Evaluation of a Shamanic Interface for Interaction with Cultural Gestures in Virtual Environments

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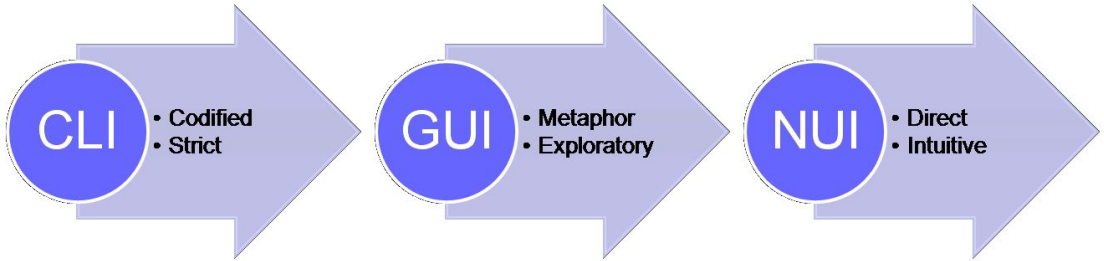
‘Natural User Interfaces’

“A natural user interface is a user interface that is effectively invisible, and remains invisible as the user continuously learns increasingly complex interactions.”



Motivation

Natural User Interfaces Are Not Natural

Donald A. Norman
Nielsen Norman Group, Northwestern University, KAIST Industrial Design | c

"I believe we will look back on 2010 as the year we expanded beyond the mouse and keyboard and started

problems of scaling up to the demands of modern complex systems, they still allow one to

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Note to Self: Stop Calling Interfaces "Natural"

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ABSTRACT
The term "natural" is employed to describe a wide range of novel interactive products and systems, ranging from gesture-based interaction to brain-computer interfaces and in marketing as well as in research. However, this terminology is problematic. It establishes an untenable dichotomy between forms of interaction that are natural and those that are not; it draws upon the positive connotations of the term and conflates the language of research with marketing lingo, often without a clear explanation of why novel interfaces can be considered natural; and it obscures the examination of the details of interaction that ought to be the concern of HCI researchers. We are primarily concerned with identifying the problem, but also propose two steps to remedy it: recognising that the terminology we employ in research has consequences, and unfolding and articulating in more detail the qualities of interfaces that we have hitherto labelled "natural".

Author Keywords
Natural user interfaces; criticism; terminology.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

(NUI) and a verb, "natural interaction". When viewed from the point of view of interaction design, this is rather strange, given that the experiential qualities of technologies are very often hard to describe; in order to understand and design meaningful interfaces, we need all the help we can get from the words we have at our disposal. Since we in the HCI community evaluate, design, or research relations between a user and a technological setup, we must be better at reminding ourselves that we also need to develop the way that we talk about and characterize the nuances of this interaction.

In this paper, we continue the brief statement in [6] and argue that the use of terms such as "natural" is problematic because the terminology highlights qualities that it does not help us understand and explain adequately, obscuring important aspects at the same time. To frame it in the spirit of the *Critical Alternatives* conference, we will first offer a critique and then outline alternatives.

"NATURAL" USER INTERFACES
We specifically wish to criticize the way the term natural is employed to describe user interfaces—an issue that we see not only in marketing, but also in our own work and interaction with colleagues in the field. Even if [13] attempted to dismiss the term in 2010, we nevertheless see university

Gestural Interfaces: A Step Backward In Usability

One step forward, two steps back.

Once again, the usability crisis is upon us. We suspect most of you thought it was over. After all, HCI certainly understands

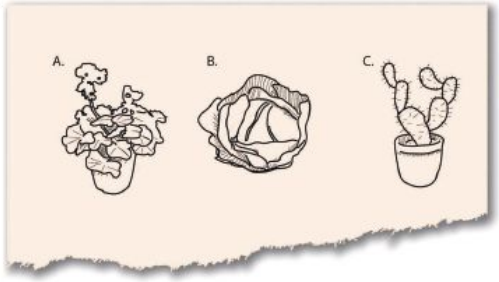
screw things up. Nielsen put it this way: "The first crop of iPad apps revived memories of Web designs from 1993, when Mosaic first introduced the image map

But the place for such experimentation is in the lab. After all, most new ideas fail, and the more radically they depart from previous best practices, the more

The Artificiality of Natural User Interfaces

Toward user-defined gestural interfaces.

