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Human-Computer Interaction Evaluation of a Shamanic Interface

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Abstract

Gesture controlled applications provide a way to streamline interaction between human and computer that deviates from traditional interfaces. While benefits are present, the lack of familiarity of users imposed with novel implementations of so-called Natural User Interfaces may however provide hurdles to their adoption, particularly on systems of higher complexity or for those who present physical impairments.
A Shamanic Interface is a proposal for a semantic bridge between Gesture Recognition and execution of application commands. The intent is to support a customized interaction experience based on gestures already existing within the user's culture, rather than simply mimicking the intended commandor imposing a specific metaphor upon the user. Cultural gestures are 'emblems', actions uniquely meaningful within an anthropological context for communicating concepts.
Being a fairly recent proposal, the Shamanic Interface concept requires further validation to assess the viability of its approach in ensuring easier adoption, higher degree of immersion or the facilitation of more advanced interaction. The intent of this work is to test the impact of using a Shamanic Interface along these dimensions, by developing a virtual environment where interaction opportunities arise. User testing procedures will be conducted in controlled test environments. Data obtained from these shall then be analyzed and findings used in evaluating the overall concept.

Keywords: Shamanic Interface, Gestural Commands, Natural Interaction, Human-Computer Interaction

"Why on earth did you make those wings?
You don't seriously think they could let your ferret fly, right?"

Randall Munroe

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Abreviations

CLI	Command Line Interface
FSM	Finite State Machine
GUI	Graphical User Interface
NUI	Natural User Interface
SI	Shamanic Interface
HCI	Human-Computer Interaction

Chapter 1

Introduction

1.1 Context

Body Motion and Gesture recognition has seen an interesting development with modern technology. We already now see it employed with many forms of sensors and applications. The most common of which includes the touchscreens found on smart devices, which became one of the basic innovations that would shape up the future of interaction between end-user and machine, as well as user expectations for current tech.

Any kind of movement performed by a human can be classified as a gesture, but not all gestures can be considered 'natural'. Natural, in this context, is assumed to be a set of behaviours that come effortlessly and intuitively to the users, in a way they may not even consciously acknowledge. This is an idea that was taken in account by Steve Mann when he introduced the Natural User Interface concept [1]. A NUI is an interface built with organic experience as its primary goal, with which the user should find a higher degree of freedom to explore it without the limitations of the technology surprising the user's anticipations or therefore damaging the ergonomics of the interaction. Thus, it focuses on human factors, the environment and senses a person relies on. Ideally, the interface itself should be effectively invisible to the user, even as they learn to perform more complex interactions with the system. The NUI designation is also later presented as an evolution of interaction paradigms as a whole, following that of the Graphical User Interface[2].

Surrounding the turn of the 2010's decade, a lot of research and development was done into NUI's, particularly in the field personal computing and entertainment. Since the release of the Wii Remote and of the Xbox's Kinect, the gaming industry had an arms race for new true-to-life interactions methods[3], meanwhile, on mobile, accelerometers, gyroscopes, proximity sensors and compasses have become the norm and implicitly expected to be a part of any model's feature set. Besides vision, touch or accelerometer based sensors, examples of applications commonly referred to as NUI may achieve its operation through use of voice recognition, facial expression, gaze direction and biometrics including heart rate or electromyographic sensing. Many devices for each type

of input have been developed, even where similar gestures are detected, as an example, the Myo Armband and Leap Motion Controller both register motion of the hands and fingers despite different approaches.
Thus, through interest in NUI's, it can be said that for Gesture Interfaces, many have been attempting to create potential standards of interaction that provides larger diversity and scope of use. While NUI's are not predicted to become a predominant form for all future interaction, it's clear they're here to stay and will carve out a mainstay niche. And the same way the GUI has not replaced the Command Line Interface, but rather lowered the barriers of entry for broader use cases and audiences to more complex degrees, the NUI will also not be replacing the GUI, but rather looks to become a facilitator for the scenarios where they do make usage and learning easier.

