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## Migration toward the boundary: modelling the safety issues and renewing the approach to prevention in the French mountain guide profession

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### **Abstract**

This paper focuses on how to consider and model the safety issues of “unsafe” activities (Amalberti, 2013) in a systemic and dynamic approach of system analysis. Drawing on the case of the mountain guide profession, this paper adapts Rasmussen's model of migration (Rasmussen, 1997) for craft and self-employed activities conducted in settings which are risky by nature. After characterizing these activities and the practical and theoretical issues currently associated with them, we propose a first adaptation of the model applied to the mountain guide profession. Our results, based on the qualitative analysis of 17 interviews, are then discussed along three points. The first point develops the idea of a *subspace of effective possibilities* for a given guide as the intersection of the space of possibilities offered by the system, a *space of truly accessible possibilities* and a *space of acceptable possibilities*. The second point aims to show that these spaces must be understood in a dynamic way and are partly constructed over time through individual acts and choices. The third point finally addresses the possible diversity of spaces possibilities that are individually perceived as acceptable and effective in terms of safety and performance. In conclusion, this text discusses the main implications of our results on the application of the migration model as well as on the practical safety issues of the mountain guide profession.

### **Keywords**

Occupational Safety, Systemic Approach, Organizational Design, Constructive Ergonomics, Mountain Guides

### *Context*

#### *The mountain guide profession: An “unsafe” activity*

With approximately 10 fatal accidents per year in France (involving clients and/or professionals) for about 1600 professionals, the mountain guide occupation can be considered as one of the most dangerous in the world (Girard et al., 2020). According to Amalberti et al.'s (2005) system classification, guided alpine tour belongs to the "unsafe" activities (i.e., activities for which the improvement of the level of safety is limited by three main characteristics: 1/ no limitation in production; 2/ excessive autonomy of actors; and 3/ competing actors (as opposed to the attitude of equivalent actors). Due to their history and their professional status as independent workers, mountain guides are particularly representative of this type of system (Girard et al., 2020, 2022): a professional culture that promotes risk-taking and "heroic" behaviours, an absence of a hierarchical link with a professional institution, and a high degree of economic competition between actors.

However, for several years, the profession has been facing increasing societal safety expectations (media, judicial and insurance pressure) in addition to the very concrete consequences of climate variations (glacial shrinkage, permafrost warming, rock collapse, etc.) on the activity and on its risks. These transformations make safety issues the focus of professional concerns.

Two ways for improving the safety level of profession are then available: 1/ encouraging the adoption of characteristics of a different safety model (which might be counterproductive at the end); 2/ relying on the capacity for progress that is available within the model in that

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specific professional settings (according to Amalberti (2013) every system has the same capacity for internal self-improvement, and safety can be improved by a factor of 10). For now, this second option appears to be the only one that professional institutions are willing to consider. Thus, this objective raises the question of the concrete available ways to achieve it: many commonly accepted strategies are indeed insufficient or inapplicable (local actions, normative strategies, etc.). For now, the lack of proven models to improve safety in this type of system makes it a practical and theoretical issue (Amalberti, 2013; Morel et al., 2009; Rasmussen, 1997). To address this question, the literature currently shows an inclination towards systemic and dynamic approaches to safety (Amalberti, 2013; Carayon et al., 2006; Rasmussen, 1997; Vicente, 1999; Wilson, 2000).

### *A systemic and dynamic approach of system analysis: migration model of Rasmussen*

Given the increasing complexity of work environments, Rasmussen (1997) suggests representing the dynamics of systems based on the mechanisms that generate behaviours in the context of concrete work situations. According to the author, it is necessary to question the objectives and constraints that delimit the workspace: "Human behaviour in any work system is shaped by objectives and constraints which must be respected by the actors for work performance to be successful" (p. 189). The author then supports the idea that "work-as-done" naturally generates a migration of activities to the boundary of functionally acceptable performance.

In this context, the analysis of the "dynamic behaviour of systems and actors" consists in the definition of its limits of functioning (in response to the constraints), as well as the gradients responsible for this migration (in response to the objectives). Based on the generic model proposed by the author and on the adaptation by Amalberti (2001), the mountain guide system can be described by five boundaries (see Figure 1):

1. a boundary of economically sustainable practices;
2. a boundary of socially and culturally acceptable practices;
3. a boundary of acceptable workload;
4. a boundary of functionally acceptable performance;
5. a resulting perceived boundary of acceptable performance (the difference between the fourth and the fifth boundary constitutes then the error margin).

