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literature, and media, challenging our understanding of what is an “art” and “literature,” and what is “human” in a digital world. Here we invite you to explore the published papers in the proceedings from the #IFM2021 Virtual Conference.

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#IFM2021 - III Interactive Film and Media International Conference

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Enactive Experience for Streaming Media Services

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Abstract

Since the beginning of humankind, storytelling enabled people to understand and shape their impressions of reality. Depicted by Walter R. Fisher, the narrative paradigm encounters the *ubiquitous computing* dimension, as proposed by Mark Weiser (Fisher 1984, Weiser 1991), that results in the interdisciplinary field of Interactive Digital Narrative (IDN).

Departing from the first text-based experimentation in the late 1970s, IDN can be considered a vibrant field wherein different forms of interactive artifacts derived such as Hypertext Fiction, Interactive Installations, Video Game Narrative (Koenitz et al. 2015), and Enactive Cinema (Tikka 2006, 2008). IDN presents a field of inquiry prevailing for over three decades, but the question remains: is it *supposed* to be strictly entertainment or something else?

In response, this paper explores the possibility of implementing an enactive paradigm to design a tailored experience for streaming media services, thus proposing a conceptual, methodological framework for designing a system to be prototyped and tested in accompanying research.

Keywords

Enactive Paradigm, Interaction Design, Interactive Digital Narrative, Immersive Technology, Research Through Design

1. The Role of Storytelling in Audiences' Viewing Practices

Storytelling is a complex, articulated subject investigated for decades across interdisciplinary fields, involving literature, art, pedagogy, psychology, cognitive sciences, marketing, and communication, to tackle history, theory, and practices related to this evolving activity. The research referenced outlines the narrative ability to trigger emotions, memories, and engagement, allowing people to understand reality, generate knowledge, and shape judgment to evoke new meanings in the continuous interaction between representation and interpretation (Bertolotti et al. 2016). Furthermore, Barbara Hardy underlines how narrative is not solely a tool manipulated by artists to control people's experiences, but it is primarily an act stemmed from the human mind (Hardy 1968).

In considering these works, we infer that technological and digital developments amplify the power of stories. Thus, it is crucial to understand how such narratives accompanying these developments continue to evolve and can be empowered ethically through immersive technology intended for cultural production. This concept results in the interdisciplinary field of Interactive Digital Narrative (IDN), wherein people interrogate themselves regarding the relation between agency and experience: namely, between a satisfying, consistent narrative and the capacity to influence the unfolding of the story through interactions with the system.

While narratives can be seen as a way to help people to maintain cultural preservation, to entertain, to educate, and to share moral values, we might assume that this definition

for interactivity demonstrates “the way that technologies have been designed to be more responsive to consumer feedback” (Jenkins 2006, 133).

In accordance, interactivity expresses the ability to affect the surrounding world and involves the aptitude to perceive an enclosed environment with its affordances and feedback, creating an input-output continuous loop. The world/environment can be both physical and digital; for example, the work developed by Myron Krueger explored the notion of physical participation in the digital world by using the *Responsive Environment* paradigm (Krueger et al. 1985). Hence, it becomes evident that interaction and storytelling develop comparatively. From ancient paintings found in caves to complex, digital artifacts, there is a long-standing history strictly related to the human capability to craft tools, technologies and to create languages, knowledge, interactions, and meanings.

Considering such premises, it is no coincidence that storytelling proves a crucial coping mechanism in the COVID-19 outbreak. As stated by Patrick Reinsborough and Doyle Canning, “A story can inform or deceive, enlighten or entertain, or even do all of the above” (Reinsborough and Canning 2010, 17). Indeed, during the pandemic, people relied on stories to understand and shape reality. Moreover, stories became essential to empower individuals and families to face the pandemic, which is characterized by a fading of events and activities related to interpersonal and community bonds, blurred work-life boundaries, and emotional exhaustion.