CONSIDER THE QUESTION of water needs associated with the vegetation appearing in the accompanying figure: what do you think is the correct answer? Most readers are likely to answer "C." However, findings from a study conducted by Haney and Scott[3] reported there were people that chose B. Why? When they were asked to justify their supposedly wrong answer they explained that, as the cabbage is not in the pot, it means it has been picked and therefore does not need water anymore. What an example of disarming reasoning! In this case, answering B was categorized as incorrect because the test writer, who assigned the correct answer to C, did not predict it.



Which plant needs the least amount of water?

In computer science there are many cases of unexpected use of systems that were unpredictable for their designers. An example is how some users build up large databases in spreadsheet programs because they find them easier to use than regular database programs. The lesson learned

We are accustomed to interact in an environment that inhibits our innate interactive capabilities. In Nicholas Negroponte's words, our connection to computers is "sensory deprived and physically limited." The mouse is the clearest example: a de-

work with it and, despite it being simple for insiders to use, there are many people who feel disoriented by their first encounter with a mouse.

Gestural Interfaces
With gestural interfaces, we strive for

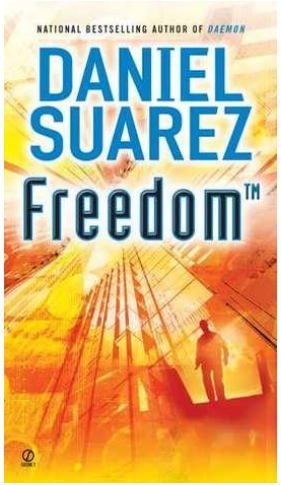
Proposal

Shamanic Interface

Name taken from a book that describes
its idealized concept:

"*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 basic idea (...) is that the creation of a concern-separation layer between the gestures being executed by the users and their interpretation by computing systems can contribute both to the access by users with special needs and to all users in general, by enabling customized approaches to gesture-based control."



Gesture to interrupt Kinect.

Objectives/Goals

Create Tool and Provide Empirical Data and Analysis

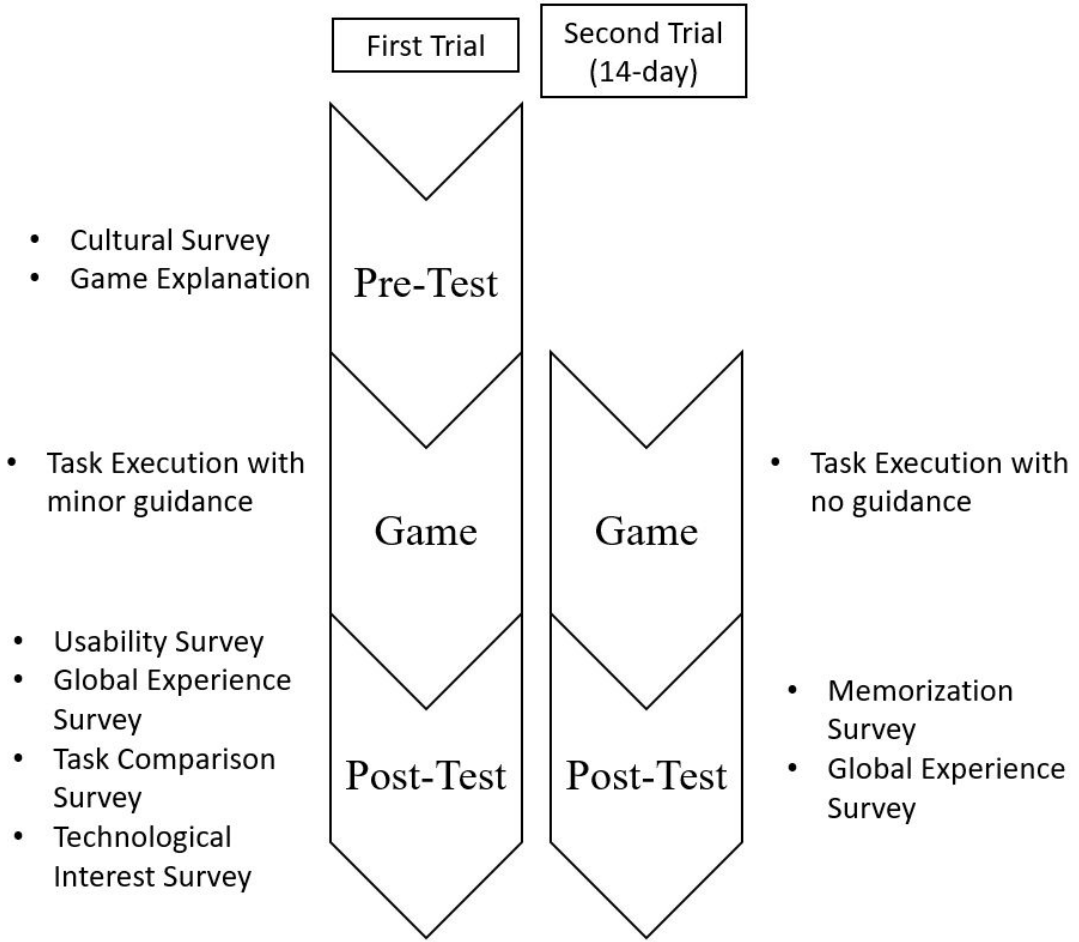
- Focusing on user culture contributes to the Learning Rate and Capacity of commands
- Focusing on user culture contributes to the Retention and Memorization of commands and concepts
- Focusing on user culture contributes to the Satisfaction and Immersion of the experience