1.2 Motivation

However, despite given the undeniable relevance of NUIs and their ongoing research towards modern technology, it can't also be undeniably stated that their design philosophy has been sufficiently explored. An opinion that was summarised by Don Norman [4][5] and has since been repeatedly cited, in regards to what he and others felt was the place NUIs currently held during the onset of its surge. He claims that Natural Interfaces are useful, but that they may currently be a misnomer. The discussion further equates their development to the early developments of the GUI, where a lot of actions would be explained through use of metaphors. For the GUI, the popular metaphor that still survives today in vernacular, was that of a work desktop with papers and filing folders strewn about, and a hand to drag and work on them. However, the metaphor was merely a learning aid, and it doesn't directly resemble the actions intended when handling a GUI. For the Natural Interface which purports to better leverage the usage of metaphors, this was not necessarily encountered.
The more remarkable example of a metaphor successfully working as a NUI, but then failing the user expectations was found with a bowling game for the Nintendo Wii system. The Wii Controller is a gestural form of input with buttons on either side allowing users to mimic the motion of grabbing and swinging a bowling ball. Users are supposed to apply pressure on the buttons, and then perform a swinging motion releasing the buttons at its end, analogous to that of using a bowling ball in a real-world environment. However, when players got invested and immersed in the game, occasionally it would be verified that they would also release the controller itself at the end of the swing, throwing the controlled most likely in the direction of the game display. This would take users out of the experience, and they'd then make their plays with more careful and inhibited, yet far less natural, impetus.
The reasons given for the labelled failure of Natural Interfaces is due to them not conforming to the rules, or heuristics, of interaction design that apply beyond the scope of any particular technology[6][7]. Specifically, existing NUIs have issues with the visibility of signifiers and thus also with discoverability of new commands. With the freedom, reliability, feedback and, as seen

above, error prevention, leading to users to perform commands they're not even conscious of, and being unaware of how to quickly correct the program after issuing an erroneous change[5][8]. This is the lead up to a lot of scenarios where users either must be taught how to perform certain commands and are told to perform mimicry of analogue movements, or conversely, of a command that represents a non-kinesthetic concept. This proves to be confusing, and then regularly users find themselves complaining, after extended periods of use, about options that they had no way of knowing existed, of commands not making particular intuitive sense for the application, or even ones that don't seem to work in new contexts with no discernible visible cue to explain the difference. A great deal of concern is given to the need of standards, and exploring the right approach that would actually feel seamless in the hands of users, and also to the difficulty that the behavioural distinctiveness of users presents to either goal.
One the tenants in HCI as a science for its usability concerns, we are told that users should not have to 'radically change to fit in', but rather that 'systems should be designed to match their requirements'[9]. So, one of the solutions presented tried to face the issue regarding ambiguity of input and user spontaneity, was through adaptability. If a technology wishes to allow users to interact with it as they are used to interact with the real world in everyday life, this technology must be malleable enough to each user, and the framing by which it should handle their involuntary suppositions would be their Culture. Culture is rich in gestures and expressions that hold special meaning. Even for concepts that have no physical equivalent and thus can't be simply produced through mimicry of the concept, the depth is such that non-verbal communication is possible. Culture aware systems could provide an answer on not just what is a valid definition of Natural for one user, but separate answers for every group of every ethnicity and upbringing.
As such, there's a need to produce research on this potential of leveraging user culture. Should a methodology prove itself to be feasible, new standards of interaction may be built for it among niches fulfilled by NUI based systems, providing users with more inclusive and immersive experiences, and opening new fields of research. The Shamanic Interface is one among ideas for introducing cultural awareness into systems, focusing on the separation of concerns between gestures classifications and virtual instructions.

1.3 Goals

The main goal for this dissertation is to explore the viability of Shamanic Interfaces as a concept and its application in interaction with virtual environments. Prior work[10], was already accomplished in building a research tool for performing field studies in a controlled environment, as well as verify its playability among a group of users from differing backgrounds. However, the empirical tests still need to be fulfilled, and the tools can still be improved. Some additional concerns were set as future work
Here, we seek to find empirical insights to the following encompassing hypotheses:

- **Focusing on user culture contributes to the learning rate, capacity and retention of commands after time periods of non-usage**

One of the very first aspects touched upon the Shamanic Interface proposal was a perceptible learning curve negatively impacting the user experience of Natural Interfaces featuring commands that scoped beyond of simple mimicry, or complex breadth of instructions and information. The approach to cultural richness is expectable to improve this situation and allow users more freedom thanks to culture having pre-loaded non-kinesthetic abstractions that may be used by designers, as well as permitting the application of semiotics through previously unexplored non-textual signifiers.

- **Focusing on user culture contributes to the satisfaction and immersion of the experience**
  Another concern sat with the receptiveness of users towards a new form of interaction, and how well accepted the naturalism of human gesture when communicating with a machine would be. It is posited that one of the advantages will be allowing users to focus better on the task they wish to perform, rather than on the interface.

- **A Shamanic Interface can be safely generalized without loss of coherence across contexts**
  Without the ability the to turn an interface into a standard, the problems with NUIs will be solved for specific practices but persist among other applications. The Shamanic Interface concept would still prove to be viable, and warrant research, but the scope of issues it professes to solve wouldn't hold, and it could face obsolescence to newer paradigms. As such, some continuous effort and thought should go into the architecture implementation.

