

INDIVIDUAL AND ORGANIZATIONAL CREATIVITY

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Introduction

“As they reached the mountain-side, a wondrous portal opened wide...”

(Browning, 1888: lines 226-227)

Where does innovation end and where do we begin? Innovation is a complicated and continuing process that demands individual and organizational creativity. To find refreshing authentic originals we need to rediscover purpose, meaning and identity. As individuals, our ability to communicate ‘the potentially creative’ fuels the organization’s innovative capacity. This paper investigates the set of mechanisms that organizations have the *option* to provide and that individuals and users can *choose* to utilize in order to enrich creativity during the design and development process. The establishment of experimentation, internal communications and learning are a reflection of individual and organizational creativity.

There are sets of mechanisms that provide organizations with the options to enrich their creative journey to the mountainside. Organizational creativity is hand in hand with organizational learning -- processes in which an organization makes use of information from past events to better adapt to future events. The establishment of feedback loops and product testing are mechanisms to generate organizational learning. It is common today to view organizations as ‘open systems’ that take inputs (money, people, raw materials) from the external environment, transform them through the interaction of people, process and technology into outputs (products). The receptivity of the external environment to these outputs is monitored through the organization's interactions with its customers and clients (users). In systems terms, these monitoring processes are called feedback loops. The aim of this paper is to examine how the design and development process are influenced by feedback loops when users are involved in the configuration of the product. Individual and organizational creative capacity will increase as a robustness and scope for redesign increases.

Imparting Knowledge

Creativity fills one gaping hole: our need to communicate and to create new ideas and new knowledge. The term *knowledge* is used here in its broadest sense, to encompass what we call knowledge, expertise, skills and information (Faulkner, 1994: 426). However, my main concern in this article is narrowly focused, on the cognitive features of knowledge generated by creative processes. This knowledge is intimately related to questions of who has particular knowledge and how easily it is to make use of this knowledge in an organization laden with instantaneous demand and response times. Are individuals defined by their knowledge rather than how they apply it? Are we finding a new pace, time, space and depth to how we innovate?

Individual Creativity

As old products are replaced by new, creativity is the identifying factor changing the way we do things. Creativity drives entrepreneurship at all levels anticipating profits through early product innovation. Whether radical or incremental innovation, creative dynamism at the individual level has a cumulative effect on the innovation process.

A pervasive image of innovation casts a scenario centering on the individual innovator. Indeed, as authors Cameron Ford and Dennis Gioia, emphasize in their book of collected essays, *Creative Action in Organizations* (1995) those searching for the fountain of creativity have traditionally focused on the solitary inventor. A single person-centered view has outlived its usefulness. Even the most legendary inventor, such as Thomas Edison, is often a team in disguise (Kelley, 2001). The idea of a lone genius distracts us from the more useful focus on the higher potential source of creativity: the organization as a collective of creative people working as a team. To promote organizational creativity among individuals attempt to remove barriers and obstacles that hinder creativity and denote the lone inventor as a myth.

The Creative Organization

It is helpful to describe creative organizations as complex, social, political and technical systems. In order to identify creative outlets and implementation a set of mechanisms, the leadership in organizations must have the skills to appreciate knowledge at the individual, team and organization levels simultaneously. The creative organization balances the integration of two central offerings: autonomy for entrepreneurship and individual creativity. Organizational creativity is linked to a risky balance between complexity, compromise and choices. The creative organization needs to be flexible while controlling entrepreneurial risk, but provide the freedom to search for new knowledge through learning and experimentation. The original output will be the outcome of internal processes of communication. The need to be a flexible organization rings true in that 'good practices' will promote creativity; 'best practices' may discourage them for optimum arrangements may change as circumstances change.

Organizational requirements for innovation include: creativity, experimentation, internal communications and learning. It will be shown that the formation of close feedback loops between designers, developers and users can contribute significantly to the identification of new ideas and the discovery of new concerns from experimentation. As well as designers and developers, non-specialist actors such as users and intermediaries play an active role in providing knowledge to increase creativity by fitting products to their purposes and imparting significance. The product is considered 'unfinished', evolving and acquiring its meanings in its implementation and use (Williams, Slack and Stewart, 2000). Effective communication must occur within the organization throughout the innovation process including the findings of product and service testing through to post-deployment. The imparting of knowledge between the creative organization, individual employees and users, the differing cultures and creative orientations, influences the product design and success. Problems at functional interfaces, such as interfaces between marketing and design are identified and perhaps new foundations for best practices are organized.

