

Empathic Interaction: Design Guidelines to Induce Flow States in Gestural Interfaces

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Abstract: The argument of this article is to propose design guidelines favoring the exploration and appropriation of an interface by a novice user, by drawing inspiration from the mechanisms of adaptation and perceptive loops in improvisation activities. We want to create sensitive digital experiences, accessible to as many people as possible, and dynamically adapt their behavior and their interface to the activity and to the emotional state of the users. Our hypothesis is that such a design would favor the emergence of Flow states, leading to the setting up of a "social contract" between the user and his interface.

1 INTRODUCTION

This research in Interactive Design is at the crossroads between Arts and Sciences and stems directly from the observation and experience of complex psychological phenomena, related to creativity or emotional amplification. The optimal experience - or Flow - a state of absolute mental absorption, that can be lived alone or shared with others in a sporting or creative activity, is in some ways the starting point. We are interested in the mechanisms linking an individual to his tool, context, or partners / adversaries, and sometimes leading to states of intense immersion, emotional contagion, creative amplification, and more generally to the feeling of being embodied with the experience.

We will connect the study of these phenomena with User Experience (UX) concepts and design methods, and from this perspective we will propose several design guidelines to induce Flow state occurrence in digital experiences. We will conclude by presenting two research projects to support these propositions.

2 CONTEXT

2.1 Optimal Experience, Empathy and Creative Amplification

"I developed a theory of optimal experience based on the concept of Flow — the state in which people are so involved in an activity that nothing else seems to

matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it." (Csíkszentmihályi, 1990).

In the various testimonies collected during his works on happiness and creativity, Mihály Csíkszentmihályi was able to identify multiple activities in which this quasi-mystical state could occur. Described as deeply inscribed in the moment, and yet disconnected from time and from the environment, Flow gives to the one who lives it a feeling of empowerment. The subject is then at the maximum of his capacities, of his creative potential, he enters a state of jubilation and happiness, for a moment that he would like to see it last infinitely.

"... a strange calmness I hadn't experienced in any of the other games. It was a type of euphoria; I felt I could run all day without tiring, that I could dribble through any of their teams or all of them, that I could almost pass through them physically. I felt I could not be hurt." (Fish, 2007).

Here is a testimony of the legendary football player Pelé, which closely coincides with many other experiences reported to Csíkszentmihályi by dancers, athletes, musicians, mountaineers. In those experiences we encounter systematically an absence of effort, the idea to be in the zone, being carried by the current, in a state of grace, harmony.

In addition to the feeling of invincibility and zero effort, participants frequently relate:

- Attention and intense focus on the present moment.

- A feeling of control over the situation or activity.
- The feeling of being able to succeed the proposed task.
- An experience of intrinsically rewarding, self-sufficient, autotelic activity.

Being in contact with these different sportive and artistic backgrounds, Csíkszentmihályi was able to detect that the existence of this modified state of consciousness was appearing when the participants were on the edge of their own physical or creative limits. Many studies followed Csíkszentmihályi's to try to level, provoke, or share this state of Flow (Mladenović et al., 2017), (Chen, 2007). Several relations have been attempted with spiritual concepts, such as mindfulness meditation techniques, Wu-wei or the non-action principle among the Taoists, dhyana among the Buddhists. However, most studies seem to agree on some of the essential conditions to help the state of Flow appear:

- The user must be involved in the activity with clearly stated goals.
- The activity should provide immediate feedback so that the user can better adjust his performance and maintain his Flow status.
- An optimal balance must be found between the challenges perceived by the user and his own abilities. The user must be confident about his ability to perform the task.

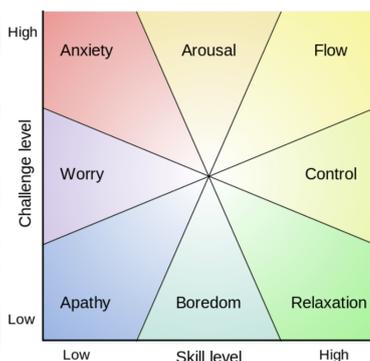


Figure 1: Mental state in terms of challenge level and skill level.