As well as by three gradients:

1. a gradient towards economic benefits;
2. a gradient towards social promotion (e.g. cultural promotion of risk taking);
3. a gradient towards individual benefits.

These system boundaries and gradients can be considered the same for all guides and can be characterized by national regulations, shared professional rules and know-how, self-employment status, level of professional economic competition, professional culture, overall client expectations, natural environment, etc. In other words, what makes it a craft system.

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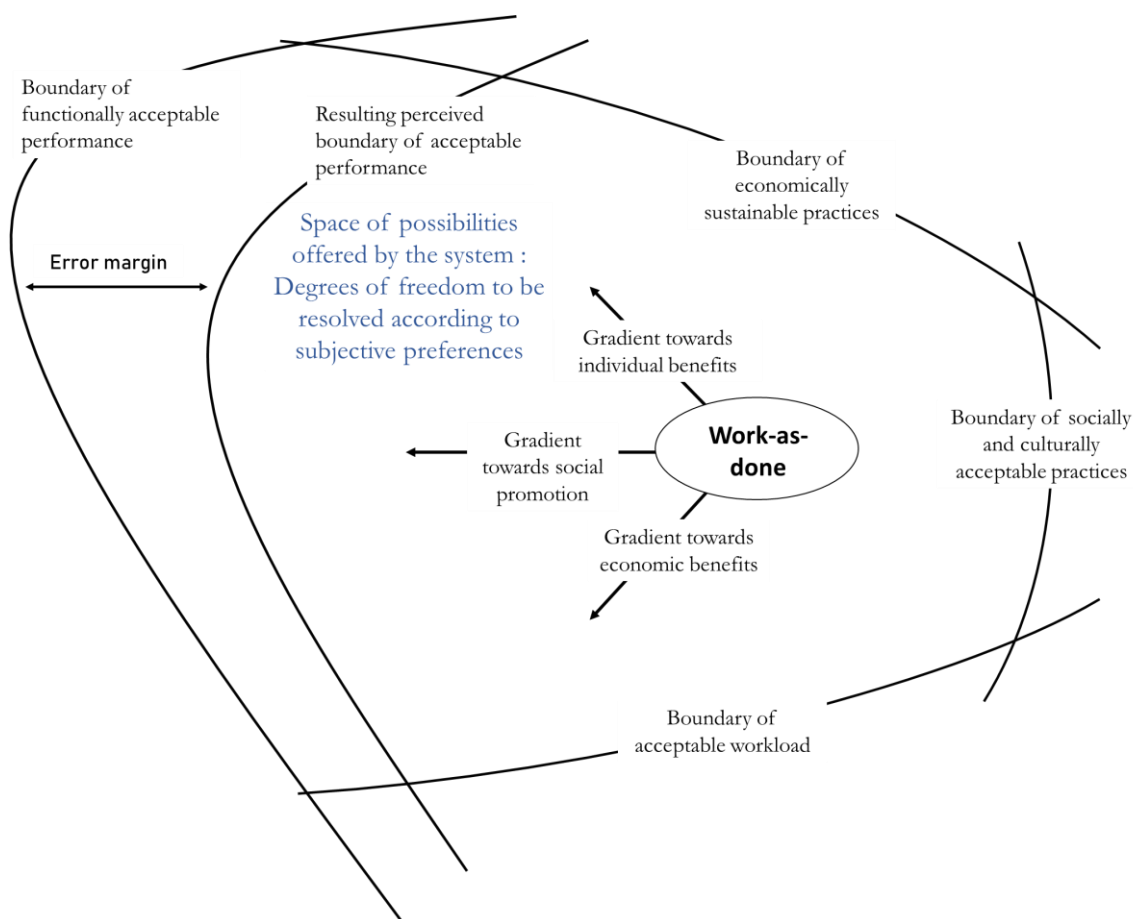


Figure 1 : Model of migration applied to the mountain guides profession.