Trends and New Opportunities

Several trends form an important basis of understanding. The first trend is the emergence of information and communications technology, which affords a seemingly unlimited opportunity to share content with connected persons on a local and global scale at the individual and organizational levels. For example, the Internet gives way to new forms of networked organizational learning, at any time, at any place, and in a manner of one's choosing (Lieshout, Egyedi and Bijker 2001: 3). In this context, a rigid, monolithic identity of the creative organization is impossible. John puts forward the 'zig zag identity', an organizational profile hallmarked by values and principles that guide creativity along pathways that balance the corporate message with individual expression (1996). The success of a design process is dependent upon the collaboration and tools between the designers, developers, users and organization as a whole.

In the last ten years new change methodologies sometimes described as 'everyone improves whole systems' have been evolving from theory to successful practice (Weisbord, 1992). These large-scale meeting formats show how internal communications enable all levels in the organization to simultaneously create future visions and implementation strategies. Buy-in, commitment to ownership of a change effort is gained as a natural by-product of involving people in the process of change. The ability to change at the individual and organizational level is essential to thrive in a world that is continually changing.

An exploratory period of designing, using and assessing products has emerged. The importance of design and development is reflected in the proliferation of prototype to market testing experiments. Beta testing, pilots, feasibility studies and trials provide mechanisms to resolve uncertainty and differences surrounding the development of new products. The importance of pre-release tests and experiments, and the knowledge they produce has often been overlooked. For example, in creating new educational information and communication technologies (ICT) there is an increase in collaboration among diverse players such as, suppliers of ICT and complementary products, content specialists and users (Williams, Slack and Stewart, 2000). Certain actors play a key role in maintaining such collaboration and knowledge flows. This often involves a company establishing creative individuals known as intermediaries. In seeking to balance the competing interests of diverse players, an intermediary has the effect of facilitating existing relationships and imparting information from users to designers. This confirms a creative role for individuals such as intermediaries in the organization to translate new information and new ideas from exploratory design assessment.

Design is an essential ingredient to the success or failure of educational ICT. To develop an online interaction, a designer and developer anticipate the users' learning goals, methods and motivations, and scripts features and functionalities accordingly. The product is pre-structured at the onset of development by the designer's configuration and representation of the user. At the origin of the technology, at the very moment of the invention, the designer may refer to their alter-ego - the user - through the representative and constitutive process of their own creative thinking. This first phase of the life-cycle of a technology is often considered an 'era of the reflexive user' (Bardini and Horvarth, 1995). During this early development phase specific uses

are preconceived. For example, by articulating user requirements scripts are created that promote certain user behavior as the designer embeds norms and values, knowledge and experiences into the design.

Designers face a dilemma of design: making a customized and personalized design implies a myriad of possible design strategies and solutions. Making one design implies losing sight of the heterogeneously-constituted user (Lieshout, 1999). User design configuration and representation of the user is very complex. User configuration derives from the product design, its context of use (localized design), and the communicative practices that develop around the product's utility. The design strategies and solutions of an educational ICT may materialize in a technological or social design or they may represent constraints on the user. Nonetheless, the design configuration will either invite or dispel user conflict.

Resolving conflict or dilemmas of design based on the configured user is vital for the success and uptake of the product. Differentiation between users is necessary in order to make products useful. This implies that designers must be aware of user profiles and behaviour. This also presupposes knowledge of distinct users. But users do not always behave in ways expected by designers. They sometimes do not interpret the product in terms of designer considerations. For example, users interpret a product in its unique context of use (Andriessen, 1996). The context of use consists of the task they want to use it for, the location of use, the instructions they receive, and the available technical support. Tineke Egyedi interprets the context of the user as the user's attitude towards the product and his or her aptitude and, experience with comparable tasks (2001: 229). These factors affect the user's interpretation and therefore bias his or her use of it. This reinforces the dilemma of design and envisages user conflict with the developer's script.