1.4 Thesis Structure

For the remainder of this document each chapter will focus on the background of each of three separate topics, their state of the art and findings that may be relevant.
Chapter 2 will first focus on Culture in HCI and gestures from a cultural perspective, starting with an explanation of the Shamanic Interface proposal, its name and past work.
Chapter 3 will shortly reiterate some implementation details and background knowledge about Gesture Detection that was relevant to the research tools built for the prior dissertation.
Chapter 4 will discusses HCI, with a brief introduction, followed by aspects related to evaluation of natural user interaction that may prove important as possible approaches to this thesis' work.

Chapter 2

Cultural Background

2.1 Problem Statement

It's typical for researchers to have a forward-looking aptitude towards their work, and to come up with ideal realities that they wish or find inevitable that will be found fleshed out. This is how in 1991, Mark Weiser described the concept of Ubiquitous Computing[11], a concept that is today taken for granted in the dawn of IoT computing, taking only as a basis the observable trend of miniaturization of electronic components and wireless communication. As such, it's not hard to imagine that the path ahead for Human-Computer Interaction has been broadly discussed, as well as its concerns and criticisms. Gestural Detection technology may appear like a modern innovation of the last decade, but it was sought after for several before, and it took progressive iteration, evolution, to reach this state.

However not all evolutions in a field are continuous, there are points in a macroscopic view of technology where discrete advancements have to be made. This describes the paradigm shifts encountered in the major approaches to HCI. Just like he Graphical User Interface (GUI) came to outperform the Command Line Interface (CLI) in several use cases, now the once predicted Natural User Interface (NUI) shows potentials to outperform the GUI in select applications.

However, just how the initial GUI's were rudimentary, and faced design constraints that were ironed out with the growth of the supporting hardware and with the emergence of technological literacy, so does now the NUI have its own problems. As was further described in the introductory chapter 1.2, the NUI as a concept for Gestural Interfaces is not realized, still has room for cultivation, and the Shamanic Interface proposal intends to contribute through an holistic vision of human communication and computer interaction as a whole.

2.2 Shamanic Interface

The Shamanic Interface takes its inspiration from the science fiction book Freedom, by Daniel Suarez, from which the name is directly lifted. In the fictional plot, the Shamanic Interface is a mechanism by which the characters apply commands to a complex augmented reality system,

through use of somatic gestures.

"It's called the shamanic interface because it was designed to be comprehensible to all people on earth, regardless of technological level or cultural background"

The argument suggested by the book was the universality of beliefs in immaterial concepts, and how they may be accessed and communicated through ceremonial and traditional gestures. The futuristic technology described leveraged these rituals, gesticulations, and made it its own form of input, connecting its user experience to acts that almost appear as if magical, where the virtual environments reacts and materializes in accordance to motion in a way that gives a logical and natural impression to anyone. However, while gesticulations and emblematic motion are indeed common to human behaviour, the notion that a single set of gestures that could be understood by all people of the world exists is unfounded and too fantastic for real practical implementation, as seen later in this chapter, namely from the contradictions found within the meaning of same gestures across cultures. For this reason, when Morgado[12] contemplated the solution taking the fantastical interface as a basis, the name "anti-shamanic" was also pondered upon as his proposal subverts and deviates from this conception.

The valuable aspect of focus was the engineering of a system that adapts to the immanent semantics as a form of command for virtual environments. To achieve this, the proposal of the Shamanic Interface required an addendum as such: To decouple the concerns of gestural identification and parameterization, and those of command classification and execution, potentially through distinct software layers. Thus, enabling customized mapping of different collections of cultural gestures onto commands. The ensuing result is that commands in the application layer of a system are independent from the actual motion of the user, and it can conversely make a choice of mappings that best fit the needs and requirements of the user.

In other words, a real Shamanic Interface would be an adaptable system with a customized experience, that allows users to establish links between their learned communal meanings and the application's commands. This is how it is expected for it to tackle the current limitations found in NUI's, where performing those commands usually adopts a mimicry approach. It is expectable that this way, the SI will allow the NUI's to overcome the difficulties of exploration and learning attached to the method. Other problems that this may directly favour NUI's with are the issues of accessibility for users with physical impairments and handicaps who are incapable of performing the current required gestures, such as wheelchair-bound users, and allowing interaction to appear visibly more natural for external observers, thus making usage of this systems more societally acceptable.

Prior work was performed on Shamanic Interfaces[10], including a research paper where a research tool was developed for testing and expanding on the concept of Shamanic Interfaces. The developed application was in a working condition, capable of identifying cultural gestures, however it specifies performing the actual tests as a requirement among future work. In this work we look to give continuity to the development and use of that tool.