We can see in the different areas of this graph the multiple mental states that can occur when we vary the level of challenge according to the skills of the user. A challenge beyond the expectations or abilities of the subject leads to stress and anxiety, making him leave the area of comfort and efficiency. On the opposite, a

participant who is too qualified for the task is subject to boredom.

On this graph the Flow appears in the upper right corner, when the balance between the levels of challenges and capacities is ideal. The subject must be confronted with stimulating solicitations, on which he will be able to exercise his savoir faire while developing and enriching his capacities. Without this, he will move into one of the other states presented, such as apathy and indifference, reflecting his lack of involvement in the task.

Flow theorists insist on the importance of creating a proper environment allowing the Flow experience in everyday life, in private life, as well as in the workspace (Csíkszentmihályi, 2013). Csíkszentmihályi connects it very closely to notions of creativity, productivity, or happiness:

"[The Flow is] A state in which people are so involved in an activity that nothing else seems to matter; the experience is so pleasant that they will continue to experience it even at a great cost, for the sheer pleasure of the experience itself." (Csíkszentmihályi, 1990).

We refer to an autotelic experience, sufficient in itself, even if these moments are also the most profitable for us in the long term:

"The best moments in our lives are not the passive, receptive, relaxing times ... The best moments usually occur if a person's body or mind is stretched to its limits in a voluntary effort to accomplish something difficult and worthwhile."

The flow therefore depends on many parameters, the context and the interlocutors being the main ones.

2.2 Interaction, Improvisation and Emotional Contagion

Flow can also be experienced as shared in group activities, such as dance, music and/or sport. (Borderie, 2015).

"The secret of football and the smooth running of teams is harmony. True harmony is equivalent to perfection, to beauty (...) Harmony can be anywhere: in the music, in the body and in the spirit, in the will of a football team to win victory (...). Harmony in a team means that everyone plays together and thinks like One." (Cantona and Fynn, 1996).

A football team will sometimes appear scattered, distressed, or lost; and sometimes will seem to reach moments of perfect coordination, where all the individual talents express themselves and form an insepara-

ble entity. In these situations, the results can reach levels beyond all expectations.

In dance or musical improvisation - autotelic experiences by essence - the goal is in the exploration rather than the completion. Each participant will propose, receive, then propose again, thus unfolding the course of the shared experience, in a balance between tensions and harmonies. These events involve complex interaction strategies between the participants, involving many expressive, perceptive, contextual and emotional parameters. The principles of mirror neurons, or empathy, resonate closely with these dynamics of coordination and affective tuning.

The desired goal is by no means discrete but multiple, it is at the same time an exploration of one's body, one's instrument, and at the same time to push one's own limits, to set oneself a challenge, for him as for others; it is at the same time a game, a surprise, it can be humorous, as it can be infuriating, violent or passionate.

A successful improvisation performance does not lie in the fulfillment of a predefined goal, but in the quality and renewal of the ideas proposed, their appropriateness to the context, and of course in the pleasure felt and the emotion shared with the partners and the viewers.

3 FLOW IN AN INTERFACE

3.1 Aim of the Study

The argument of this article is to propose design guidelines favoring the exploration and appropriation of an interface by a novice user, by drawing inspiration from the mechanisms of adaptation and perceptive loops in improvisation activities. We want to create sensitive digital experiences, accessible to as many people as possible, and dynamically adapt their behavior and their interface to the activity and to the emotional state of the users. Our hypothesis is that such a design would favor the emergence of Flow states, leading to the setting up of a "social contract" between the user and his interface (Bianchini et al., 2015).