In some cases, the interaction between computers and users, an activity called interaction design, is appropriately designed and developed (Hewett, 1986). The emphasis in interaction design is on the creation of compelling experiences. Interaction design is at once both an ancient art and a new technology, for media have always affected the creation of experiences, but currently new media offer capabilities and opportunities not yet addressed in the history of interaction and performance. How these skills are expressed through interactive technologies and what demands and interests audiences remains to be somewhat misunderstood. Consequently, there are few sources of information about these issues and the techniques used to meet them. This is new territory that is desperate for creative ideas and cogent explanations (Shedroff, 1999). Individual and organizational creativity are critical components to the success of interactive products and the imparting of new information and ideas from the increasingly wider gamut of product feedback.

The User as a Creative Outlet

Design covers a wide range of activities. All of them involve the creative visualization of concepts, plans and ideas, and the production sketches, models and other representations of those ideas, aimed at providing the instructions for making something that did not exist before. (OECD, 1982: 14). Design therefore, is the activity in which ideas and needs are given physical form, initially as solution concepts and then as a specific configuration or arrangement of

elements, materials and components. Thus, 'design' is the very core of innovation, the moment when a new object is imagined, devised and shaped in prototype form (OECD, 1982).

The success of a redesign process is dependent upon creativity, collaboration and decision routines between the designers, developers and individual users of the product. The inherent organizational creativity is stimulated and boosted by adding to it: other people, other things, new, stimulating nutrients. The user is stimuli to escape from accustomed conceptualizations of the products and the more unrelated the feedback from the user is to the product at hand, the more likely it will provide original solutions. Walsh *et al.* describe three ways in which the direct involvement of the user can enhance iterative product design and development process (1992: 188):

- Provide invaluable market know-how to convert an idea into a commercially viable product and give guidance on the best performance/price blend;
- Provide an 'opinion leader' to endorse the design in the market place, so enhancing the success of the product.
- Result in a flow of user-initiated improvements to the original design;

An organization involving users and practicing iterative design and development without a genuine willingness to follow through is going to generate more cynicism than positive ideas. This attitude to design is experience and observed in the day-to-day activities, which culminate in new products and processes. Any organization mimicking prototyping practices but unprepared to make an honest and sincere commitment to test those prototypes risks an entrepreneurial backlash (Schrage, 2001: 150). The treatment of user involvement and post-test evaluation is vital to enhance the product development process and harness creative input from the users.

Key Individuals within the Organization

Pragmatic methods are needed to capture user feedback and translate it into clear user requirements. Formal confirmation of user requirements and how to learn, clarify and confirm user requirements is a creative process. The intermediaries play a multifaceted role in the development and deployment of the product. They are the primary conduits of solicited and unsolicited feedback from the user to the designers and the organization.

Not only do intermediaries identify user requirements from direct observation and implementation of the product, they express product facilitation requirements. They open communication between users, designers and developers. Poor communication between users and developers is a barrier to the user's influence on the design and development process. The intermediary is a crucial actor in overcoming such barriers since this role bridges the product, ensuing technology, social disciplines and ultimately the organization's contact with the user. The intermediary's skill-set and ability to interpret dual perspectives is fundamental as their role as a deployment and development intermediary. This is particularly apparent in beta tests where it is clear that their role as conduits of knowledge is critical to mobilize the user's knowledge and include user feedback. What is crucial to this intermediation role then is this ability to cross

different spaces – between different research and development units, and between the developers as technical specialists and users as non-specialist actors.

The Learning Organization

In order to identify new opportunities and translate new knowledge, both within the organization and in the external environment exploratory learning should be supported. Individual learners actively seek out new insights by scanning, analyzing and continually adjusting their direction of inquiry. The individual will change the organization in that enthusiastic curiosity and a flexible mind will likely use alternative methods and apply lessons learned. The organizational learning literature hails the benefits of experimentation, both in day-to-day activities and in product or organizational life. The ‘organization as brain’ (Morgan, 1997) is seen as a complex system capable of continual learning and innovation. The ability to process information from various mechanisms such as beta testing is a process that takes place at the individual, team and organizational levels. The advantage of attempting to create organizations consistent with the learning organization metaphor is simple: many more minds contribute knowledge and creativity thus spurring innovation and continual improvement (CCMD, 2001: 19).

