

HOW DESIGN REASONING PERSPECTIVES PROMOTES PROSPECTIVE ERGONOMICS WITHIN THE TEACHING OF STRATEGIC DESIGN

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ABSTRACT

The current debate in ergonomics centres on the innovation of future products and services. Inherently, this implies a shift from being customer to need oriented, paving the way for a more progressive type of ergonomics, namely “prospective ergonomics”. Prospective ergonomics is a sub-discipline of ergonomics, which shares a common ground with strategic design, through the anticipation of undiscovered needs of stakeholders with respect to imagining new products and services. The aim of this article is twofold. First it discusses the relationship between Prospective Ergonomics and strategic design from an overarching strategic management perspective (see figure 1). Hereby, relationships among strategic management, strategic design and prospective ergonomics will be elaborated using selected business, design and ergonomic frameworks and models. Secondly, it proposes and argues for certain design reasoning perspectives with respect to generic strategy perspectives

Results indicate that strategic design, is mostly aimed at profit making, whereas in prospective ergonomics a balance between performance / productivity on one hand and human well being on the other hand is sought after. Moreover, understanding the dynamics among strategy perspectives, modes of design reasoning, strategic design, and prospective ergonomic modes of thinking allows educators, practitioners and students to be more conscious about their design attitudes and the range of methods and tools they are able to use to target different types of value.

Keywords: Prospective ergonomics, generic strategies, design reasoning modes, strategic design.

1 INTRODUCTION

In the past 25 years, ergonomics did not gain much acceptance by business managers. According to the Administrative Science Quarterly, Perrow argued that the problem of ergonomics is that too few ergonomists work in companies [1]; that they have no control over budgets and people; and that they are seen solely as protectors of workers, rather than creators of products, systems and services.

Presently, the value of ergonomics extends beyond occupational health and safety and related legislation. While maintaining health and safety of consumers and workers, ergonomics has become more valuable in supporting company's business strategies to stay competitive. Given this context, debates in ergonomics centre on the innovation of future products and services. Inherently, this implies a shift from being customer to need oriented, where corrective and preventive ergonomic approaches are paving the way for a more progressive type of ergonomics, namely “prospective ergonomics”. Prospective ergonomics is a sub-discipline of ergonomics, which promote a broad and long-term approach towards anticipating undiscovered needs of stakeholders with respect to imagining new products and services [2]. With respect to methods and tool use, prospective ergonomics rely on numerous data collection methods from a wide variety of disciplines to investigate how human behaviour and needs may determine the development of future products and services [1]. These disciplines include ergonomics, psychology, sociology, management, economics, and engineering.

The aim of this article is twofold. First it discusses the relationship between Prospective Ergonomics and strategic design from an overarching strategic management perspective (see figure 1). Hereby, relationships among strategic management, strategic design and prospective ergonomics will be elaborated using selected business, design and ergonomic frameworks and models. Secondly, it proposes and argues for certain design reasoning perspectives with respect to generic strategy perspectives [4].

This has led to the formulation of the following research questions:

RQ1. What are the theoretical and conceptual differences and similarities between strategic design and prospective ergonomics?

RQ2. How do management strategy perspectives and schools of thought influence strategic design and prospective ergonomics?

RQ3. How do design reasoning and strategy perspectives promote prospective ergonomics within strategic design?

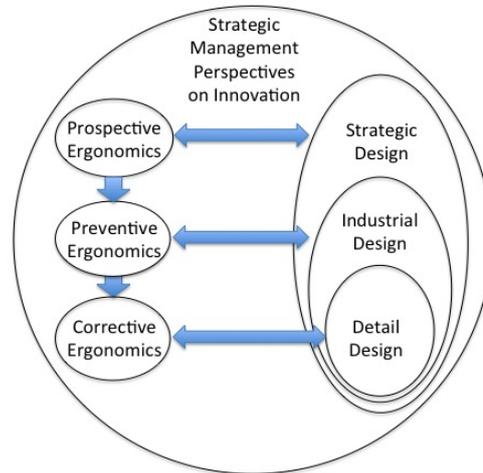


Figure 1. Alignment of ergonomic and design interventions at different levels of comprehension

2 ERGONOMIC INTERVENTIONS ON DIFFERENT STAGES OF THE DESIGN PROCESS

De Montmollin has categorized ergonomics into corrective ergonomics and preventive ergonomics [5]. The former is about correcting existing artefacts, and the latter deals with systems that do not exist yet in reality. Laurig associates “corrective ergonomics” with traditional ergonomics and describes it as developing “corrections through scientific studies” [6]. In this context, “developing corrections” refers to situations where the ergonomist or designer makes user functional improvement to existing products, systems or processes in a reactive manner; in other words “redesigning”.