## Objectives

For the author (Rasmussen, 1997), a variety of practices are accessible to achieve the productive objectives imposed by the work (the “degrees of freedom” given by the system). These describe the space of possibilities accessible by the operator (see Figure 1). The actual work can then be represented by the individual path in this space which describes the “adaptive search guided by process criteria (p. 189)”. Consequently, safety must be based on “an identification of the boundary of safe performance” and on “the criteria that drive the continuous adaptive modification of behaviour. Efforts for improvement must then be directed toward the control of performance in interaction with the boundary, not on control of errors” (p. 206).

Our study has two objectives: on the one hand, it aims to describe and analyse the activity through which mountain guides maintain themselves in an efficient space of practices and interact with its boundaries; on the other hand, it aims to invite a new approach to the control system of mountain guides in this phase of adaptation.

The associated theoretical issue is then to discuss the relevance of transposing the migration model, initially designed for staffs working in safe-intensive environments, to individual and unsafe activities. One of the specificities of the study consists in situating the analysis at the “meso” scale, i.e., at the level of the enterprise (Amalberti, 2013). In practical terms, this means considering mountain guides, not as sharp-end operators but as managers of their own businesses in interaction with others (clients, other guides, organizations, society). This change of perspective should then allow the analysis of risk management in a global approach: not only focused on the risk of accident, but also on the economic and social risks implied by the objective of sustainability of the enterprise.

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## Methods

### Data collection

The data collected and used in this study are transcripts of 17 interviews conducted with professionals with various characteristics (age, seniority, gender, origin, etc.). These interviews dealt with risk management in relation to 1/ career path, 2/ work organization, 3/ interactions with clients, sales intermediaries, and other professionals.

### Data analysis

Data analysis was carried out by a qualitative method articulating deductive and inductive reasoning. The aim was to organize and make sense of the data with an emphasis on interpretation by developing categories and relationships between categories (axial and selective coding (Point & Voynnet Fourboul, 2006)). The content of the categories that emerged deals with different levels: from very local risk management (e.g., technical know-how) to societal issues (e.g., climate change).

## Main results

Our main results can be summarized in three points presented below.

### 1. A space of possibilities and gradients depending on contextual constraints and individual acceptability

Within the boundaries of the system, the “effective practices” are not the same for each mountain guide.

Indeed, theoretical accessible practices can be affected in the first place by contextual constraints. These may be systemic such as the geographical location which will have a strong influence on the type of accessible routes, the type of accessible clientele, the level of economic competition, etc. For example, “*there are only a few mountain guides who work with the Grenoble<sup>1</sup> office. There are ten guides who work a little bit, that's all. That is not much... Although they are active in Grenoble but there is not a big clientele (Guide 1, SSI<sup>2</sup>)*”. But they can also be individual, such as seniority, which sometimes means that young guides only have access to a limited range of clients or routes: “*You accept work with people you don't know and then, when you're an established guide who's been working for a long time, you have a quality of work. You have a reputation where you have access to good clients with whom you will develop a relationship. But at the beginning, you have to start [...] when you are a young guide it is too complicated (Guide 9, SSI)*”. Taking these elements into account then highlights a restriction of **the space of possibilities offered by the system** (i.e., defined by the practices theoretically offered by the system) to a **space of truly accessible possibilities** (i.e., defined by the accessible practices, taking into account the contextual limits). But it also implies a variable intensity of gradients, for example gradient towards economic benefits: “*I am thirty-four years old, so I don't have the same financial situation as someone who is twenty. I have bigger financial needs anyway. And so, I have to work, yeah. So sometimes I do three Mont Blanc in a week (Guide 10, SSI)*”.

Secondly, the fact that a practice is accessible for a guide does not mean that it is subjectively acceptable to him/her. Indeed, for various individual reasons such as the perceived level of risk, the induced workload, the lack of interest or competence, the financial aspect, the mode of organization, but also the personal way of life, etc., the guide may be led to refuse certain types of practices. For example, it can happen that guides refuse, on a matter of principle, some routes, some locations, or some disciplines: “*In winter I don't work very hard, I don't work every day on skis like guides in the ski resort. Because in fact, I find it dangerous when you are not settled in a ski resort. The snow conditions are too complicated to manage (Guide 3, SSI)*.” These elements thus show that it is also

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<sup>1</sup> City in the Alps, France

<sup>2</sup> SSI: Semi-Structured Interview

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necessary to consider the **space of acceptable possibilities** defined by subjectively acceptable practices.