A central idea in any form of improvisation is the tuning and good communication between the individuals involved. In the context of an interactive experience, the emergence of a participant's feeling of freedom requires that his power and his grip over it are clear, and that the effects produced are immediately perceived. To base our interactional paradigm we can not ask the human to express themselves in the native

language of the machine, but we can instead draw inspiration from inter-human modes of communication.

Empathic phenomena work by identification, by projecting oneself into the body of another. We must be able to translate all the information coming from the user to the machine, to reveal his ease and emotional state so that the interface can adapt to it.

This proposal and this entire research focus therefore on the expressive dynamics that can be envisaged between the user and the system. Coordination in creative improvisation is the result of multiple adaptations based on the entire perceptual and cognitive domain; drawing inspiration from it for an interface design implies to determine which information can be observed from the user and how it can be reflected with an adaptation from the interface.

We will detail what implies the idea of a coordinated interaction for the user and the machine.

3.2 Adapt to the User – Movement Qualities

We want to give the user the feeling of being understood by the system, to give him the will to propose and improvise through it, to explore it freely and to bond a new and personal form of exchange. We need therefore to identify what we can track to design our adaptive and pseudo-empathic process.

Many models exist for the evaluation of a user in a digital context. These models list a certain number of criteria specific to the cognitive, physical, psychological and emotional domains. For our research we seek to identify the characteristics that have an influence on the phenomena of emotional and empathic contagion. Further explorations will be conducted on the actual characteristics during a co-creative activity with the ArTiculations project. In this study, two participants will interact in a virtual reality experience via a simplified representation of their movements. We want to analyse quantitatively the observed behaviours and collect the emotional outlines of their experiences (see 4.2.2).

In Figure 2, some characteristics are distinguished through several temporalities. Some will remain fixed from one session to another (the gender, the physical characteristics ...), others can change radically as the experience is lived (the emotional state, the cognitive load ...). For reasons of comfort and portability we do not want to equip the users with sensors, or asking them to fill questionnaires beforehand.

We will build our analysis engine on the basis of the clues collected during the actual experience, and centered on the core of our proposal: the expressive and intuitive potential of the gesture.

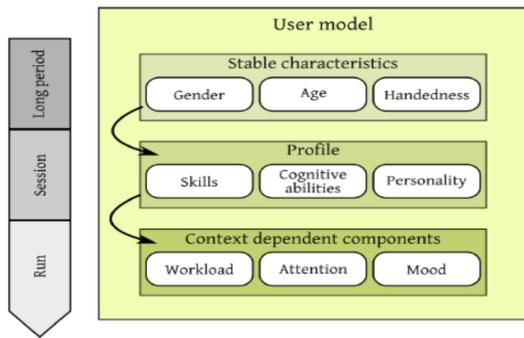


Figure 2: User Model – arranged from the least stable (context dependant), to the most stable (stable characteristics).

There is something deeply intimate in the way we move, in the way we express ourselves through gestures. A movement whether it is planar or in space brings much more nuances and expressiveness than a discrete touch of a keyboard key. An interactive gestural paradigm makes it possible to think of a form of freedom of use that is wider, more personal, more sensitive.

We are particularly interested here in the works of Rudolf Laban, as well as ones based on his notions of effort and qualities of gesture (Laban and Lawrence, 1947), (Bernhardt, 2007).

These qualities distinguish movements by their intentions, their characters, and seek to explain them verbally. We use action names like floating, slashing, pressing, punching, as well as attributes such as directivity, contraction, suddenness, fluidity, fragility...

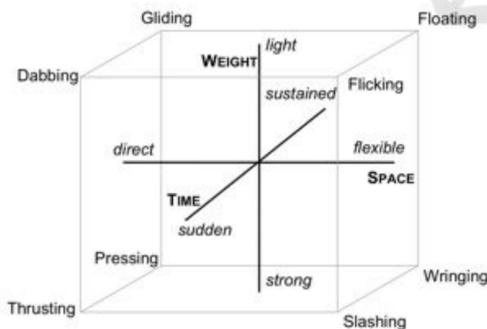


Figure 3: Laban's gesture qualities axes.