2.3 Culture in HCI

Cultural is a notoriously difficult term to define. In a more general sense, culture is interpreted in the aspects of a society's artistic productions, their traditions, the system of beliefs held by the populous and their modes of expression. Usually driven by symbols which have values attached, which themselves are regarded thanks to attitude or faith of the community in those values. However the interest in culture is restrained to, from one view in HCI as described by Hofstede[13], the *"collective programming of the mind which distinguishes the members of one human group from another"*. The distinctions between cultures, leads to different approaches to communication, learning, admissibility and work ethic, which in turn, signifies differences in how people will interact with other people, and with technology.
Cultural diversity is a challenge for HCI. The widespread adoption of the GUI is one aspect of what is considered the apparent process of globalization. Businesses outgrow their national boundaries, form a global presence and ship products even to developing countries. Technology itself promotes international growth thanks to the existence of the world wide web, social media, new forms of communication, advertisement and even vectors for outsourced manpower. As such, it's not unusual to find products and services that break the cultural boundaries. This multi-culturalism often proves to be an obstacle towards the usability of the system[14] leading to rejection or slow adoption within certain communities without additional differentiating work applied to it. In recent review works on the subject of culture and HCI, the distinction between visible and invisible attributes or indicators was made, with visible attributes relating to interface design and localization issue, while invisible attributes pertain to Hofstede's theory of cultural dimensions[13][**?**]. One example of dimension is the Power Distance, which levels how receptive users are to inequalities among other members of a society, a result of individualism[15]. This would be relevant in the case of online gaming, where western audiences find the concept of paying for power unacceptable, but asian players state they find no issue with the practice.
And as such, culture is a highly researched topic in HCI, as no singular approach will exist for an interface because of culture. And this is the obstacle of culturally-aware systems. It is expectable of them to adapt to the users' needs in all stages of HCI design, which means, as opposed to creating different builds for each context, the systems must include cultural models as well as generate adaptation rules. From the visible indicators, these include the presentation of information, the language, the dialog design and the interaction design itself[16][15].
Here, the shamanic interface may be pertinent to the latter, as it models and integrates sociocultural information relevant to user background.

2.4 Cultural Gestures

One important task to prior to the development of the goals was to answer the question of what gestures are, and how does motion relate to meaning. We know that gestures play a role in com-

munication and learning[17][18], but we seek out a definition of gesture that would provide an understanding of the information by them encoded. The field of gestural study covers this as well as other topics[19], such as their kinetics and shape, however, the typology of consequence, is the relationship between gesture and verbalizations. Gestures can be produced in conjunction with speech, in alternation or replacement of speech, or as their own utterances.

Gestures had prior classifications but were categorized, based past work in the field, in a singular set by Adam Kendom[20] along a continuum of closeness to speech or, opposite to that, to metaphorical allusion. Wherein, the following five types of gestures were distinguished and still today referenced[21][22]: **Gesticulations** are spontaneous movements that accompany speech. These consist of 90% of the gestures performed by humans and are most usually started imperceptibly, often accompanying strokes in the semantic pattern of utterances, usually synchronizing or preceding emphasis and pauses. Their prevalence is universal in human nature, and not necessarily applicable as an act of communication, as the interlocutor in a phone conversation will often perform these gestures as an aid in speech production; **Speech-Framed Gestures** are gestures that are a part of the spoken sentences themselves. These replace words directly. They're no co-expressive the same way gesticulations were, instead replacing a grammatical hole in the message; **Pantomimes** are used within a similar fashion, but these do not aid verbal communication. Epitomized with the description of "Dumb-show", it's any exaggerated mimicry that describes a shape, an action or any other physical concept. **Emblems** which are familiar symbology conventionalized within a specific culture, translating directly to a specific significance. The meanings are vastly diverse, ranging from polite, to less-than-so, such as they're addressed informally as 'quotable gestures'. Despite their innate substance, they can naturally be interweaved with one another or with speech itself as a form of gesticulation. Their meaning is powerful and long lived, such as that many emblems have outlasted their own historical roots, the languages that could describe their meanings they co-existed with. **Sign languages** which are fully fledge lexicons, with their own linguistic structures, including that of grammatical patterns and vocabulary. These do not directly correlate to that of a native language and have evolved out of the necessity of coordination with speech, with the practice of signing and speaking frequently proving to be a disruption for practitioners.