Robert and Brangier have extended the focus of ergonomics by including prospecting and by mapping out the differences and similarities among corrective, preventive and prospective ergonomics [7]. Comparisons across the three subsets of interventions, which are interesting to be aligned to a similar comparison within design and strategic design later on, are:

- Nature of work and intervention with respect to temporality and expected outcomes
- Main focus and starting point for human factors activities
- Implications for research and data collection

Nelson et al. proposed to align the product development process with different ergonomic interventions, as shown in figure 2 [8]. Developed around speculative scenario building and use, prospective ergonomics is strongly compared with the Fuzzy-Front-End of Innovation, where future product and / or service proposals are sought after. From this prospective ergonomic perspective, scenarios are intended to assist decision-making at three main stages in the design process [9]: (a) the analysis of problem situations in the start of the process, (b) the generation of design solutions at various levels of complexity, and (c) the evaluation of these design decisions according to UCD criteria. In this context it can be argued that the purpose of scenarios in the early stages of design is not only to provide an accurate vision of future user activity, but also to crystallize designers’ current knowledge and assumptions about future activity. Thus, from this point of view, scenarios of future use in prospective ergonomics are not just a material for analysis, but also a product of creative design [10]

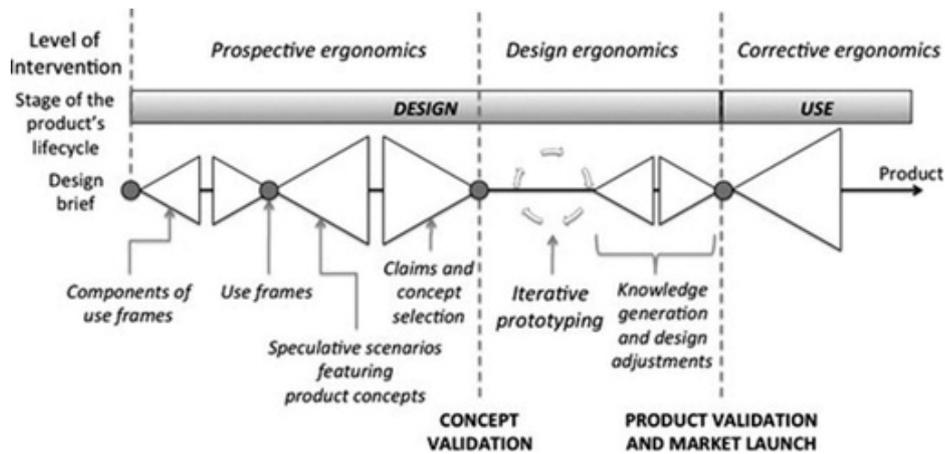


Figure 2. Alignment of the product development process with different ergonomic interventions (Adopted from Nelson, 2013, p. 9 [8])

3 GENERIC STRATEGY PERSPECTIVES

To provide decision makers with fundamentally different ways of thinking about strategy in a wide range of situations, four perspectives on strategy were mapped according to process and outcome (see figure 3) [4]. These perspectives, which are classical, evolutionary, processual, and systemic, have their roots from “Mintzberg’s 10 Schools of Thought about Strategy Formation” [11]. As a precursor to Whittington’s generic strategy perspectives, these schools were compared and positioned on a bipolar spectrum according to planned and emergent strategies [11].

When addressing the “outcomes” axis, “plural” dimension should be interpreted from a more nuanced perspective, considering both the short and the long term, as well as diverse ambitions of all stakeholders within and outside the organization, in contrast to the focused profit-maximizing aims of the organisation leadership. The “processes” axis illustrates a spectrum between deliberate and emergent ways of planning

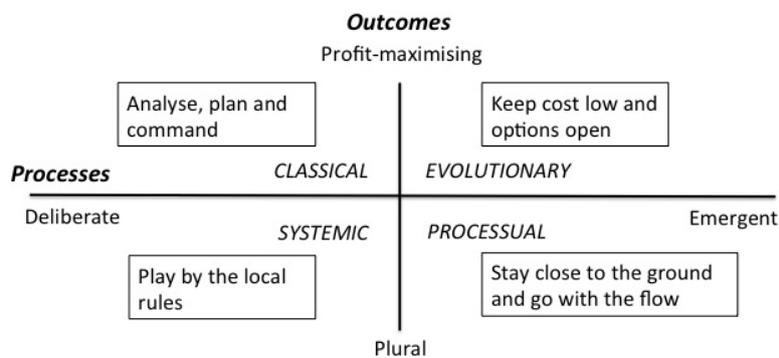


Figure 3. Overview of generic strategy perspectives.

