hence employ object-oriented technology instead of more traditional procedural programming languages to implement the 3-level architecture described above. For instance, the current version of the *EIS Simulation* is implemented using HyperTalk as a programming environment.

This approach can be used to model situations in which an algorithmic approach is not suited given the complexity and the qualitative nature of the relationships between system components. In addition, it greatly enhances the flexibility, transparency, and extendibility of the simulation model. For instance, within the *EIS Simulation*, every manager populating the simulated organization (the VIBE) is modeled individually in terms of generic attitude towards the proposed change, willingness to interact and collaborate, membership of formal and informal networks, control of organizational resources, and individual reactions to different types of events taking place during the simulation (e.g. the organizational development tactics implemented by the user). The adoption of this approach makes it particularly easy to:

(1) extend the system with new components (e.g. through the introduction of a new manager, for instance a union representative, in the simulated company environment, or with the extension of the tactics the user can activate),

(2) incrementally encapsulate sophisticated or highly specialized behavior into existing system components, in order to observe the effect of such local changes on the overall dynamics of the system, and

(3) enrich the quality of the interface (the Physical Network) and indirectly of the learning experience [Bell & O'Keefe 1995; Palmiter 1993] by adding multimedia items such as sounds, graphics, and videos to the individual system components.

4. Pedagogical Perspective: Improving learning efficiency and effectiveness

One of the key characteristics of simulations used in an educational context is to enable learners to acquire experience by encountering complex situations resulting from their own decisions [Kolb 1984; Senge & Lannon 1990]. This factor, combined with the fact that learners are not forced to deal with verbally abstract descriptions of problems, but with realistic situations in which they have to perform a real role, has been demonstrated to have an impact on learners' motivation [Sherrell & Bunns 1982], as well as on their satisfaction and involvement with the learning experience [Pierty 1977; Dekkers & Donatti 1991]. Simulations have also been found effective in terms of long-term retention of knowledge [Bredemier & Greenbalt 1981] and of increased interest about the subject taught [Clarke 1970; Livingston 1972], as students exposed to a subject through simulation techniques tend to display a strong inclination to seek additional information outside the classroom.

Since 1994, we have used the *EIS Simulation* in well over a hundred modules, in MBA and executive programs both in business schools and companies. Aside from one common factor (virtually all our participants have had *some* managerial experience), we have worked with groups of managers featuring all possible levels of diversity in terms of hierarchical level, cultural and professional background, and type of industry; from the small top management group of a national manufacturing company to large international groups of consultants. This diversity has given us a rich experience base and feedback on the design and delivery of the simulation. The major trend of this feedback is that, when conducted under conditions we describe later, the module is overwhelmingly rated as an enriching experience by learners and instructors. In the rest of this section we describe:

(1) Four types of pedagogical benefits offered by modules based on the *EIS Simulation*.

(2) Two enabling factors that contribute to make such modules an efficient and effective learning experience.

4.1. *EIS Simulation* -based learning modules: Four types of potential benefits

Modules based on the *EIS Simulation* typically run over four to four and a half hours, starting with a half-hour introduction in class, followed by a "run time" of about 2.5 hours (in groups of four to six participants), a group debriefing of up to 0.5 hour, followed by a one hour class debriefing. Participants' and instructors' feedback often focus on the simulation's sophistication and its ability to trigger interesting and often passionate discussions. In our view, the simulation is very effective on two counts: (1) it highlights several important dimensions of effective change management, and (2) it creates a more fertile ground for subsequent class discussions on the subject. Combined with the group interactions that accompany the simulation, EIS-based modules present four types of potential benefits:

Effective highlighting of "basic rules" of change management

The first benefit comes from the direct feedback that learners get interactively during the simulation. The architecture of the *EIS Simulation*, the vast number of possibilities of action its offers, and its stochastic components allow for each run to be a unique experience. As a result, each team gets different feedback, leading to the identification of different learning points. Still, the *EIS Simulation* is designed to highlight a number of basic, quasi-universal "rules" of change management. Virtually all teams will trigger feedback emphasizing the following four dimensions:

- The importance of "understanding the terrain" by collecting background on the management team. This includes understanding the importance of managers' formal power (e.g. for many tactics, subordinates respond more positively when their boss has already decided to adopt) as well as of various sources of informal power (e.g. the simulation forces participants to go through "gatekeepers"; managers who command little respect within the organization bring small "returns" while working with opinion leaders yields significant "ripple effect"; the same principle applies with members of informal networks).