Of these, the ones that most interest our work are the emblems. Culturally charged gestures with a basis on the background their users originate from, such as the thumbs up, or the tongue protrusion. While an accomplished shamanic interface wouldn't restrict itself to simply detecting emblems, these have the strongest link between a natural movement and an inferred interpretation, and thus, are the most promising towards the primary contribution of the proposal. Also, on their own, they function as idioms, potentially having multiple denotations, and as thus, a rigid system would not be able to utilize one without facing eventual need of teaching them to the user, or directly clashing with the expectation of users from different contexts.

In the past work [10], an example list of emblems was researched. The following table 2.1 is a summary of information that was sourced from David McNeill's article[23] on gestures, however, the examples were also themselves further sourced to Desmond Morris' findings on an earlier

book[24] from which the accompanying figure 2.1 is sourced. With the prospect of having a more complete set of gestural emblems as a basis for the requirements of the thesis' work, a later dictionary-like publication by Morris featuring over three hundred gestures that could be contemplated as meaningful was obtained, and important findings will be clarified upon the thesis delivery.

Table 2.1: 20 examples of Emblems, their meaning and distribution

Sign Name	Cultural Background	Meaning
Fingertip Kiss	Holland, Belgium, Yugoslavia and Turkey	Praise
	Portugal, Sardinia, Malta and Corfu	Salutation
FingerCross	England, Scandinavia, parts of Sicily, and Yugoslavia	Protection
	Corfu and Turkey	Breaking a friendship
The Nose Thumb	Everywhere	Mockery
The Hand Purse	Italy, Sardinia and Sicily	Query
	Portugal, Greece and Turkey	Good
	Belgium and France	Fear
	Holland and Germany	Emphasis
Cheek Screw	Italy, Sicily and Sardinia	Good to eat
	Germany	Crazy
Eyelid Pull	Italy	Watch out, be alert
	Everywhere else	I'm alert
Forearm Jerk	North America	Italian Salute
Flat-Hand Flick	Belgium, France, Italy and Greece	Beat it
Ring		OK
	Tunisia	Threat
	Brazil	Insult
	Germany, North Italy, Northern Sardinia and Malta	Orifice
	Belgium, France and Tunisia	Zero
Vertical Horn	Spain, Portugal and Italy	Cuckold
Horizontal Horn	Malta and Italy	Protection
Fig		Sexual comment
		Insult
Head Toss		Negation
		Beckoning
Chin Flick		Disinterest
		Negation
Cheek Stroke		Thin and ill
Thumb Up		OK
Teeth-Flick		Nothing
		Anger
Ear Touch		Effeminate
		Watch out
Nose Tap		Secrecy
		Insult
Palm-back V-sign		Victory
	Britain	Sexual insult

