Personal Factors in Dealing with Safety Risks
for Design and Use of Products and Systems

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Abstract—**This paper presents our study's result on the influence of personal factors on the design or use of products and systems in dealing with safety risks. It explores the impact of individual preferences on professional choices. The conducted interview results and collected responses show that personal preferences influence professional decisions for managing safety through design or operation.**

Keywords-safety; leadership; human factors; design; engineering

I. INTRODUCTION

Safety is the state of freedom from harm for humans, properties, and the environment, according to [1]. Safety overlaps with security. Safety and security are mainly about people, and humans have the most considerable influence on them. Humans, or people, have different values and interests. They sometimes share their interests and sometimes compete with each other. Also, people may use products in unintended ways or even misuse products. The human factors and safety culture are well-established in design, integration, and technical systems operation; see for example [2][3]. Although human factors for the users have been well-studied through literature [4], human factors may also influence designers themselves. In other words, the personality of designers (or their characteristics) may affect their design. That is a topic that requires attention because it can influence the use. This paper focuses on personal styles and their influences on both design and service.

Dealing with personal factors has been discussed in the literature. Among others, Katcher et al. define four different orientations that influence a person's value, interest, and behaviour [5]. This study adopts Katcher et al. because they focus on humans' strength to determine their behavioural styles. They define four main orientations to describe an individual style. They assume that each person has elements of all four directions in his or her behaviour. Those four orientations or categories are Supporting-Giving (SG), Controlling-Taking (CT), Conserving-Holding (CH), and Adapting-Dealing (AD) [5].

Studies show that human behaviour is also under the influence of the context. Katcher et al. describe two particular contexts stated as favourable and unfavourable [5]. They argue that personal behaviour – or the so-called personal style – is the combination of the four orientations and the context's influence.

II. HUMANS SYSTEM INTERACTIONS

For studying the role of humans in connection with a product or system, we first look into the product/system life cycle. The entire product life cycle includes three different phases: functional, technical and operational, according to [6], as shown in Figure 1.

The role of humans in each one of those phases is explained next.

A. Humans in dealing with functional aspects

Functional aspects refer to the life cycle stage which results in functions and specifications for a system or product [6]. Safety is a market must and dictated through regulations. However, pushing safety through a prescriptive approach is most of the time giving its place to reaching goals and motivations. In addition to the safety-related requirements, personal, social, or political interests may compete or conflict. Those needs – which might be unspoken – may substantially influence a specific design's success or failure.
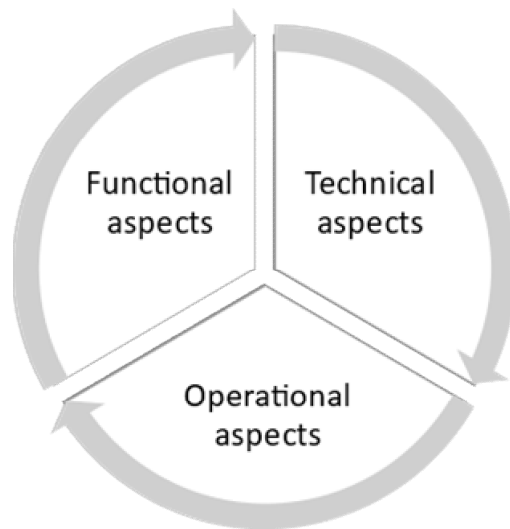

Figure 1. A system/ product life cycle has functional, technical, and operational phases, adapted from [6].

B. Humans in dealing with technical aspects

Technical aspects refer to the life cycle stage which results in technical design, production, and installation for a system or product [6]. This phase is under the direct influence of designers. Designers are also humans and have their values, styles, and interest which may influence their design practices.

C. Humans in dealing with operational aspects

Operational aspects refer to the life cycle stage which results in operation, maintenance, and retirement for a system or product [6].

Managing risks and opportunities for occupational health and safety is a significant task for the safe operation of products and systems. The commitment of top management, sound policies and communication, consultation and participation of workers, and effective processes are critical success factors [7]. Therefore, proper commitment, communication, and culture are indispensable elements of safe and successful operation.