Finally, one way to combine and represent these empirical observations is then to consider the **space of effective possibilities** for a given guide as the intersection between the space of possibilities offered by the system, the space of truly accessible possibilities and the space of acceptable possibilities (see Figure 2).

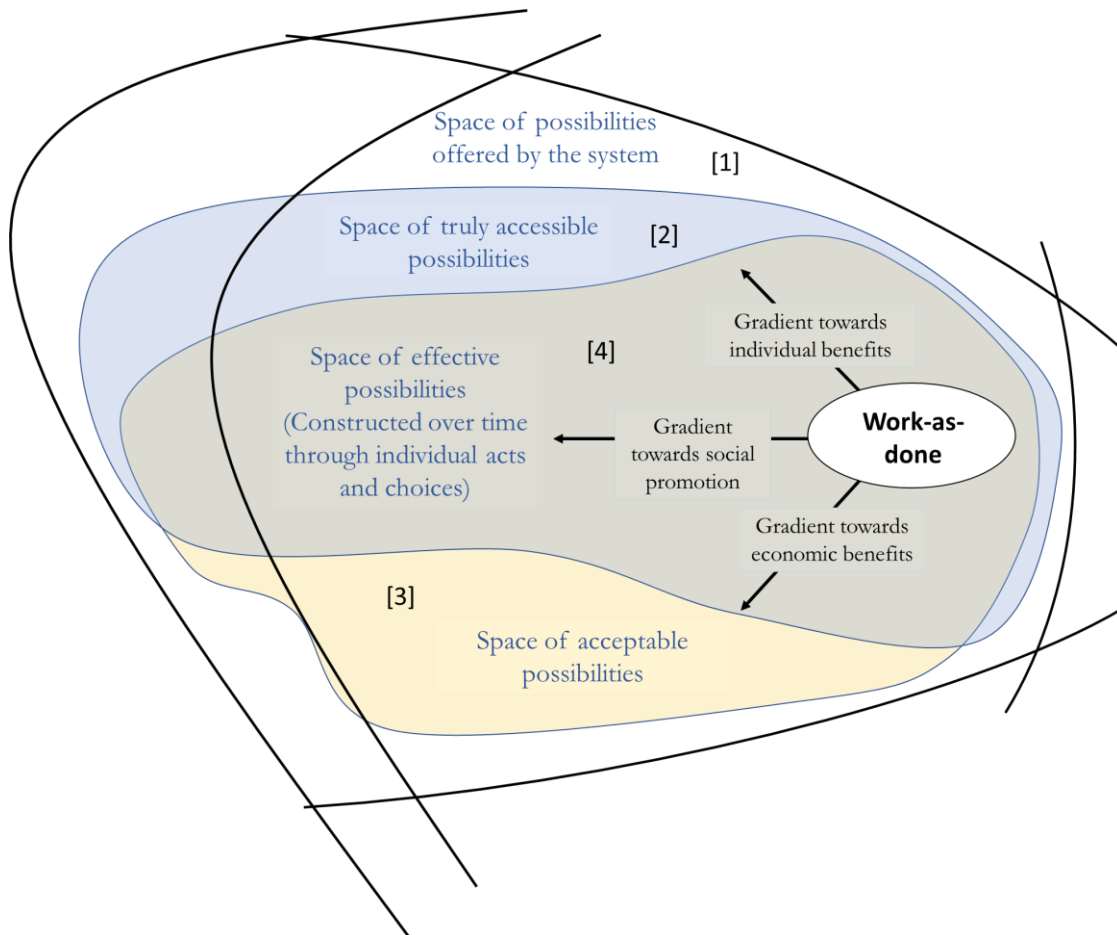


Figure 2 : A representation of the different subspaces of possibilities and gradients with which a guide interacts. The effective space of possibilities (where the activity can actually be observed) is defined by the intersection of the space of possibilities offered by the system, the space of truly accessible possibilities and the space of acceptable possibilities. This effective space of possibilities is then constructed over time through individual acts and choices.

Given these elements, we postulate the following formula:

**Effective possibilities =**

**Possibilities offered  $\cap^3$  Truly accessible possibilities  $\cap$  Acceptable possibilities**

These observations allow us to distinguish between different types of practices (see Figure 2). Some are theoretically offered by the system but individually inaccessible and unacceptable in practice [1]. Others are truly accessible but are individually considered unacceptable [2]. Others may be individually desirable but not accessible because of contextual elements [3]. On the other hand, to become potentially effective, practices must first be offered by the system, and then be in line with local conditions of context and individual acceptability [4].