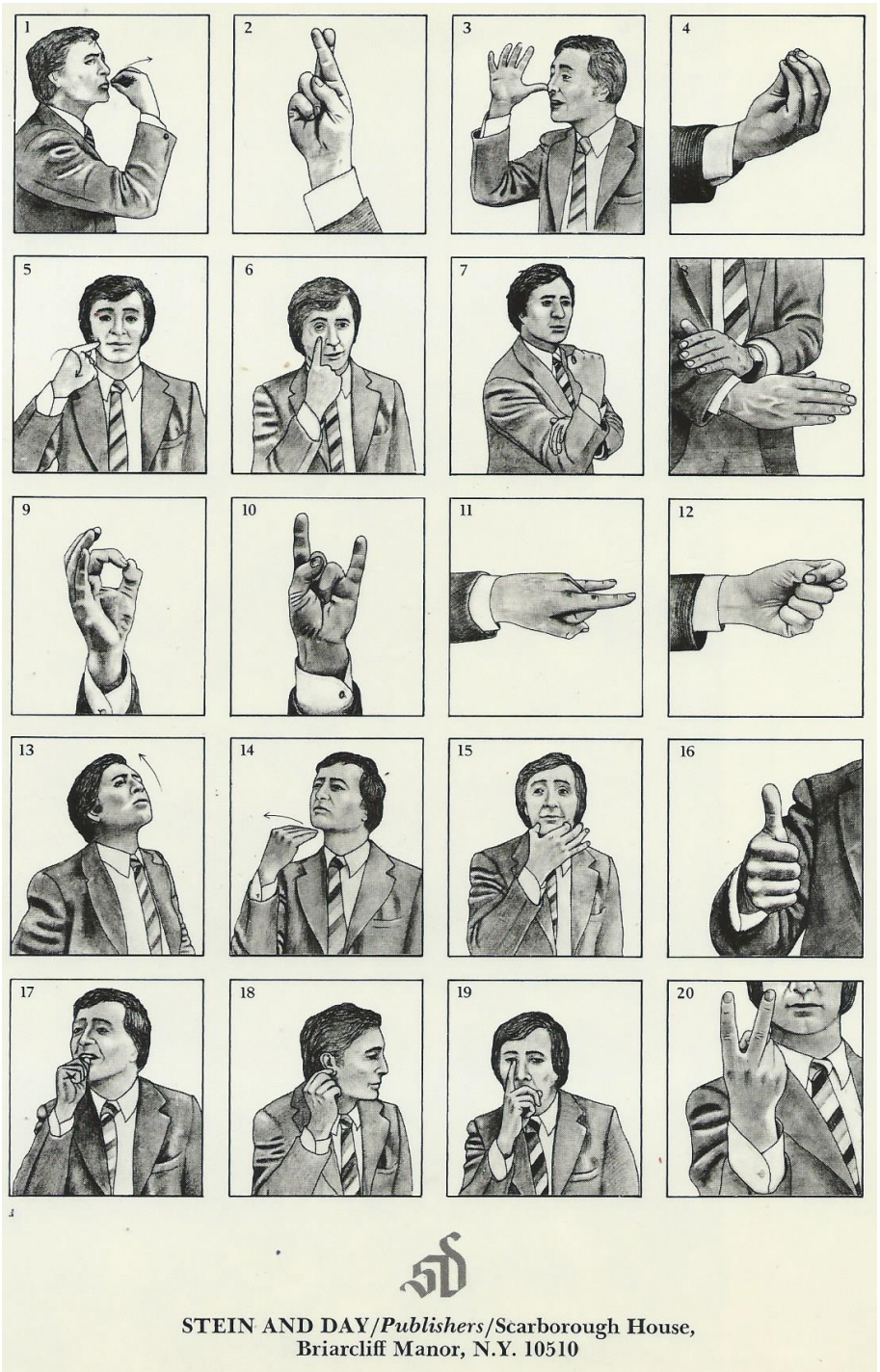

Figure 2.1: Representation of the emblematic gestures

Chapter 3

Technical Details

3.1 Previous Work

As previously stated, this work is a continuation on the thesis by Tiago Susano Pinto[10]. The goal of that work was the creation of a research tool that utilizes the shamanic interface concept, so empirical research can be performed with it.
The developed software realizes the shamanic interface concept through its cultural layer, which is responsible for generating a classifier through which the application will interchange gesture and command information. The cultural layer achieves this by storing relations between sequences of gestures, culture and meaning, and linking these to gesture models based on chosen culture. The models themselves follow a Hidden Markov Machine approach., which was made available through the Accord.NET Framework for supervised learning. As for the playable environment itself, it was built in Unity and it is controlled using a Leap Motion controller, which detects hand gestures.

3.2 Gesture Detection Methodologies

Gesture Recognition and Gesture Classification are two distinct aspects of the final application. Classification pertains to the attribution of meaning to a detected Gesture, and is therefore handled by the cultural layer, as each gesture may have different interpretation dependent on the culture chosen. Recognition is the prior step and is involved in how the system identifies meaningful gestures from among all gestures performed by the human users, in real time.
There are a couple of approaches to handle recognition, between mathematical models and soft computing. Before tackling those, first it'd be important to quickly list the types of gestures that can be recognized and how they're processed. These depend on the supporting instruments, which target different portions of the human body, obtain different sensor stimuli: Electric, Optic, Acoustic, Magnetic and Mechanic. These devices include: Gloves, Body Suits, Optical Trackers among others. Furthermore, vision-based techniques are incredibly varied and have several factors differentiating among themselves, by which broad fields of research and business are formed. The basic

structure of a Gesture Recognition controller's analysis involves two main tasks: Segmentation and Feature Extraction, features which are forwarded into a recognition module to build models. Segmentation is the extraction of the limbs of interest from background and determination of its location, while feature extraction is the determination of valuable data and cues among the segments. Not all input methods require the latter step, for example, magnetic sensors.
The Recognition module follows up with different approaches: *Hidden Markov Models* are a process governed by an underlying Markov chain with a finite number of states, and a random set of functions, each associated with each state. The transitions between states are based on probabilities. After each of a discrete amount of time, the system will be in one state and will observe a new symbol that feeds into the functions which will either yield a new state for the system, or output a recognized gesture for the followed chain. The chain involved a lot of mathematical modelling, producing a lot of deterministic integration, however, it can be seen as merely a sequence of observations and states, and thus it received the term "Hidden". *Particle Filtering* or alternatively, Sequential Monte Carlo, are approximations to simulation-based methods. Works by representing probabilities of noisy and partial samples, building a predictive model for the likelihood of following states. The benefit of these over grid-based filters such as conventional Markov models, is these do end up modelling uncertainty. *The Finite State Machine* approach, by which a gesture is ordered by a sequence of states that vary in space and time. Each state is a datapoint of trajectory data, and the gesture is divided by each substantial change in trajectory data, sampled in a 2D space. Addition of gestures is achieved by constructing new FSM models and each gesture is matched to all the deterministic FSM's. This does mean that adapting the system to more gestures requires incremental computational power, as well as adding winning criteria between gestures to choose the most likely when multiple are matched. *Soft Computing*, which is a number of techniques which involve computational intelligence and computer learning with high degree of tolerance for imprecisions and uncertainty. The system can be trained even while in use and adapts to users. Methods include fuzzy logic, genetic algorithms, artificial neural networks. These, however, require a large amount of data and iterations to find adequate robustness.