In the classical approach, profit maximising is the highest goal of business and rational planning. This classical theory claims that if Returns-On-Investments (ROI) is not satisfactory in the long run, the deficiency of the business venture should be corrected, or abandoned [12]. Key features of the classical approach are the attachment to rational analysis, the separation between planning and execution, and the commitment to profit maximization [12], [13].

Evolutionary approaches are characterised by an on-going struggle for survival through reactive decision-making. In the search of profit maximization, natural selection will determine who are the best performers and survivors [14].

Processual methods do not aim for profit-maximisation ambitions, but strive to work with what reality offers. Practically, this means that firms are not always united. Instead, individuals with different interests, acting in an environment of confusion and mess, determine the course of action. Through a process of internal bargaining within the organization, members set goals among themselves, which are acceptable to all.

In a systemic approach, the organization is not simply made up of individuals acting purely in economic transactions, but of individuals embedded in a network of densely interwoven social relations that may involve their family, state, professional and educational backgrounds, even their culture, religion, and ethnicity [4].

4 THE IMPLICATIONS OF GENERIC STRATEGIES, WORLDVIEWS AND MODELS OF DESIGN REASONING ON PROSPECTIVE ERGONOMICS

With respect to various perspectives on innovation, philosophical worldviews were introduced as a foundation for the discussion of six models of “Design” reasoning [15], Lie’s extensive literature review has led to a systematic framework (p.68) [15], which illustrates the current dispute between positivistic / deliberate design approaches on one hand and the more plural, reflected and embedded design approaches on the other hand. The alignment of the six design reasoning models, which are “Problem Solving”, “Hermeneutic”, “Reflective Practice”, “Participatory”, “Social”, and “Normative”, with the generic strategy framework [4], shows existing relations and conjectures (see figure 4), justifying the close relationship between design thinking and business strategizing.

Although processes and outcomes are different for strategizing and designing, the understanding of similarities among different generic strategies, worldviews and models of design reasoning will be invaluable for ergonomist, designers and business managers to create better products systems and services. This understanding will lead to an appreciation that strategic perspectives and design reasoning modes are somehow similar in nature in determining innovation attitudes. Furthermore, this alignment will provide a better understanding on how to position ergonomic interventions relative to strategic management, strategic design and industrial design theories. The following sections will elaborate more on these similarities.