In this time of crisis and social trauma, the audience witnesses an exponential growth in media consumption, such as using digital technology as an alternative form of connection and entertainment throughout a period of social distancing and enforced lockdown (Boursier et al. 2021). As a result, *Video-on-Demand* (VoD) and *Subscription Video-on-Demand* services (SVoD, like Netflix, Amazon Prime Video, and Disney+, etc.) increased, parallel to viewing broadcast TV. While the former impacted consumers' engagement and still retains uplift, the latter was driven by news consumption and gradually returned to an average level (Boursier et al. 2021).

The pandemic, alongside quarantine regulations, accelerated the conformity to streaming services developed within the last decade, wherein the TV emerged as a significant hub for entertainment. As a matter of fact, SVoDs reached their current maturity in 2020, taking advantage of the adoption of smart TVs and over-the-top (OTT) platforms such as Apple TV, Chromecast, PlayStation, Xbox, and Amazon Fire TV sticks that make VOD content more accessible. For instance, during March 2020, Netflix in Italy saw an increase of access by 332% for March 2020 (Cucinotta and D'Oro 2020); with Smart TVs as the most popular device to stream video content (Stoll 2021), Netflix gained 182 million subscribers worldwide in April 2020 (Alexander 2020).

Convenience, control, and choice offered by streaming media services (Lamkhede and Das 2019) relate to the different viewing types to characterize contemporary viewing habits; these traits include appointment viewing, serial viewing, and addictive viewing behaviour labelled as binge-watching.

Rather than discussing the psychological implications of viewing behaviours in terms of motivation and outcomes (e.g. social interaction and level of engagement, relaxation, escapism from reality, a strategy to cope with emotional distress and stress), we wish to focus on the possibility of designing a tailored experience in looking to streaming media services to delve beyond traditional information retrieval (Lamkhede and Das 2019).

2. Methodology

Foregrounding the MSc thesis, “Designing Interaction for Enactive Storytelling Experiences,” developed at the Politecnico di Milano School of Design, this work explores how the enactive paradigm comments upon eye-tracking and emotion-analysis technologies to offer input that enables enactivity (Varisco and Interlandi 2020).

In doing so, we apply a Research Through Design approach that encompasses processes and tools from the discipline of User Experience Design to integrate data as raw material to design meaningful experiences and prototypes to generate knowledge. This approach adopts an iterative structure within the thesis to build on user-centred agile software development (UCASD). By applying an iterative structure to prototypes, we explore aspects of enactive interaction, analyze practical results, and acquire knowledge from each step. The first iteration was executed in an HCI workshop; the Pheel® laboratory of Politecnico di Milano supported the second iteration.

We hypothesize that use beyond the interactive cinematic experience might gesture towards designing a tailored media streaming experience upon drawing from data gathered in this thesis. Emotion analysis through face recognition and eye-tracking could enable platforms to gather real-time data that can impact the users' watching experience: emotional state, attention, gaze, and environment (a sense of presence amongst other users).

In response, we address the following questions in this paper: how can the enactive paradigm be applied to streaming platforms and smart TVs by acknowledging both technological possibilities and user experience? What opportunities emerge because of these technologies and data through the implementation of this paradigm? Finally, considering how the COVID-19 pandemic impacted our media habits and media environments, what are the added values and possible critiques in applying this technological and interactive paradigm to this existing system?

3. Interaction Through Enactivity

The research presented in this paper stems from the work of Giulio Interlandi on interactive streaming experiences. In particular, Interlandi's investigation developed an interactive storytelling experience based on eye-tracking and emotion analysis to test the enactive paradigm, which addresses design issues through evidence-based explorations (Varisco and Interlandi 2020). Both the interactive prototypes and investigations facilitated initial guidelines to create design areas of experimentation that seek to identify starting points for future directions. Our research aims to explore content suggestion through streaming media platforms.

In 1991, Francisco J. Varela, Evan Thompson, and Eleanor Rosch introduce the concept of enaction in *The Embodied Mind: Cognitive Science and Human Experience*. Enaction determines how the subject interacts within a unique, unrepeatable situation established by parameters, which may include the environment, the subject's condition, the presence of other individuals, as well as how personal interaction, and the product, service, or artwork itself (Varela et al. 1991).