<sup>3</sup> Mathematical sign for intersection which signifies the set of points common to different objects sets.

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### 2. *An effective space of possibilities and gradients constructed over time through individual acts and choices*

Another very important element that emerges from our study is that this space of effective possibilities and these gradients should not be addressed in a static way. Indeed, they evolve and change over time. Either because the contexts and the people change on their own (modification of the clientele, ageing of the people, accidents, etc.), or because the acts and choices made by the guides in the short, medium and long term have an impact on these spaces. A relevant example of this temporal dimension is provided by a guide who explains how she tries to build a professional practice in accordance with the new personal constraints imposed by the birth of her son: *"I haven't done Mont Blanc for three years, since I had my son in fact. Because it's tiring, it's not hard but it's tiring. I've been trying since I had my son - but it's not easy - to change my clientele. Because when I first came to the area, I didn't have much confidence in myself, I took a lot of jobs, Mont Blanc and stuff like that. Now, I've been working for the company in Chamonix<sup>4</sup> for two years and I'm starting to have access to more interesting work and therefore to clients that you can keep over time. And it's not in Mont Blanc that you find this clientele. So, I stopped doing Mont Blanc because it doesn't build customer loyalty at all (Guide 12, SSI)."* An interpretation of this situation is that an event modifies the space of acceptable possibilities of the guide; and that the guide then seeks to transform through her acts and choices the space of truly accessible possibilities to maintain a sufficient space of effective possibilities. So, in other words, the space of effective possibilities is a constructed space over time through individual acts and choices. Our data show that these observations are common to all the guides interviewed and that this construction seems to be a natural way to cope with migration and to maintain oneself within the boundary of acceptable performance. In particular, this construction is based on the interaction with five main variabilities of the system:

- The way of carrying out the professional activity, which refers for example to mono-activity (only guide) or multi-activity (guide and another activity): *"To the young guides, I tell them: "Don't have only one job", because when you are only a mountain guide, you "have to"... If you have another professional activity, at least when the weather is bad you can say "no", that gives you a little more flexibility. [...] I worked only as a guide for a few years, I only had this income. And then sometimes you go out and you think... it's crazy. [...] It's a financial reality. So, you don't have to accept any client request (Guide 4, SSI)"*.
- The professional structures available, which are intermediaries between the clients and the professionals, and which offer different sales products, variable remuneration and job security, etc. For example: *"I stopped working with agencies because my way of working didn't match theirs, I think. However, it was comfortable because it was a little better paid than at the Mont Blanc Company where I was paying a fee on my alpine tours and a little less with the agency. But I didn't agree with them because they were selling a finished product like "we'll go to Mont Blanc" and even when the conditions weren't good, we had to try it anyway (Guide 12, SSI)."*
- The disciplines practiced, which correspond to different seasonality, skills, etc.: *"Ice climbing, at the beginning, I thought it was quite dangerous overall, and in fact, now, I work a lot in ice climbing and progressively, I have developed the choice of locations to go to according to the weather, according to the temperature. Now, it seems to me rather easy, rather well manageable, yeah (Guide 3, SSI)"*.
- The accessible clientele, which refers to the differences between clients (technical level, expectations, etc.): *"To take as little risk as possible. You have to know the conditions and adapt the"*

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<sup>4</sup> City in the Alps, France

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*level of the route to the environmental conditions and the clients. And that's only possible if you have a client who is willing to do what you say. If you have clients who are stuck on their ideas, it's going to bring you where you don't want to go. It happens, but yeah those clients you try not to keep (Guide 7, SSI)."*

- The possible routes, characterized by dangers, prices, etc.: *"The ascent of Mont Blanc by Mont Tacul is one of the routes for which I always say "no", with the Dôme des Ecrins and the Barre des Ecrins<sup>5</sup>. [...] These are personal judgments, after all, I don't have much experience either, maybe by being in the field you change your perception [...] but even if I think that you can find risks everywhere, there are routes where you are much less relaxed than others (Guide 15, SSI)."*

These variabilities are the object of choices and trade-offs by the professionals according to their subjective preferences and to work demands for example, deciding to work for one agency rather than another, doing more skiing or climbing than mountaineering, doing several Mont Blanc ascents or not, etc. This will then have a direct influence on their professional activities and on their enterprise in the short-term (sales revenues, risk-taking, mobility, etc.); but also, through each iteration in the medium and long term by designing their own organizational model. In other words, the operations implemented in professional practice do not only respond to a productive and functional purpose, but also to a constructive and meta-functional purpose, more or less conscious and voluntary. These elements lead us to qualify the effective space of possibilities as **a constructed space over time through individual acts and choices** (see Figure 2).