- The importance of developing and maintaining momentum in the change effort (e.g. the system triggers positive or negative reinforcement depending on the pace of progress).

- The importance of communicating regularly both up and down (e.g. the simulation rewards communication tactics, but some more than others, highlighting the need to adapt to different communication methods and patterns across organizations).

- The fact that receptiveness to change tends to be unevenly distributed within organizations. (e.g. the managers of the simulated company react quite differently to change tactics. This of course implies that some members of the organization might be easier to "convince" than others, which may influence the order in which managers get "targeted").

It is virtually impossible to go through the *EIS Simulation* without getting feedback on these four dimensions. Interestingly, these "quasi-universal rules" are typically not new for experienced managers. Most participants "already knew" them. They are typically not controversial either; virtually all participants agree that these are indeed important points. Yet many participants fail to apply this "non-new" and "non-controversial" knowledge! This is of course a common observation for educators; knowledge is not always implemented by learners. Often we "forget" things, or rather this knowledge seems to be stored too far in our mind to be brought to bear into decisions we face.

Consistent with prior research on simulations, participant feedback suggests that the *interactive* and *multimedia* nature of the pedagogical experience makes it more vivid and memorable. The interactive nature of the system makes the feedback received a function of participant actions, which gives participants an active role in their learning process. The multimedia dimension (e.g. managers have faces and backgrounds, feedback comes through both written and sound formats) increases the appeal of the experience. As a result, the simulation helps bring some of these "golden rules" back into "core mental space" in a vivid and thus more memorable way.

The *EIS Simulation* also makes many points that are more subtle and less unambiguous than the "golden rules" presented above. For example, the system rewards change agents for not "leaving too many individuals too far behind" in the change process. This is not an unreasonable position. Yet, in practice (as well as in the simulation), some change recipients are extremely difficult to bring to the adoption stage. As a result, given non trivial time constraints, one may decide to leave one or two targets "behind" to focus instead on more numerous and receptive "targets". This is not a clear cut point; the learning benefit comes from identifying the issue and some of its major dimensions (e.g. how influential is the "apparent resister" one is tempted to "leave behind"?).

The *identification* and *analysis* of such issues can occur individually following feedback from the simulation, but both aspects benefit from group and class interaction. The class helps *identify* such learning points by incorporating more strategies and tactics than a single team can have tried, and both group and class interaction can enhance the quality of the *analysis* by bringing more views and experiences to bear. The benefits of group and class interaction are discussed further below.

Creating "open space" for learning

It is well known that there can be no effective learning without some dissatisfaction with the status quo (see, for example, [Nadler 1987] or [Kotter 1996]). This observation is particularly important for domains such as change management, where (i) many of the pitfalls are implementation-related (as opposed to conceptually complex), and (ii) most managers have some experience with the subject. As a result, managers have a tendency to think of themselves as experts and to walk into the classroom with a correspondingly low "dissatisfaction with the status quo".

The *EIS Simulation* helps create such dissatisfaction by directly confronting participants with the limits of their knowledge and skills. First, the simulation has been designed to include a large number of "traps" in which change agents typically fall into. Secondly, the pace of change experienced by the learners is realistically but disappointingly slow. As a result, the simulation is often a frustrating and humbling experience for participants.