III. PROBLEM STATEMENT

Designers and users are the two stakeholders who influence product safety at most, according to [6, 8]. Designers are dominantly present in the functional and technical phases, and users (or operators) directly affect the operational phase. This study's primary question is: "do the personal factors influence the design or use style?". In this context, the personal, design, and use styles have been defined as follows:

- Personal style refers to the combination of the orientations that characterises a persons' behaviour
- Design style refers to the combination of the orientations that characterise a designer's choices in the course of design
- Use style refers to the combination of the orientations that characterise a user's choices in the course of the use

In other words, the hypothesis is that the design or use styles are under the influence of personal orientations. This assumption leads to two important conclusions. It implies that design style may be under the influence of the designer's personality. It also means that the use style may be under the influence of individual users.

IV. RESEARCH METHODS

A. Literature domains

This study assumes that people have different styles and uses four categories of personality types based on the method developed by Katcher et al. [5]. Those four categories are SG, CT, CH, and AD. The literature for this research mainly covers the domains of human behaviour [5][7], safety engineering [1][9], and design [6][8].

B. Interviews

In addition to the literature review, this research's primary hypothesis was reviewed by different experts in human psychology, system safety, and professional designers. Interviews were conducted through an unstructured approach. Based on the literature review and the collected feedback, a questionnaire was designed to find the possible correlation between personal and professional styles.

C. Questionnaire

A questionnaire was designed to cover multiple topics and to identify personal styles, design style, and the responders' use style. The questions were multiple choice and had no right or wrong answers. In other words, all the answers were correct and of an equal level of importance. They were designed to force the responder to prioritise the given choices. In this way, the responder is likely to prioritise those answers that resonate with his/her personal preferences. A summary of the questions is provided in Table 1.

TABLE 1. THE SETTING OF THE QUESTIONNAIRE

	Subject of questions	Main questions	Sub-questions
1	personal style recognition	6	24
2	design style recognition	3	12
3	use style recognition	3	12

D. Workshop

The responders were asked to participate in a workshop. The responders were assigned to different groups. The same use scenario was given to all the groups, and they were asked to sketch the response of the users/ designers based on various personal orientations. Based on the author's review, the outcomes showed that the reactions were converging to specific patterns.

V. RESULTS AND DISCUSSION

In total, ten professional designers completed the questionnaire successfully. In general, the responders found the questions relevant and exciting. However, they also often experienced a dilemma to choose the most favourable answer. The results are presented in Figure 2. In this figure, the axes show relevant scores per each orientation, and each colour represents a response. There are two types of markers in the graph. The circles present the design orientations, and the triangles present the use orientations. In general, the figure shows a Pearson correlation between personal, design, and use orientations.

Table 2 shows the Pearson correlation coefficients between personal style and design style and between personal style and use style. In both cases, more than 50% of answers represented a correlation above 50%.

The results present a correlation between personal preferences and design or use choices. The results confirm that a designer with the supporting orientation intends to help and support others in the best possible way considering that all human lives are of equal worth. For the conserving direction, the designer wants to focus on quick solutions and the users' responsibility. A designer with a conserving orientation is likely to focus on details, follow instructions,

and use logical arguments for managing risks. A designer with an adaptive orientation is likely to focus mainly on the reactions of users, stakeholders, or other team members aiming to avoid conflicts.
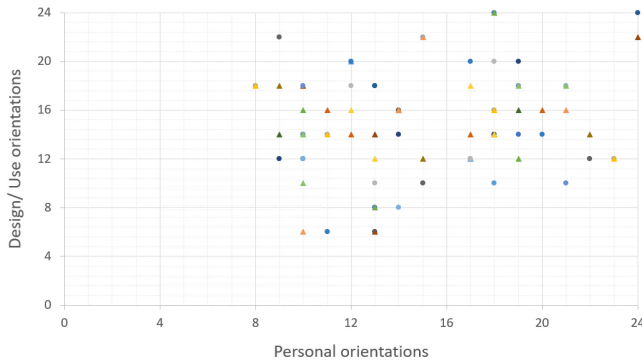

Figure 2. Collected responses

TABLE 2. CORRELATION COEFFICIENTS

		Correlation coefficient (%)			
	Style	0-25	25-50	50-77	75-100
Number of responses	personal vs design style	1	3	1	5
	personal vs use	1	3	5	1

VI. CONCLUSIONS

This paper's main conclusion is that personal factors (preferences, values, and styles) influence professional choices for designers, operators, and users. It seems necessary to point designers' attention to their unique styles and make them aware of their strengths and points for extra attention. Moreover, this awareness can help to design products and system in a way that will satisfy a variety of users with different styles. In other words, designers need to aim to design products and systems in such a way that the operation in both normal and extreme modes of operation covers a wide range of personal styles.

The next step for this study will be reviewing and comparing the final products delivered by different designers.

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