It is possible to associate emotions to these gestures, to detect evolutions in nature and intensity, and thus to observe and react to them.

These qualities, initially created and used to describe the danced gesture, have been appropriated by digital artists and researchers to compose the interactive basis of their works or studies in cognitive psychology (Niewiadomski et al., 2017), (Fdili

Pressing	Sure, Confident
Flicking	Carefree
Wringing	Frustration, Conflicted
Dabbing	Happy, Content
Slashing	Annoyed
Gliding	Calm, Conscientious
Punching	Angry, Upset
Floating	Sad, unsure

Figure 4: Emotional states associated with movement qualities.

Alaoui et al., 2011). They allow, thanks to real-time qualification tools (EyesWeb for example) to evaluate the users' performance in a more subtle, sensitive way. It is possible today to obtain a state of these qualities of motion in realtime, and to think of appropriate reactions from the point of view of the interface.

However, it is necessary to identify how we could define and base these reactions.

3.3 Intuition in the Experience – NUIs / UX

In the 90's the idea of natural user interfaces (NUI) appeared. Popularized by Microsoft with inventions like Kinect or Microsoft Surface, this concept brought the idea of intuitiveness into the development of digital interfaces.

Through gestural interfaces, whether on smartphones, touch tables, or via motion capture, the NUIs have offered a new interactive paradigm, giving opportunities to use linguistic forms more faithful and close to our modes of inter-human communication. They appear as a response to the WIMP era (windows, icons, mouse, pointer) by simplifying the display, and dynamically adapting the complexity of the proposed commands as the user gains ease of use.

The desired effect is a lower cognitive load and an immediate user comfort.

Rachel Hinman, UX researcher at Nokia Research, give us some basic principles for the development of a good NUI (Hinman, 2011):

- *Performance Aesthetics - Unlike GUI experiences that focus and privilege accomplishment and task completion, NUI experiences focus on the joy of doing. NUI experiences should be like an ocean voyage, the pleasure comes from the interaction, not the accomplishment.*
- *Direct Manipulation - Unlike GUI interfaces, which are enabled by indirect manipulation*

through a keyboard and mouse, natural user interfaces enable users to interact directly with information objects. Touch screens and gestural interaction functionality enable users to feel like they are physically touching and manipulating information.

- **Scaffolding** - Successful natural user interfaces feel intuitive and joyful to use. Unlike a successful GUI in which many options and commands are presented, a successful NUI contains fewer options with interaction scaffolding. Good NUIs supports users as they engage with the system and unfold or reveal themselves through actions in a natural way.
- **Seamlessness** - GUIs require a keyboard and mouse for interaction with a computing systems. Touchscreens, sensors embedded in hardware, and the use of gestural UIs allow NUI interactions to feel seamless for users because interactions are direct. There are fewer barriers between the user and information.

When Rachel Hinman speaks about intuition, she appeals to what is already known by the user. Designing an intuitive and accessible interface for a large number of people requires to first of all understand the expertise of the users regarding NUI's, in relation to other interactive paradigms that they may have already experienced (or integrated).

Gord Kurtenbach, director of research at Autodesk tells us:

"There is no such thing as natural or intuitive interface [...] Effective user interface design is a very carefully controlled skill transfer - we design interfaces so users can take their skills from on situation and re-apply them to a new situation." (Widgor and Wixon, 2011).

Same as in the previous section regarding the state of Flow, we are talking about being embodied in the experience. The interface becomes an "extension of the hand". A good NUI is therefore based on metaphors borrowed from the reality, that the user will recognize and take over easily. In this way, he will be able to integrate the experience instantly, and unfold more complex functionalities while being in action. The system accompanies and guides the user throughout the whole experience.