Communication

Effective communication must occur between organizational units, throughout the process including the findings of market testing and product testing through to deployment. At every stage of the overall product development process there are bugs, problems to be solved and new information required, which produces feedback loops. Effective feedback loops between developers and users, facilitated by management and intermediaries can contribute significantly to the identification of better applications, services and the discovery of creative invention.

Interactions among groups within the organization, cultures and orientations, all influence the product design. Throughout the development process open and effective communication between marketing and design is required (Hopkins, 1981). Not only do designers need to know about the product, the target market and the price they also need detailed knowledge of the characteristics of the consumer and to be regularly updated on any changes in their requirements (Dace, 1989). After experimentation, a well-structured marketing unit communicates the product information from solicited and unsolicited feedback to the rest of the development team. Whether by intermediaries or marketers, great care is needed in collecting, translating and applying the findings of testing.

A research associate at MIT's Media Lab and the author of *Shared Minds*, an inquiry into the nature of collaboration, Schrage took his studies a step farther to produce his 2000 book, *Serious Play*. This article talks about the shared spaces in which collaboration takes place. By shared spaces, Schrage means the objects and artifacts - the prototypes – that people play with to transform their ideas from notions to innovations. Why is this important to designers? Because, as Schrage points out, media and tools for modeling and prototyping are fundamentally changing and these changes are accelerating (Schrage, 2000). Things that couldn't be modeled five years ago can now be prototyped or simulated fast and cheaply. Organizations that want to manage their innovation skills most effectively will pay attention to the quality of communication, new

space and depth to how they innovate through beta versions, prototypes or simulations. The creative organization used models or prototypes to gain insight and understanding into how people are going to behave, discover new knowledge on the intended use, and how did it was actually used. This is the knowledge, the understanding that designers can gain and open the scope for redesign.

Concrete examples exist denoting opportunities gained and opportunities missed by paying attention to user feedback and testing result, or not paying attention, to the use of beta tests, such as Microsoft's successful use of beta versions in the launch of its Windows 95 software. They lured the customer, the user, into co-designing the product with them. Prototypes are increasing currency in digital form. Tomorrow's design management challenge will model and prototype the prototyping process. Eventually, the most creative companies will be the ones that best manage that process.

Analysis of the User

The user is involved in the process of accommodation, resistance to, and regulation of the design and development process over a period of time. The use and nature of the product include very complex conceptualizations. Patterns of usage, the identity of the user, the hidden and apparent activity processes are all embedded within the design and development process (Haddon, 1994: 94). To take this argument one step further, users undergo constant learning processes when engaged with products. Gershuny articulates that social innovation occurs as user's influence extends beyond that of merely altering given products to finding new uses appropriating new meaning to the product (Gershuny, 1983).

Prototype testing can result in a flow of user-initiated improvements to the product design or service. The doctoral thesis of Reva Shapiro provides an account of the user which is entrenched in a symbolic/ interactionist 'social construction of reality' tradition (Shapiro, 1998). She examines the process of becoming a computer user, or learning values, rules and perspectives. She also devotes time to challenging the limited role given to users in the innovation process, reflecting upon the role of users in 're-inventing' or modifying industry products (Shapiro, 1988: 21-6).

The user has ways of seeing that are not apparent to designers and marketers (Kohler and Rath, 1984). Therefore individuals at the organization need to be prepared and open to new ideas and new knowledge coming from the user. Translating the user's experience and feedback into technically useful information requires creativity and ingenuity. Walsh *et al.* found that firms with high profit growth were significantly more likely to subject prototypes to direct customer and user feedback than those that relied just on intuition or simple, indirect methods (1992: 218). It is clear that time and cost of user feedback correlates with higher turnover and profit growth. In addition, the way in which product development is organized and how systematically the firm responds to user feedback is crucial for the success of the product. Market and design testing take precious time that is often weighed against design improvements and the potential for new applications.