Leveraging learning through the use of "groups" of change agents

Running the simulation in teams of four to six participants has three types of benefits. First, as mentioned above, the presence of other change agents helps *generate more learning points*, as the simulation feedback resonates differently with different individuals, each bringing his/her own experience to the team. For example, the members of the team may have all seen the system "reward" the adoption of a given tactic X at a given point in time but may be unable to interpret why and/or to infer a learning point from this event, except for one of the members who, for any of a number of reasons (e.g. s/he may have tried the same tactic in practice), is able to "make sense" of the feedback.

Similarly, a team presents a richer pool of knowledge and experience to *analyze* such issues. For example, the simulation tends to penalize unilateral strategies such as compulsion. This is a debatable result, as in many firms IT changes are implemented through compulsion. The system's feedback becomes the starting point of a reflection, then a discussion process among the team members: Does your firm resort to compulsion? Why (what are the advantages of compulsion as a change tactic)? How effective have you found compulsion to be? How do you define and measure "effectiveness"? Maybe compulsion is more effective in some conditions than others, what would be these conditions?

Second, the team dimension allows for a *confrontation of each participant's views*. These views are in fact theories about organizations, about individual and organizational behavior, and about managerial effectiveness (e.g. "under conditions X and Y compulsion is the best approach"). Whether the theories are tacit or explicit (i.e. whether or not the participant is aware of them and can articulate them), these theories are an important starting point.

Case discussions led by a skilled instructor can also help participants identify and reflect on their own theories (by exposing them to the theories held by others and the rationale and evidence supporting the others' views). We believe that this confrontation process is likely to be more effective following the *EIS Simulation* than in a more traditional setting (e.g. a lecture or a case discussion). First, because of the humbling and mind-opening impact mentioned above, and second because of the emotional involvement associated with the direct feedback provided by the simulation. This involvement, as well as the necessity for team members to agree on which tactic comes next, are likely to lead to more forceful advocacy of, and, hopefully, inquiry into the other learners' theories.

In practice, members of an *EIS-simulation* team are often led to articulate and debate their respective views on themes such as:

- Resistance to change ("Is there an intrinsic, human propensity to resist change? Why do some people resist change more than others? Is resistance to change an individual-specific or an innovation-specific phenomenon?").
- Motivation theories ("How much influence over their task environment do people prefer to have? Can we effectively tell people what to do, when and how to do it, or do they need some measure of self-determination? How much do people differ on this dimension? Do circumstances also influence individual preferences?").
- Change management ("bottom-up" approach based on a lot of communication, or "start at the top and cascade down", or a combination of the above, etc.).

Third benefit, working as a team of change agents has the second order benefit of creating some "here-and-now" data on participant behavior. The simulation then becomes a microcosm of a change project, where each participant advocating his/her views is also acting as a change agent within the team. The team members have to agree, if only implicitly, on a structure (self- or leader-managed team?), they have to listen to one another and make the best of the members' respective competencies, they have to manage time, etc. Team members also have to resist the temptation to resort to "heavy-handed" tactics such as compulsion when they become frustrated with the slow pace of change halfway through the simulation period, and/or when they start to panic as the deadline gets closer and they feel pressed for time. These challenges exist in real life, with much higher stakes than within *EIS simulation*. In particular, the "run time" often illustrates for participants the benefits of starting a change effort with an overall strategy/master plan, based on a good understanding of the nature, cost and expected benefits of the range of available tactics.

Generating "here-and-now" behavior is important because participants' behavior in the team may reflect a different theory that the theories of "change management" they articulate and espouse (see [Argyris 1983] for the distinction between "espoused theory" and "theory-in-use"). In particular, participants tend to display less bilateral and supportive behavior toward team members with whom they disagree than they advocate doing with members of the simulated organization.