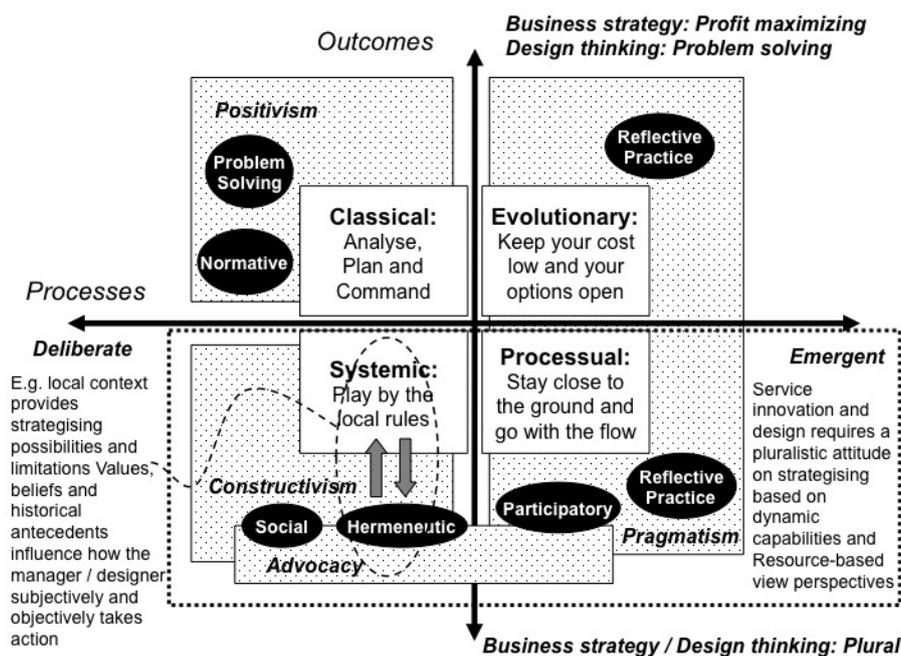


Figure 4. Extension of generic strategies to models of design reasoning based upon philosophical worldviews (adapted from Whittington, 2001, figure 2.1, p.10 [4])

A positivist worldview underpins the classical strategy approach, where profit making is planned and commanded. This is in line with a focused and structured problem-solving approach, where a systematic design process defines the solution space [16]. The normative reasoning model is exemplified by how a strict and concrete program of requirements complements this problem-solving approach. Typically, PMT-matrices [13], and Style / Technology Maps [17], are examples of methods and tools, which supports a planned and structured approach towards innovation and design.

The evolutionary and processual strategic approaches are built upon a pragmatic worldview. Lacking a debate as to whether reality is objective or subjective, the emergent and in some cases opportunistic characteristics of these strategies determine how organizations behave to achieve their profit-making targets or goals. For instance, within corrective ergonomics, an evolutionary business strategy, complemented by a reflective way of designing, would suffice to incrementally improve ergonomic functionality of existing products. Similarly, there are design-reasoning attitudes, which can be aligned with these emergent approaches. The reflective practice addresses design issues from a constructivist, though pragmatic, perspective by engaging in conjectural conversations with the situation [18]. The participatory element, where different stakeholders are actively or passively involved in the design process, bringing along their personal interests, is a real-life and pragmatic phenomenon, which aligns well with an emergent strategy driven by pluralistic objectives, but which may not always lead to profit-maximizing or optimal, economical design solutions. To address such a complex situation, which emphasizes well-being, prospective ergonomics may facilitate the discovery of hidden needs and anticipate future solutions.

The systemic strategy is co-constructed by different stakeholders and individuals in a social context [19]. Although processes are planned and deliberate, multiple objectives exist because of the complexity of multiple views, which are socially, historically, culturally, and contextually embedded in respective communities of practice. From a prospective-ergonomic and strategic design perspective, the designer attempts to anticipate human needs and activities so as to create new artefacts and services that will be useful and provide positive user experience [7]. Reiterating the importance of systemic embeddedness, contexts, values, and functions should be considered here as a key element in getting any collaborative process going, involving different stakeholders.

5 DISCUSSION

When comparing between prospective ergonomics and strategic design, the development of innovative products and services is a common activity in both fields. However, the differences are:

- In strategic design, innovation is mostly aimed at profit making, whereas in prospective ergonomics a balance between performance / productivity on one hand and human well-being on the other hand is sought after.
- Prospective ergonomics aims at developing products, which addresses a product and service, which does not exist yet, and aims at anticipating future needs in certain contexts. The aims in strategic design are more diverse, ranging from product extensions to incremental and radical innovation.

Referring to figures 1, 3 and 4, Whittington's generic strategy framework forms the basis to position different modes of design reasoning, which either characterises strategic design or prospective ergonomic attitudes towards innovation.

Moreover, understanding the dynamics among strategy perspectives, modes of design reasoning, strategic design, and prospective ergonomic modes of thinking allows designers to be more conscious about their design attitudes as well as clients to be more aware of the broader value of design.

In term of design education and practice the framework as show in figure 4, provides a foundation for design students to be more conscious about the different aims and values of "Design"

It will also have an implication on which methods and tools they should be using according to the outcomes they are aiming at together with the collaborative company and other stakeholders. This implies the need for further research to position methods and tools according to "deliberate versus emergent process" and "performance versus plural outcome" axes in relationship to the different modes of design reasoning. For example, "SWOT", "User testing", "Personas" and "Scenario Development" are typically planned and executed by the designer. "Creative Problem Solving", "TRIZ" and "Storytelling" are tools, which embed a participative involvement, are more suited for addressing pluralistic outcomes for a systemic strategy perspective.