It is important to obtain concurrence from all actors, negotiate the meaning of the system, then refine it, and obtain concurrence yet again. By analyzing the users' interpretation of the product, designers and developers can estimate the proximity to system utility. But, the accuracy of utility estimates is dependent on the intermediary's ability to creatively translate feedback from the user. It is also recognized that beta testing results related to technical functionality often receive priority. When gathering feedback methods of data gathering must be conducive to provide comparative analysis and measurable change. Products are clearly 'unfinished', evolving and acquiring meaning from pre-release beta tests, implementation and from intermediaries creatively channeling the user's feedback into the developmental cycle.

Each iteration produces a richer, more complex and more authentic learning system. Communication between users, facilitators, designers and developers is a key factor to improve design. The iterations imply a sharing of competencies between the users, intermediary, designers, developers and the organization as a whole. It is clearly recognized that the intermediary is a conduit of information from the user to the developers during the entire development cycle. However it is recognized that the inclusion of their feedback is a selective and creative communication process. It is also recognized that the *translation* of their feedback by the intermediary has an impact on the product throughout the design and development process.

The concept of 'the user' is a widely used device to help decide and solve difficult design decisions (Bardini, 1995; Woolgar, 1991). Constructing a notion of 'the user' is both part of design, and a resource to be used for design decisions. During the early stages of product innovation, developers construct a notion of the eventual user, the construction of a 'typical user' and their requirements. This is an essential device (Garfinkel, 1967) in making design decisions. In design literature this imaginary user is both a topic of controversy and a resource. Arguments can take place over the typical user's level of technical skill, or what they want to do with the product. Those involved in development claim the right to speak for the user, and to describe his or her situation. The notion of 'the user' is used as a creative resource - particular designs configurations are evaluated in terms of how well they fit the real user. The imaginary user is thus a concept which is demanding creativity and continually contested and developing in any design discussion.

Although strong reservations about the 'typical user' are established, one should not transfer these reservations to its creative use. As Lynch and other ethnomethodologists argue (Lynch, 1991; Lynch, 1992; Lynch, 1993; Sharrock and Anderson, 1986), one should not seek to 'ironicize' actual practice with sociological critique. While the concept of 'the user' may be ontologically inappropriate, its appropriateness must be decided by its ability to address the need for creativity and problems demanding creative solutions. 'Who the user is' and 'what they want' can be opened up and contested, without becoming unmanageable.

Conclusions and Recommendations

It is said that Newton got the idea of gravity when he was hit on the head with an apple while sitting under an apple tree. It is not necessary to sit under trees and wait for an apple to fall - get up and shake the tree and eat the apple on the way to the mountainside. The users provide solicited and unsolicited feedback to be processed and translated into technically useful design information throughout the innovation process. Response to the feedback depends upon organizational creativity and perception of user involvement in the innovation process. Organizations *can* produce their own chance events.

How to make creativity part of the ongoing life of a company is elusive. Organizations investing in learning should consider actively investing in ways their organizations learn to utilize creativity, ideas and seize opportunity. A few simple questions about how individual and organizational creativity can be addressed remain: What creative value does the organization bring to its employees and product users? What makes the employees and product users satisfied with their experience with an organization or product? What is being done to drive individual and organizational creative capacity? Can you meet or exceed the commitment to individual and organizational creativity? What mechanisms are in place to meet these expectations?

Few companies are likely satisfied with the answers to the above set of questions. Authors distill elements and methods that contribute to identifying and refining strong organizational creativity concepts. They analyze the organizational structures and management that support creativity. As I have done, several explore the link between users and new-product ideas. Prototype development and testing by designers, developers and users for evaluating usability and acceptability is one detailed mechanism to make creativity part of the ongoing life of an organization. Close feedback loops between developers and users, facilitated by management can contribute significantly to the identification creative competencies and the discovery of new concerns and creative intervention by intermediaries and users.