3.4 Adaptation from the Designer's Perspective – Hassenzahl's UX Model

More concretely, several tracks can be explored to base the idea of adaptive interfaces. We choose to focus here on the works of Marc Hassenzahl (Hassenzahl, 2005), (Hassenzahl, 2018):

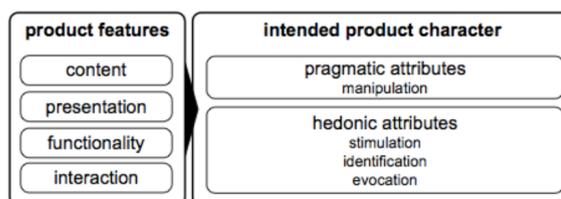


Figure 5: Hassenzahl UX Model - Designer Perspective.

Hassenzahl explains here the links between the user and the product: the UX is seen from the designer's side as a set of contents / presentations / functionalities / interactions. That is, as designers, what we can consider as plastic and adaptable.

These characteristics are then merged into two types of attributes :

- The pragmatics, that concern what can be manipulated, what has a practical use. These attributes refer to the functionalities of the product.
- The hedonics, that concern the elements in charge of improving one's well-being. These attributes refer to the stimulation, the identification of the user.

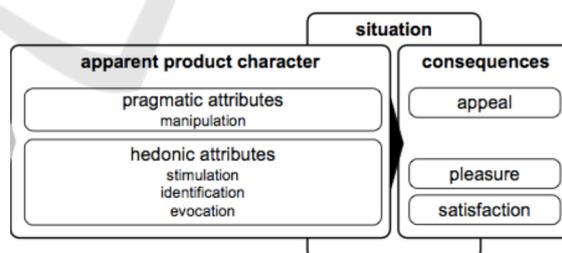


Figure 6: Hassenzahl UX Model - User Perspective.

On the user's side, these two types of attributes are translated into attractiveness, pleasure and satisfaction. Each digital product has these two types of attributes, unequally balanced:

If the pragmatic aspect is particularly strong, we are talking about ACT products, more linked to objectives and tasks, which seek to bring satisfaction.

If the hedonic aspect is in foreground, we talk about SELF products, linked to the user himself, where we want to induce pleasure.

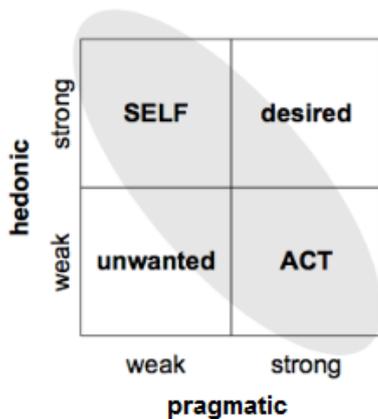


Figure 7: Hassenzahl UX Model.

Hedonics does not have the same purpose as Pragmatics and there are situations where the need for stimulation, novelty or attractiveness will be strong; on the contrary, sometimes this need will be more directed towards a high rate of accomplishment of tasks.

The general emotional reaction depends on how a product is momentarily suitable for a situation. The designer will ideally seek the appropriate balance between pragmatic and hedonic attributes, playing on both utility and usability, both on the senses and the seduction.

This formulation makes it possible to categorize better the type of adaptation and the spirit of the experiment that we consider to develop. We will now outline the key points of our proposal.

4 PROPOSITION

4.1 UX Design Guidelines

By comparing the different notions presented here, we propose a set of objectives for the design of experiences inducing the appearance of a state of flow among users of all kinds :

1. The interface must involve metaphors inspired by reality.

We need to allow a transfer of skills and remain intuitive for novice users. To this purpose, we propose a focus on the design of biomorphic entities animated by movements with life-relevant dynamics. In order to create a form of empathy and an emotional language immediately noticeable by the user, we will play with the behavior of these visual entities by modulating their movements explicitly.