The external world is not predefined, but is created by the state of enaction between the being and the environment. As a matter of fact, the enactive approach stresses that consciousness and subjectivity connect to intentionality and autonomy in a continuous flow of life. A basic example to understand the concept of enaction is a biological one. For instance, a leaf springs in an enactive way concerning its environment and the tree; depending on many variables (such as shade, wind, water, etc.), the leaf itself can grow differently. We can define the interaction between the acting organism, the environment, and other elements in the environment as 'dynamic' – an interactive flow in which the organism is inseparable from subjectivity, body, the world, and life itself. One of the first experiments in Enactive Interaction (evident in multimedia formats), as performed by Pia Tikka (Tikka 2008) involves the creation of a functional enactive system, in the short film, *Obsession* (2004), which transformed into a biosensor-based interactive viewing experience at the *Museum of Contemporary Art KIASMA* (Helsinki, 2005) (Tikka et al. 2006).

Drawing from Tikka's study, "Designing Interaction for Enactive Storytelling Experiences" moved forward to consider eye-tracking and emotion analysis through

facial recognition technologies as viable 'enablers' for an enactive interaction. While Tikka's enactive research was inspired by Paul Eckman's *Facial Action Coding System* (FACS), biosensors in the enactive cinema installation, *Obsession*, required contact with the user's skin. Today, it is possible to obtain data in a more precise, less invasive way, without physical contact from the user due to technological progress. As an example, webcams can extract data to read facial expressions, as investigated by Eckman regarding how to track and monitor the gaze.

Moreover, it is necessary to develop a system that can translate collected data into information and thereafter, knowledge through algorithms, to facilitate an enactive system. This knowledge can either determine new functions or to improve existing ones. Once formalized, this information becomes valuable for users and stakeholders alike.

Nowadays, people live in a world where users accept the pervasiveness of technologies. Since data operate at the core of certain streaming services, and providers often rely on users' personal information obtained through data, it is conceivable to tailor user experience. In relinquishing closed privacy, the customer shares personal data because of the additional value that these services offer upon data collection. Therefore, personal data may be perceived as a by-product of digital devices (Schneier). The value created by personal information is essential to both the individual and the company to craft meaningful experiences based on the interpreted data. According to Laura Varisco, "[...] it is essential for designers to understand how

technological solutions can imply the use of personal data to provide meaningful new services or improve existing ones” (Varisco 149).

3.1. #Experimentation: Designing for Unconscious and Enactive Interaction

In creating and developing prototypes for experiences which emulate enactive interaction, the Netflix film, *Black Mirror: Bandersnatch* (Slade, 2018), demonstrates how users can affect the unfolding storyline through making active choices.

The idea of testing passive, unconscious interaction through the user’s gaze in storytelling experiences was developed during the workshop, *New Paradigms for Human-Computer Interaction*, at the MSc in Digital and Interaction Design at the Politecnico di Milano in 2019. The challenge implored for designing and implementing a graphical user interface (GUI) to support natural interaction with kiosks, information points, and vending machines through tracking eye-gaze. Two prototype designs supported this experimentation.

The first prototype was created by combining *Qt Design Studio* software with scenes from the interactive film, *Bandersnatch*. This development sought to understand that eye-tracking, alone, is not enough to produce a reliable, effective, unconscious choice. Such reflections warranted a hypothesis that combine eye-tracking and emotion-analysis through facial recognition in the second prototype developed with *Unity 3D®*. This data offers new possibilities to design interactive, tailored experiences whilst exploring logics, and introduce emotion recognition through built-in cameras to define

a language which might manage enactive storytelling via non-invasive, affordable technologies.

4. Preliminary Results: Data Creates Value

Research indicates that significant data values might detect the user's emotional state in real-time, which extends to certain screen areas. These data values, open for analysis, may extend to emotion analysis software (e.g. happiness, sadness, anger, surprise, fear, disgust, neutral, valence, and arousal) and eye-tracking tools (e.g. saccade, fixation). In this study, Noldus® Face Reader software and a Tobii® device collected data. Cross-referenced data sought to obtain the emotional values regarding the focus on visual elements. Today, however, more advanced technological solutions could integrate eye-tracking and emotion-analysis through webcam use; one such example is Deep Glance®. Moreover, the values for *valence* and *arousal* are interdependent, which leads to a potential interpretation of an individual's emotional state from these values (Bestelmeyer et al. 2017).