Chapter 4

HCI and Evaluation

4.1 HCI: Goals and Definitions

Human Computer Interaction is a term that gave rise in the 80's to describe a then emerging field of study. Jenny Preece describes this in her book[25] as rising acknowledgement that the focus of interest of interface designers was no longer just that of the design of the interface itself, but also to the aspects that relate to the interaction between human and computer. She further names the primary three concerns and branches of study of HCI: The design; the evaluation; and the implementation, of interactive computing systems. So rather than being considered a singular discipline, HCI is often thought of as a joint effort from multiple areas of research, as each concern can benefit from contributions arriving from various sources.

The escalation of interest HCI came as a reaction to the equally explosive appearance of new challenges that beset it. Technology advances rapidly, and with it, so did the rate at which new user experience opportunities with their own collective of hindrances to cohesive and proper interaction. Problems such as, the broadness of audiences and environments, users of different ages and outdoor and public settings, such as the range of activities enabled by the hardware, such as the forms of information and physical objects that hardware can transmit.

And thus, HCI sets for itself the purpose of matching the needs and requirements of users in through careful consideration during the design stages. The HCI experts must ponder about the organizational and social factors, about appeal and about efficiency and effectiveness of the interaction in order to assemble a valuable system, with the core belief that users should not emph"radically change to fit in". It set goals, and set principles, which were found to be taken as the artful and professional process by which good design is put to use. In better understanding of what makes applications emph"interactive, instructional and effective", Preece names the goal of HCI as the design of emph "computer systems that are safe, efficient, easy, and enjoyable to use as well as functional"[25].

This obviously involves a lot of discussion. Lessons relevant to HCI cannot simply be reproduced from related established, for example from cognitive psychology [26] and requires basic research on the new domains HCI is tackling, as a whole range of different factors affects the learnabil-

ity, accessibility and memorability of an interactive system that might have not other fields. And those factors can be messy and hard to track. From the human side of interaction, we have communication theory, cognitive psychology, linguistics, socio-cultural background, meshing with the machine's choice of graphical presentation, operating design, physical input, all of which further coupled with the effect of an uncontrolled and unpredictable, distracting environment, as is normal to the case of personal computing. This leads to a lot contested definitions in HCI, as was the exemplified above on the section about culture 2.3. Despite clear and valuable conceptual developments, the above does contribute to its over-reliance on empirical data and usability as a metric[27][26].

4.2 Evaluation

Again, looking through Rogers and Preece's work[28], one finds four common evaluation paradigms used in HCI research: *"quick-and-dirty" evaluation, usability testing, field studies and predictive evaluation*. Among them, the one that provide the most interest for the desired findings are field studies (see fig 4.1). Field studies are performed with the aim of better understanding how users behave naturally and how a technology impacts them. The goals of a field study include finding opportunities for innovative technology, determining requirements for designs, facilitating introduction of paradigms and evaluating the natural assimilation of the products.
In practice, a field study involves two primary techniques: Observing the user; and asking users their opinions. Testing user performance is also often relevant as an observation, however that is not necessarily a part of the process. Observation should be performed while utilizing support tools and technologies, such as taking notes, recording audio and video, keeping interaction logs of the experiments. The evaluator should not disturb the users during the observation procedure, as a person's presence may be considered obstructive. As for asking users what they think, it should be done separately from evaluation, and can be done through an interview or a questionnaire.
One of the more important tasks for the planning aspect, is to identify what will be the practical issues facing the testing environment and the participants, and plan around them to ensure that every user is faced with the same conditions, and that results obtained pertain to the test's design and not to other factors. These issues may be: The design of each task, choosing users of interest, preparing and recording the test conditions, and choosing how to run the tests. Establishing requirements and objectives early allows an easier decision of the remainder of the important aspects, such as establishing dates, times and places, gaining contacts, and choosing what recording techniques will be employed based on available equipment. For the testing stage, a couple focus point are prevalently relevant, such as preparing and photographing the controlled environment with minimal distractions, obtaining consent of recording the interaction, writing down observations as they occur and user answers as is without personal flair, and attempting to be as unobtrusive as possible. Analysis should always occur later, but any observations that seem peculiar must be noted down as they happen and clarified with the users after the session is completed, to obtain some insights. It's also important to perform a pilot observation session (real or not) to get a feel of what to expect