### 3. A variety of organizational models and efficient spaces of effective possibilities

Finally, and contrary to our initial hypothesis, it appears that there is no organizational model and space of effective possibilities identified by most professionals as one-best way of practice that would promote better safety performance. Rather, there are many organizational models that allow them to cope with a variety of variabilities and contextual constraints, according to their individual preferences and experience. The objective of these different ways to approach their job is then for them to counter the gradients (e.g., economic pressure) by remaining within a boundary of functionally acceptable performance: *"The financial pressure, you have to manage it because that's what can lead you to go to a place when it's in bad conditions or to keep a client who is not a good client. It's kind of the stress of thinking: "What am I going to do if I lose this client, if..." (Guide 7, SSI)".* And building one's own space of practices appears to be a popular response in order to have sufficient economic resources: *"I know exactly how much I need per month to make a living, and I can see from my schedule if it's going to be good or not. [...] This means that I can make enough money to live on. To be able to pay my fixed costs and to be able to enjoy myself. And my profile, my private situation is still comfortable. I'm single, I don't have any children, I don't have many expenses, I have a loan, that's all (Guide 15, SSI)",* but also in order to have known clients to limit a form of social pressure: *"it's not the same thing when it's your personal clients, that you briefed well before and that you gave them all the information you thought necessary, and where you try really hard to answer their request. It's different from a company or office client where they have paid for a product, and you are responding to that offer. Where the clients have asked for a product initially and you feel you have to go for it (Guide 17, SSI)",* etc. There is therefore a diversity of spaces possibilities that are individually perceived as acceptable and efficient in terms of safety and performance (see Figure 3). One of the questions that emerge from this result but not addressed in this text concerns then the collective acceptability of these different effective spaces.

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<sup>5</sup> Famous routes in the French alps



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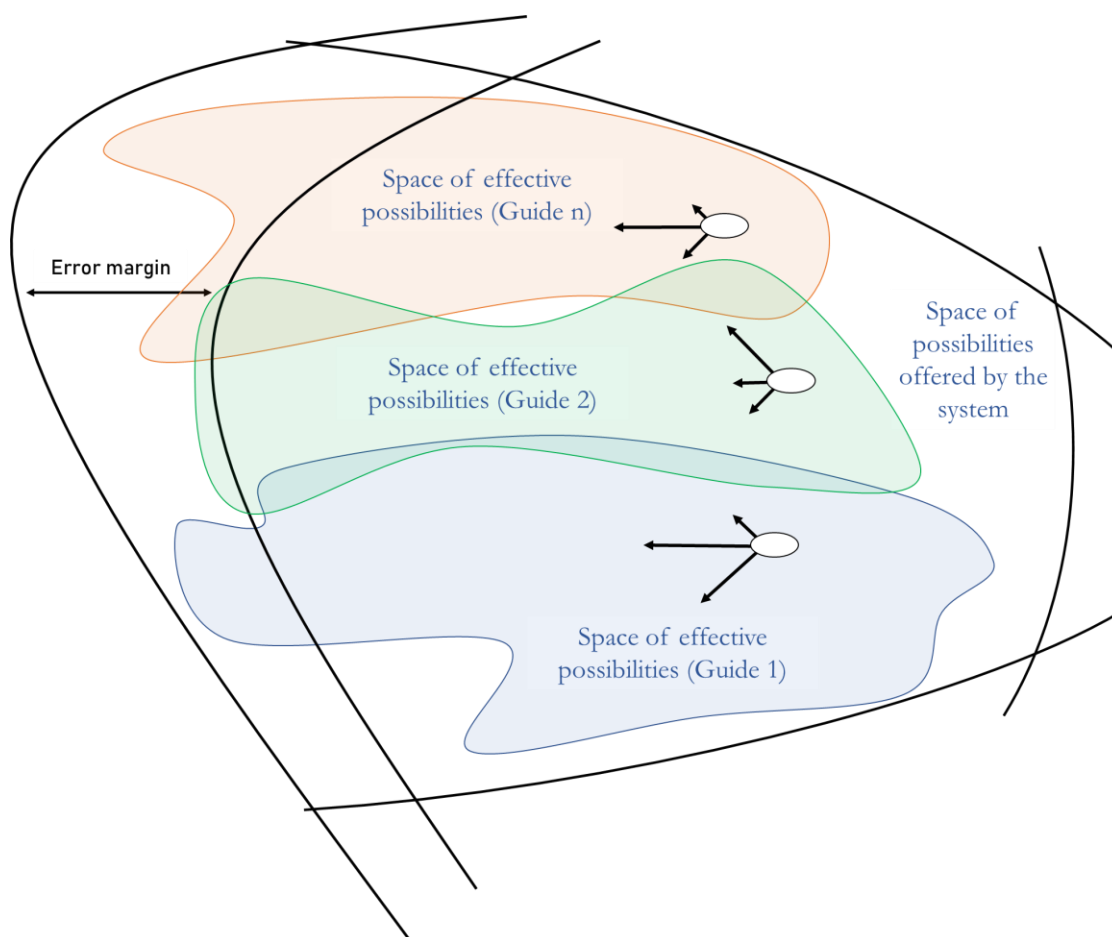