In light of such premises, emotion-analysis and eye-tracking technologies could prompt a considerable contribution to data that, if properly processed, would become valuable to streaming services. While the user consciously agrees to share their data in exchange for an experience grounded in value, personal data gathered in real-time through enaction without intentional involvement from the user may broaden research devoted to streaming services.

Although hardware is often straightforward to embed and implement, both the software and the system's design are more complex, needing to be carefully crafted to foster real, added value.

In this context, the role of the designer is essential in many ways. One of the most important factors to consider is the designer's intentionality concerning issues related to the ethics and responsibility of the product or system designed; these problems include transparency and added value. Regarding the former, users must be informed on data usage: how they are used, who can access them, and why. Indeed, the company shares a certain degree of responsibility for the service offered, because user data is frequently shared with stakeholders. Transparency is necessary, especially on this level which involves multiple actors. The latter – added values – proves essential to contributing both to users and companies. Therefore, it may be beneficial to share data values determined meaningful for the user in exchange of improving user experience. In this way, it is feasible to build and maintain trust with people so that users understand the actual value of the service and permit access to their data.

Mentioned in the introduction, the future direction mandates the need to go beyond traditional information retrieval by leveraging on behavioural data to determine an approach relevant to all streaming platforms beyond individual peculiarities (Lamkhede and Das 2019).

5. Conclusion

The thesis formulated at Politecnico di Milano integrated existing material to bolster a study carried out during the pandemic. Based on this thesis, we rely on data gathered through eye-tracking and emotion-analysis tools to hypothesize the possibility for a means to design a tailored media streaming experience. Preliminary research demonstrates how the enactive paradigm applies to storytelling and entertainment. Moving forward, we would like to propose a framework in application of the enactive paradigm to streaming media services, whose adoption grew significantly in the pandemic. Considering enactive interaction as a plausible paradigm for unconscious control of interfaces, we propose an initial framework in the development of tailored media streaming experiences through three dimensions:

5.1. Application of the Enactive Paradigm

Aligned with Tikka's research, this approach demonstrates the enormous advantage to an unconscious, unobtrusive measurement alongside data collection. Underlined previously, the values attributed to *valence* and *arousal* can shed light on a person's emotional state; emotion analysis, therefore, informs a general knowledge of the user's mood that is enriched how the system attributes values to the various detected emotions.

Development of Enactive Interfaces through gaze detection technology

Moreover, eye-tracking technology allows us to take a monumental step forward in the enactive paradigm. With the combination of data related to emotion and eye-tracking, monitoring a specific visual area can be attributed to the values in association with

these emotions. This process cultivates the retrieval of more information regarding the elements in the interface, such as:

1. whether the component was seen or not;
2. for how long;
3. what emotional values emerge during the focus.

These results enhance the enactive paradigm alongside the mutual enrichment between the data provided by eye-tracking and those supplied by emotion recognition. Therefore, these technologies allow both hands-free and unconscious interaction, thus increasing research within interaction design and HCI fields.

5.2. Technology design and implementation

In terms of technological implementation, we observe no significant hardware changes. On one hand, laptops, tablets and smartphones often contain the necessary components for this approach (e.g. camera, operating system). On the other hand, smart TVs lack an embedded camera, which would be easy to implement in most instances. However, the complexity of software development relates to the integration of necessary functions for the proper crossing and real-time processing of data stemmed from emotion recognition and eye-tracking. This feat requires the commitment of a reasonable amount of time to design and then prototype the back-end architecture of the application.

Through the experimentation of immersive technology in modes of cultural production, the aforementioned research urges a deeper understanding and exploration of how to

consciously design native story-based content, user interfaces, and interactive or enactive experiences to access them.

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