To promote organizational creativity among individuals remove barriers and obstacles that hinder creativity and denote the lone inventor as a myth. This paper illustrated important lessons and practices:

- have an unfinished vision of the user and use
- be willing to prototype
- have a well-established internal feedback process between organizational units
- the product must be developed iteratively, with design changes and feedback cycles
- have cohesive efforts in design, engineering and marketing
- continue iterative development in the lifecycle of each product to develop a wider product line.

Weaknesses emerge following prototype design or service deployment. Recognition of post-test or post-deployment improvements based upon user feedback is vital to create design solutions. Individual creativity is required during the post-testing or post-deployment stages to meet the

weaknesses. Based upon individual employee's responses, this information may open up new applications or services. Walsh *et al.* found that firms with high profit growth were significantly more likely to subject prototypes to direct customers and user feedback than those the relied on intuition or indirect methods (1992: 218). Nonetheless, at every stage of the overall product development and deployment process there are bugs and problems to be solved and new information is required, which produces feedback loops to insert creative solutions.

Effective communication must occur throughout the innovation process including the findings of product and service testing through to post-deployment. Interaction between the creative organization, individual and user, their cultures and varying skill orientations, influence the product design. Only through effective communication can problems at functional interfaces be identified and perhaps new foundations for best practices are organized.

The future uses and utility of a new application may not at first be self-evident. This is because of the difficulty of anticipating the outcome of the expected uses -- users do not behave in ways expected by the designers and developers. This dilemma of design can be confronted by gathering feedback from the user and then incrementally matching an authentic design. Acknowledge the importance of presumptions, however, address subsequent mismatching of user needs and the need for user participation.

Users in their efforts to apply and use the product become actors in the design process. It was shown that users directly contribute to the reconfiguration of the product and provide the knowledge and creative resources for future technologies. This social shaping influence depended upon the existence of channels for the user to relay feedback and experiences to the supplier. In this light, the product emerged through an iterative design and development process involving various kinds of feedback and new knowledge *from* the implementation and appropriation of products *to* product design and development. The interaction between designers and users has been placed within a social shaping framework, drawing upon the social shaping of technology perspective (Williams and Edge, 1996). A understanding has been established of the user as a source of novel information and ways in which products are shaped by the users via user centered design processes.

The challenge remains how to integrate creative output with strategic objectives and the realities of day-to-day business. Contributors to the volume of knowledge at an organization share insights on building these connections and nurturing a creative organizational culture. Individual and organizational creativity has been illustrated through organizational learning, creation of feedback loops and experimentation through prototype deployment. It was shown that users should be not only involved in, but an integral part of, design and development.

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References

- Andriessen, J.H.E. 1996. "The why, how, and what to evaluate of interaction technology: a review and proposed integration". P.J. Thomas, ed. *CSCW Requirements and Evaluation*, London: Springer Verlag. pp.107-124
- Bardini, T. and Horvarth, A.T. 1995 "The social construction of the personal computer user: The rise and fall of the reflexive user". *Journal of Communication*, (45)3: 40-65
- Canadian Centre For Management Development (CCMD). 2001. *Building trust: A foundation of risk management*. Action-Research Roundtable on Risk Management. Ottawa: Canadian Centre for Management Development
- Dace, R. 1989. "Japanese new product development". *Quarterly Review of Marketing*. (14)2: 4-13
- Browning, R. 1888. "The Pied Piper of Hamelin". Electronic version prepared by Jian Liu 1998, Indiana University Libraries: Reference Department
<http://www.netten.net/~bmassey/PiedPiper.html>
- Egydei, T.M. 2001. "Diversified Hypermedia Use: An Experiment with Dis-closure" M. Lieshout, T.M. Egyedi and Bijker, W.E. eds. 2001 *Social Learning Technologies: The introduction of multimedia in education*. Hampshire, Eng.: Ashgate Publishing Limited. pp. 226-250
- Faulkner, W. 1994. "Conceptualizing Knowledge Used in Innovation: A Second Look at the Science-Technology Distinction and Industrial Innovation". *Science, Technology & Human Values*, (19)4: 425-458
- Ford, C. and Gioia, D. 1995. *Creative Action in Organizations*. California, C.A.: Sage Publications
- Garfinkel, H. 1967. *Studies in Ethnomethodology*. New Jersey: Prentice Hall
- Gershuny, J. 1983. *Social Innovation and the Division of Labour*. Oxford: Oxford University Press
- Haddon, L. 1992. "Explaining IT Consumption: The case of the home computer". Silverstone R. and Hirsh, E. *Consuming Technologies: Media and Information in Domestic spaces*. London: Routledge. pp. 82-96
- Hewett, T. T. 1986. "The role of iterative evaluation in designing systems for usability". Harrison, M.D. and Monk, A.F. eds. *People and Computers: Designing for Usability*. Cambridge: Cambridge University Press. pp. 196-214
- Hopkins, D.S. 1981. "New product winners and losers". *Research Management*. (24)3: 12-17