6 CONCLUSION AND FUTURE RESEARCH

Prospective ergonomics has developed from corrective and preventive ergonomics to be more "forward looking in time" by emphasising on context, user-experience and human-centeredness. To identify and develop methods and tools, which are typically suited for prospective ergonomics and strategic design, it is important to first position tools from design, engineering, and the social sciences

according to Whittington's generic strategy framework with respect to modes of design reasoning and worldviews.

In terms of practice, prospective ergonomics created awareness among stakeholders that the anticipation of user needs and imagination of radically new products and services are essential for the survival of organisations and their business eco-systems. Adopting a systemic and contextual perspective, six thematic areas are particularly relevant for further research in prospective ergonomics, addressing global social and economic issues. These areas are: (1) Healthcare and Welfare Design, (2) Inclusive Design, (3) Service Design, (4) Aesthetic and Experience Design, (5) Interaction Design within the context of culture and acculturation, and (6) Transportation Design.

REFERENCES

- [1] Perrow, C. The organizational context of human factors engineering. *Administrative Science Quarterly*, 28 (4).1983 pp. 521–541.
- [2] Robert, J.M and Brangier, E. Prospective ergonomics: origin, goal, and prospects. *Work*, 41. 2012, pp. 5235–5242.
- [3] Gordon T.J. and Glen, J.C. Integration, Comparisons, and Frontier of Futures Research Methods. *EU-US Seminar: New Technology Foresight, Forecasting & Assessment Methods* – Seville 13-14 May 2004.
- [4] Whittington, R. *What is Strategy- and does it matter*. 2nd edition, Cengage Learning EMEA, UK, 2001.
- [5] De Montmollin, M. *Les systemes homes-machines, introduction a l'ergonomie*. Presses Universitaires De France. 1967.
- [6] Laurig, W. Prospective Ergonomics: New Approach to Industrial Ergonomics. In: *Karwowski W. (ed.) Trends in Ergonomics /Human Factors III*. Elsevier Science Publisher. B.V, North Holland, 1986.
- [7] Robert, J.M. and Brangier, E. What Is Prospective Ergonomics? A Reflection and a Position on the Future of Ergonomics In *B.-T. Karsh (Ed.): Ergonomics and Health Aspects, HCII 2009, LNCS 5624*. Springer-Verlag, Berlin Heidelberg 2009. pp. 162–169.
- [8] Nelson, J., Buisine, S and Aoussat, A. (2013). A methodological proposal to assist scenario-based design in the early stages of innovation projects. *Le travail humain* 3/2012 (Vol. 75).
- [9] Rosson, M.B. and Carroll, J.M. Scenario-based Design. In *J. Jacko & A. Sears (Eds.), The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. Lawrence Erlbaum Associates, 2002, pp. 1032-1050.
- [10] Nelson, J., Buisine, S., Aoussat, A., Gazo C. Generating prospective scenarios of use in innovation projects. *Le Travail Humain*, 77. 2014. pp. 21–38.
- [11] Mintzberg, H. Strategy Formation: Ten Schools of Thought. In *Fredrickson (Ed.), Prospectus on Strategic Management*, Ballinger: New York. 1989.
- [12] Sloan, A.P. *My Years with General Motors*, Doubleday, 1963.
- [13] Ansoff, H.I. *Corporate Strategy: An Analytic Approach to Business Policy for Growth and Expansion*. Harmondsworth: Penguin, 1968.
- [14] Einhorn, H.J. and Hogarth, R.M. Behavioural Decision Theory: Process of Judgment and Choice. *Annual Review Psychology*. 32, 1981. pp.53-88.
- [15] Lie, U. *Framing an Eclectic Practice; Historical Models and Narratives of Product Design as Professional Work*. Doctoral dissertation, Norwegian University of Science and Technology, Trondheim. 2012.
- [16] Roozenburg, N.F.M, and Eekels, J. *Product Design, Fundamentals and Methods*, Wiley, Chichester, UK. 1995.
- [17] Cagan, J., and Vogel, C. M. *Creating breakthrough products: Innovation from product planning to program approval*. Upper Saddle River, NJ: Prentice Hall. 2002.
- [18] Schön, D. A. *The Reflective Practitioner: How Professionals Think in Action* (2nd ed.). Aldershot: Arena. 1995.
- [19] Lincoln, Y. S., & Guba, E. G. *Naturalistic inquiry*. Beverly Hills, CA: Sage. 1985.