Leveraging learning through bringing the groups back together in class

As mentioned above, the *EIS Simulation* allows for each "change effort" to be a unique experience. As a result the class debriefing session is always a rich experience. Teams often realize that they obtained different results with *apparently* similar approaches, in some cases with very similar approaches (due to the simulation's stochastic component). These comparisons greatly facilitate participants' identification of issues such as:

- The importance of the timing of use of tactics, as some tactics are particularly effective at generating awareness, others at increasing interest, others yet tend to be more effective when the "targets" are ready to pilot the innovation.
- The effectiveness of using a balanced approach, focusing both on specific individuals and on groups (e.g. meetings with individuals followed by seminars or inter-departmental meetings).
- The need for change agents to display both consistency and flexibility. That is, uncoordinated and unplanned change efforts are less likely to succeed than coordinated ones, yet change agents must also learn from the organization's reaction and adapt their approach when necessary.

To stimulate such discussions each team brings back to class a transparency of their *EIS Score Sheet* and of the summary of their group debriefing. We then aggregate the learning points across groups. This process allows further challenge of participant views (e.g., on resistance to change). It also allows the instructor to propose a number of "tools"/conceptual frameworks designed to enlighten some of the discussions, including models of change management (e.g., [Kotter 1995 and 1996]), the concept of procedural justice [Greenberg 1990; Kim and Mauborgne 1995], self-determination theory and informational limit-setting [Deci & Ryan 1985; Deci & al. 1991].

Again, these discussions are facilitated by the fact that managers tend to walk back into class much less comfortable with their change management skills that they were three hours before.

4.2 *EIS Simulation* -based learning modules: Two enabling factors

Part of simulations' effectiveness comes from their ability to involve participants' at an emotional and intellectual level. To obtain this involvement it is important to prevent participants from disconnecting emotionally and/or intellectually. This disconnect could occur before the simulation starts (the participant never engages) or during run time. Other things equal, participants are more likely to disconnect during run time if the simulation is not "real" or "engaging" enough. This need for "realism" is particularly high in the case of organizational simulations like the *EIS Simulation* because participants do not "play against one another" as in simulations recreating competitive situations. They "play against" an organization, which overall happens to be only moderately supportive of their efforts. The "realistic appeal" of the simulation is hence a first enabling factor.

Aside from the simulation's objective limitations, we have also seen participants disconnect from the simulation *to insulate/distance themselves from their or their group's ineffectiveness* as change agents and/or as a work unit. As mentioned before, a humbling experience can act as a constructive impetus for learning ("I didn't succeed as well as I thought I would, therefore I have something to learn"). It can also become a reason for participants to distance themselves from the simulation ("I didn't succeed as well as I thought I would, therefore something must be wrong with this simulation. It does not resemble my past experience, therefore it is not realistic"). We have learned, the hard way!, that despite the power of the simulation, the instructor has a crucial role to play to help participants handle the frustration and treat it as an impetus for learning rather than a reason to disconnect.

The "realism" of the simulation

The main limitation of the current version of the simulation is the unilateral nature of the tactics available, which shows both at the macro and micro levels. At the macro level, the task given to the change agents falls within the bounds of single-loop learning [Argyris & Schön 1978]. That is, the change agent is asked to implement an EIS and has no latitude to question whether implementing this EIS now is the most appropriate solution. Similarly, none of the tactics really allow the simulated change recipients to have an impact on the project. They can be "involved" in terms of being communicated to, being met with, being asked for help; they can even take part in meetings and influence their colleagues' attitude toward the change process, but they cannot be *really* involved, as in "jointly influencing the diagnosis of the organizational problem or the design and implementation of the solution".

At a more micro level, the change agent has no impact on the quality of the tactic's *delivery*. A meeting can be requested and will or will not be awarded, regardless of the way the change agent requests it. The impact of meetings is also not a function of the communication skills and attitude of the change agent.

Although non trivial, these limitations have so far not been a major handicap in practical use of the simulation. Participants increasingly point out the unilateral setting of their mission, but they typically do so during the final debriefing rather than the introduction. We are currently addressing this issue by presenting the single- vs. double-loop distinction and positioning their mission as a single-loop strategy. We also present the notion of Informational Limit Setting (ILS) [Deci & Ryan 1985] to illustrate how "involvement by change recipients" is not an either-or affair. The introduction of an EIS might not be open to debate, but other dimensions might be such as the shape of the system, its breadth of coverage, and/or the timing of its implementation.