- Kelley, T. and Littman, J. 2001. *The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm*. New York: Doubleday
- Lieshout, M., Egyedi, T.M. and Bijker, W.E. eds. 2001. *Social Learning Technologies: The introduction of multimedia in education*. Hampshire, Eng.: Ashgate Publishing Limited
- Lieshout, M. 1999. "The digital city of Amsterdam: between public domain and private enterprise" B. van Bastelaer and C. Lobet-Maris eds. *Social Learning regarding Multimedia Developments at a Local Level: The Case of Digital Cities*. Namur: University of Namur. pp. 101-149
- Lynch, M. 1993. *Scientific practice and ordinary action: Ethnomethodology and social studies of science*. Cambridge, Eng.: Cambridge University Press
- Lynch, M. 1992. "Extending Wittgenstein: The Pivotal Move from Epistemology to the Sociology of Science". A. Pickering ed. *Science as practice and culture*. Chicago: University of Chicago Press. pp. 215-265
- Lynch, M. 1991. "Method: measurement- ordinary and scientific measurement as ethnomethodological phenomena". G. Button ed. *Ethnomethodology and the Human Sciences*. Cambridge, Eng.: Cambridge University Press
- Morgan, G. 1997. *Images of organization*. Thousand Oaks, C.A.: Sage Publications
- OECD. 1982. *Innovation in Small and Medium Firms*. Paris: Organisation for Economic Cooperation and Development
- Shapiro, R. 1998. "Analytical portraits of home computer users: the negotiation of innovation" *Ph. D. thesis*. California: C.A.: University of California
- Sharrock, W. and Anderson, R. 1986. *The Ethnomethodologists*. London: Tavistock.
- Shedroff, N. 1999. "Information Interaction Design: A Unified Field Theory of Design". Jacobson, B. ed. *Information Design*. Cambridge, M.A.: MIT Press. Chap. 3. pp. 87-112
- Schrage, M. 2000. "Serious Play: The Future of Prototyping and Prototyping the Future". *Design Management Journal*. <http://www.designmgt.org/dmi/html/publications/journal/> :(11)3 (Summer)
- Walsh, Vivian, Robin Roy, Margaret Bruce, and Stephen Potter. 1992. *Winning By Design*. Oxford: Blackwell Publishers
- Waters, J. 1996. "Chaos or Chorus". *Design Management Journal*. http://www.designmgt.org/dmi/html/publications/journal/journal_d.jsp : (7)1 (Winter)

Weisbord, M. 1992. *Discovering Common Ground: How FUTURE SEARCH CONFERENCES Bring People Together to Achieve Breakthrough Innovation. Empowerment, Shared Vision, and Collaborative Action.* San Francisco: Berrett-Koehler Publishers

Williams, R., Slack, R., and Stewart, J. 2000. *Social Learning in Multimedia: Final Report.* EC Targeted Socio-Economic Research Project: 4141 PL 951003. Edinburgh, Scot.: Research Centre for Social Sciences, The University of Edinburgh

Williams, R., and Edge, D. 1996. "The social shaping of technology". *Research Policy*. (25)6: 865-901

Woolgar, S. 1991. "Configuring the user – the case of usability trials". J. Law ed. *A Sociology of monsters – Essays on power, technology, and domination.* London, End.: Routledge and Keagan Paul. pp. 58-99