Figure 3: Representation of a variety of spaces of effective possibilities that are constructed by individual acts and choices to cope with constraints and work demands. There are disparities in individual acceptance when approaching different boundaries. For example, some professionals refuse certain routes that they consider too dangerous, while other professionals accept. Some refuse to work below a certain rate, while others prefer the quality of the work. Etc.

## Conclusion

Our results provide an adaptation of the migration model to craft and self-employed activities conducted in settings which are risky by nature. In the case of mountain guides, this analysis was made possible under two conditions: 1/ adapting the nature of the constraints and objectives to the characteristics of the profession; 2/ modelling the *meso* scale, an intermediate level between the individuals and the system. Thus, improving safety in this type of activities should be addressed not only by acting on the global constraints and gradients of the system (as advocated by Rasmussen (1997)), but also by acting on the subspaces of possibilities of the individual actors. Additionally, our results have a direct implication on the initial approach to migration: they suggest that the modification of the system's boundaries may have little effect on certain individual spaces, or on the contrary, may have counterproductive impacts such as the disorganization of a personal organizational model. In conclusion, the analysis of the "dynamic behavior of systems and actors" should consist in analysing the dynamics of the interactions between the space of possibilities offered by the system and the subspaces.

## Discussion/perspectives

Based on our results, three questions should be addressed:

- A discussion on how to encourage and support the construction of individual spaces of effective possibilities that offer sufficient flexibility to the actors to allow them to act below a functionally acceptable performance boundary. This must be put into perspective with the development of actors' capabilities (Falzon, 2015; Sen, 2008): i.e., the availability

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of a capacity, as well as a genuine possibility to use it (the existence of conversion factors). This proposal thus invites to link the construction of these spaces to ergonomic action focused on the development of enabling environments (Falzon, 2015, p. 3).

- This way of considering safety is also not without consequences for the training of mountain guides, still largely focused on the technical aspects of the activity (Girard et al., 2019). In this profession, which is characterized by a great variety of ways of practicing, we believe that training programs should be dedicated not to the acquisition of *the best practice* (with the idea of the “one-best-way”) but rather to the acquisition of capacities that would allow each mountain guide to build *his or her own best practice* and to make it evolve over time. This point seems to us to be essential in a context of constant adaptation to the brutal effects of climate change (Mourey et al., 2019, 2020). The latter can be understood in our model as profound transformations of the functional boundaries of the system that directly impact the spaces of truly accessible possibilities and of acceptable possibilities.
- The presence of a diversity of spaces of effective possibilities partly constructed by the professionals themselves, invites us to question the acceptability of their respective limits. It appears necessary to examine the acceptability of the choices and trade-offs made by the guides in their activity (on *micro* and *meso* scales). This can be put into perspective with various studies concerning the decision made with a view to individual preferences (Amalberti & Valot, 1993; Wilde, 1982) and concerning the collective acceptability of practices (Mollo & Falzon, 2008; Weil Fassina & Valot, 1998).

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