and test out any observation sheets.
Without having a better feel for what's the expected cultural background of voluntaries, or without having a clear schedule for the environment, the questions of who and how cannot be objectively answered. However, the flow of the sessions can be pre-emptively decided. Due to the need of evaluating the capacity and retention of gestural commands in the system, it makes sense to employ more than a single session per user. As such, the study will be performed in two phases, an initial longer one and a second, shorter one focused more on user performance. Each session will have 5 parts to it: The *Introduction*, wherein the user is welcomed to the controlled environment and recording consent issues are handled; a *Warmup* where users are introduced to the tool and asked about their familiarity with it, and are given some easy instructions that may be required for setup; the *main session*, during which they will perform their tasks with lesser involvement from the overviewing researcher and will have to perform tasks in escalating complexity and difficulty; *Cool Off* period, during which they are interviewed about their experience, their difficulties and some more confusing aspects of the session will be clarified; and finally, a *Closure* in which the recording is stopped and the user is thanked and led out of testing. The second of the two phases will have a much shorter warmup session, and the researcher will have much lesser involvement in the main session, as users should by then be more aware of what is the flow of the program and what tasks they should perform.

Evaluation paradigms	"Quick and dirty"	Usability testing	Field studies	Predictive
Role of users	Natural behavior.	To carry out set tasks.	Natural behavior.	Users generally not involved.
Who controls	Evaluators take minimum control.	Evaluators strongly in control.	Evaluators try to develop relationships with users.	Expert evaluators.
Location	Natural environment or laboratory.	Laboratory.	Natural environment.	Laboratory-oriented but often happens on customer's premises.
When used	Any time you want to get feedback about a design quickly. Techniques from other evaluation paradigms can be used–e.g., experts review software.	With a prototype or product.	Most often used early in design to check that users' needs are being met or to assess problems or design opportunities.	Expert reviews (often done by consultants) with a prototype, but can occur at any time. Models are used to assess specific aspects of a potential design.
Type of data	Usually qualitative, informal descriptions.	Quantitative. Sometimes statistically validated. Users' opinions collected by questionnaire or interview.	Qualitative descriptions often accompanied with sketches, scenarios, quotes, other artifacts.	List of problems from expert reviews. Quantitative figures from model, e.g., how long it takes to perform a task using two designs.
Fed back into design by . . .	Sketches, quotes, descriptive report.	Report of performance measures, errors etc. Findings provide a benchmark for future versions.	Descriptions that include quotes, sketches, anecdotes, and sometimes time logs.	Reviewers provide a list of problems, often with suggested solutions. Times calculated from models are given to designers.
Philosophy	User-centered, highly practical approach.	Applied approach based on experimentation, i.e., usability engineering.	May be objective observation or ethnographic.	Practical heuristics and practitioner expertise underpin expert reviews. Theory underpins models.

Figure 4.1: Characteristics of different evaluation paradigms

Chapter 5

Conclusion

5.1 Summaries and Workplan

NUI's, one of the great fields of technology in the modern tech sector, are the next step in the evolution of interfaces, expected to replace the GUI's within certain old and new use cases. But their definition is challenged with by the current state of design and technology. The central contribution that the Shamanic Interface attempts to tackle has to do with this subject. The proposal states that it would benefit gesture recognition interfaces to make a concern-separation layer between gestures performed by users and the commands the system can execute. The SI would contribute by improving natural usability and learning, and by improving the immersiveness of those systems.

A previous thesis was worked on from which a research tool for testing a SI implementation was developed. The tool itself was tested, but there was no conclusive evaluation or empirical analysis of the SI concept itself, leaving that as future tasks for the present work. Some improvements and alterations to the tool itself may be required, and as such, some of the concepts behind its inception were looked at. One such change is the need to include more meaningfully rich gestures from cultures among the commands the virtual environment's tasks demands.

The essential aim of the thesis will be to perform field studies with the modified tool. Field research are data gathering activities performed in a natural context. In this case, the intent is to perform direct observation of user behaviour when attempting to complete tasks with the tool, with small involvement of the observer. To meet the goals, participants should be of at least two separate cultural backgrounds and they will need to perform on two sessions set apart some time from each other.

Conclusion

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