2. The user must have an immediate feedback of his implicit and explicit actions.

Any gestural information emitted by the user should be considered relevant and generate a reaction by the interface. We will base the adaptation of the Hassenzahl's PRESENTATION and INTERACTION criteria on all the information coming from the analysis of the qualities of movement.

3. The interface must adapt its behavior as the user improves.

We recommend here an adaptation of the functionalities as well as the behaviors of the metaphors inspired by reality.

The ACT aspect of the experience must be designed as dynamic. The interface must unfold its complexity and functionality in a consistent manner. The basics need to be mastered for more advanced concepts to become available.

4. The interface must be creative and surprising.

Modeling our study on the principles of autotelic experiments, the SELF aspect must be particularly developed. The interface should not be completely predictable, on the contrary it should provoke the desire of exploration to the user, and make him adjust his own gestural activity. For that, we plan to oscillate the adaptivity of the interface between a tuning according to the qualities of the user's movements on the one hand, and the creation of a certain degree of tension on the other hand. A perfect tuning would lead to comfort and harmony. An ideal degree of tension would lead to a form of resistance and playfulness.

4.2 Experiments

We will conduct a research around these design guidelines through two Arts / Sciences research projects, each highlighting a different part of this study.

4.2.1 Tamed Cloud

"*Tamed Cloud, Sensitive interactions with a behavioral cloud of spatialised information*" is a research conducted by Ensadlab / Spatial Media - Reflective Interaction in partnership with IBM, and which is part of the actions of the Cognition Carnot Institute around the theme "Artificial and Cognitive Intelligence". It proposes an articulation of human's biological, biomechanical and psychological models with quantitative data.

The project integrates a user into a virtual reality experience, and explores the possibility of a truly responsive relationship based on gesture and speech



Figure 8: Ingame footage of Tamed Cloud.

with large masses of information thought as a living and malleable entity.

In the current state of the project, the information consists of floating paintings taken from the MOMA catalog in New York.

The paintings encircle the user and move like a swarm. The user can grab one or more of them and move them into space. He can also ask the cloud, by using voice commands, to organize itself by color, or by date, in which case all the paintings are reordered around him in the desired mode.

We consider to apply the previous proposals to this project, and to design a "character" to the cloud that would be changeable, unpredictable, but however related to the movements made by the user. The user would naturally be invited to explore his own gestural vocabulary in order to understand which of his actions could have an impact on the cloud's behavior.

4.2.2 ArTiculations

This second research project was submitted as part of the EUR ArTeC call for projects and aims to explore the processes involved in collaborative artistic creation situations. We want to study, in the controlled context of a virtual reality scene, how the dynamics of interaction by the gesture favor the emergence of creative behaviors.

The system will immerse two people dancing and improvising freely together, represented in a minimalist way. Their movements will be captured in real time while their physiological states will be analyzed a posteriori, linked to a review of their lived experience.

Our goal is to identify the emergence of intersubjective forms and dynamics of creative interactions.

5 CONCLUSION

This research raises questions that cross multiple fields like UX design, cognitive psychology, arts and creativity, but focuses on something deeply connected with one's well-being and self-actualization. In all the fields of interactive media, we see the spectator becoming actor, and artworks often being described as experiences. With the rise of virtual reality, adaptive learning, artificial intelligence and voice assistants, we can now extend our capabilities by exploring new situations and activities, by experiencing new interactions modalities and linguistic (or non-linguistic) models.

Adaptive interface designers are keen on creating smart tools that align with the way people live, think, or feel. They seek a projection in the user's life, by tuning well their product and inducing proper emotional responses. The product may have multiple forms of use, and may be conceived for different support devices. First and foremost, it has to be designed for the user, who will hopefully remain subject to unpredictable changes.

Trying to adapt in realtime an interface to the ease of use and the gestural activity of the user is an extension of this idea. We proposed here a set of objectives to reach a more human way of thinking an interaction, allowing the user to inject a bit of his unpredictability to the system, which will react to him in the same manner.

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