Within a single-loop learning context, much effort has been invested to increase the "realistic appeal" of the *EIS Simulation*. It remains a simulation, of course. People do not pop out of the screen, you cannot visit them or talk to them personally! But, like real people, they have a face, a background, a position in professional and social networks, and formal as well as informal power. They can be available at the office, they also sometimes go on trips or on vacations. They can help you or try to slow you down, depending on several factors including the way the change agent approaches them.

In addition to the complex characterization of change recipients, the simulation studies the history of tactics used by the change agents to detect and prevent "inadequate choices". The tactic chosen can be inadequate because it was not preceded by the required steps (e.g. meeting someone before obtaining some background on the person) or because it reflects either an irrational choice (something no one would ever do in practice) or an attempt by participants to "game the system" (e.g. by repeating the same tactic too many times). The realistic touch includes the content of the feedback given by the system (e.g. "Come on! You cannot call for such a meeting every week. People are too busy!").

All these dimensions have *observable effects* in the feedback provided by the simulation. Aside from the actual "realistic touches" this complex architecture conveys to the simulation, it also reflects a lot of work from the designers, which seems to have signaling value for participants ("it is clear that a lot of work has gone into it; (therefore) it is a serious learning tool").

The role of the instructor

Over the last two years we have found participant reaction to be more a class-wide phenomenon than an individual or even a group one. That is, the module tended to work well with the whole class or to work less well with a significant portion of the class, which suggested that participant reaction was heavily shaped by common events. Of the two common events - the introduction to the simulation and the debriefing session, we believe the introduction component is particularly crucial because it influences participants' attitudes toward the simulation and during run time. In particular, we have found that a competent introduction can significantly improve participants' ability to handle the frustration they may experience as members of a team and/or as change agents.

Specifically, we make sure that our introduction emphasizes the following:

- Introduction on managing change and how difficult it is. Inviting participants to describe past experiences.
- Positioning of the role play with statements such as "For the next three hours you are consultants operating into an organization in which you don't know anybody, and nobody knows you, yet". Experienced managers immediately understand that this means trouble.

- We emphasize that while this is a simulation, past participants have found it to be remarkably "life-like". We reinforce this link with reality when introducing the time constraint ("In real life you have deadlines, so do we"), the need to start with some form of strategy ("What's the first thing you would do in "real life"?") and when dealing with the question "can we 'lose points' during the simulation?" ("Well, what happens in practice? Do people always go forward in the adoption process?", "No, they sometimes regress", "Well, same here!").
- Through leading questions, we emphasize that the simulated company is not a "typical organization" (There is no such thing as a "typical organization". Each organization is different, with its own culture, its own communication methods and patterns, etc.).
- Finally, we remind participants that after the "run time" they will spend some time reflecting on their experience with the simulation, both in terms of change management and in terms of their group functioning. This instruction helps participants to remain connected when they experience group dynamics problems.

When the introduction is performed well, the simulation tends to go very well, which means that participants typically return to class in humbled but positive spirit, and with many learning points to share with other groups. The management of the class can then resemble a relatively standard "case discussion" class, with one exception: participants have worked very hard for three hours, emotions have run high, and participants' competitive drive can quickly kick in as they compare the various groups' results. Some groups become proud of their achievement (e.g. the group that "did very well with 14 adopters"), others are embarrassed (e.g. the group that fell prey to "paralysis by analysis" and only completed three months of simulated time). It is important for the instructor to emphasize that the simulation is not a certified test of the group's change management skills; it is a pedagogical device designed to initiate and support a learning process.

4.3 Next steps

The preceding sections present what we have learned and done up until now. We are currently pushing forward on two different levels: (a) improving the *design* of the *EIS Simulation*, and (b) enhancing the effectiveness and efficiency of its *delivery* .

As mentioned above, the unilateral nature of the mission and tactics proposed by the simulation has so far not been a cause of reject or disconnect on the part of participants. Still, it is a limitation that restricts the range of effectiveness of the simulation. Allowing more interactive communication between change agents and simulated change recipients would involve the integration of "dialogue simulators" (see [Cruz et al. 1991]) associated with some interactive evaluation of learner's conversational effectiveness. We have conducted preliminary investigations in this direction.

In terms of delivery, the one area that we have not yet been able to build on is the "here-and-now" change agent behavior dimension. We do regularly comment on the issue of frustration and/or panic in the change team, but this remains a macro (team level) comment as opposed to an entry into the individual (team member) mind set. Exploiting the three hours or so of "behavior under pressure" would clearly require more time than the usual 4.5 hour module. It would also require additional physical and human resources (e.g., taping equipment and facilitators).

We also need to examine the impact of going through the simulation a second time after the class debriefing. Although many participants request it, we have tended to resist on the argument that the objective of the exercise is to stimulate a thinking process rather than learn to "beat the system". Still, going through the simulation a second time might help participants "internalize" the lessons they just discussed by giving them the opportunity to "refreeze" their learning.

5. Current research related to the *EIS Simulation*

The quantitative feedback we have collected so far has typically focused on the module rather than the simulation itself. As a result the ratings include both perception of the simulation and instructor feedback, which makes it difficult to make strong inferences on the simulation itself. The simulation-specific feedback has been until now of qualitative nature. We are developing an extensive quantitative feedback format on the simulation, its delivery and a variety of participant related indicators (e.g. participant motivation level, satisfaction with, and appreciation of, the learning experience, etc.).

Our objective is to examine systematically the association between participant-related indicators and various measures of the team's performance such as the number of adopters (task specific performance), participant- and instructor-ratings of the quality of each group's team work (during "run time") and of each team's debriefing module, and participant ratings of perceived effectiveness of the introduction and class debriefing modules.

We also intend to study more systematically the impact of going through the simulation in an individual vs. a group setting. That is, do individuals outperform teams? We know that individuals take less time than teams to go through the six months of simulated time, we do not know whether they get more or less adopters, nor how (run) time constraints influence the average number of adopters (e.g. groups get less adopters than individuals over two hours of run time, the same average number over 2.5 hours and more adopters over 3.0 hours). Beyond task-specific performance, we also want to try to assess the amount of learning that goes on. For example, individuals might proceed faster and get more adopters (given short periods of "real time") but "learn less" from the experience than teams do.

This study will of course require identifying a satisfactory (set of) measure(s) of learning. One possibility we are currently considering is to use a measure based on progress between a first and second run of the simulation. We also plan to extend this analysis of individual vs. team performance, with "performance" understood widely to include both task performance and learning from the experience, to compare several types of teams varying in terms of size, mono- vs. multi-cultural, as well as existing vs. new teams.

6. Conclusions

Through the discussion of the main characteristics of the *EIS Simulation*, this paper illustrates an innovative approach to the design of instructional simulations in the domain of organizational dynamics, and describes the pedagogical impact of this type of advanced learning technologies. A number of research projects based on the material described in this paper are currently underway at the Centre for Advanced Learning Technologies (CALT) in collaboration with an international group of business schools and research centers. The research agenda includes (1) analyzing the extent to which the inclusion of further multimedia components has a measurable impact on the quality of the learning process, (2) extending current knowledge on change management processes through the collection of detailed usage data automatically captured by the monitoring mechanism included in the *EIS Simulation*, (3) extending and adapting the knowledge base included in the current version of the simulation to specific contexts and change processes (e.g. the challenge of introducing total quality programs in hospital environments), and (4) validating the design approach described in this paper through the development of other instructional simulations in the domain of organizational dynamics.

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