User Trials

Performed in a control environment devoid of other people or active equipment.

Seeks to find useful evaluation data of two primary types, observational data and user opinion data.

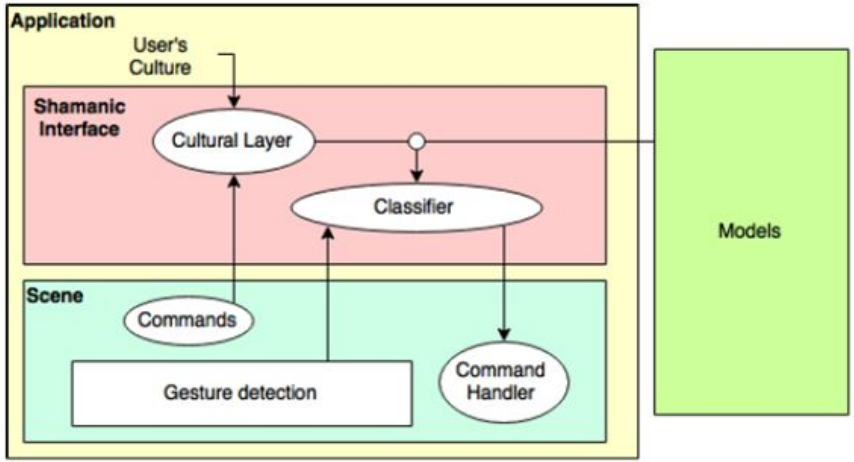
Two trials required due to necessity of evaluating recall and recognition.

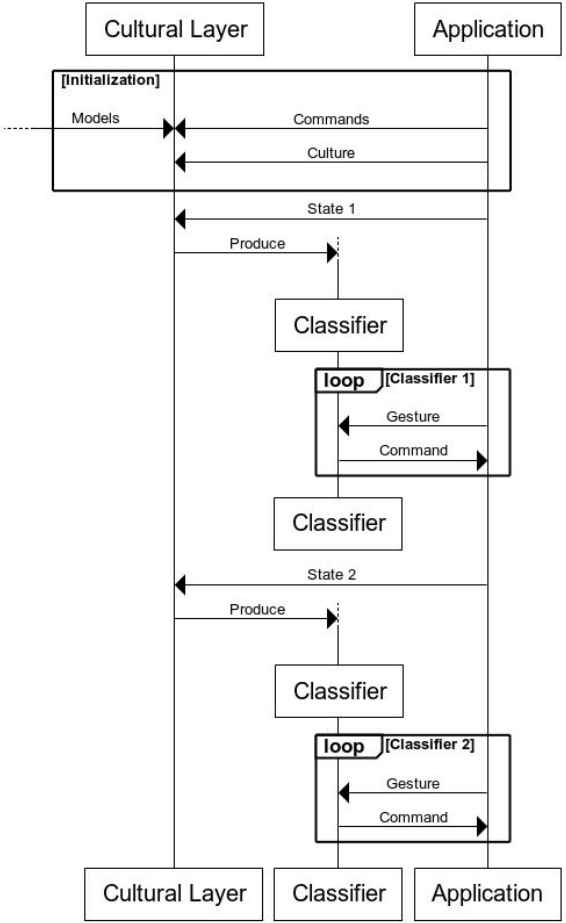


Research Tool based in a Shamanic Interface

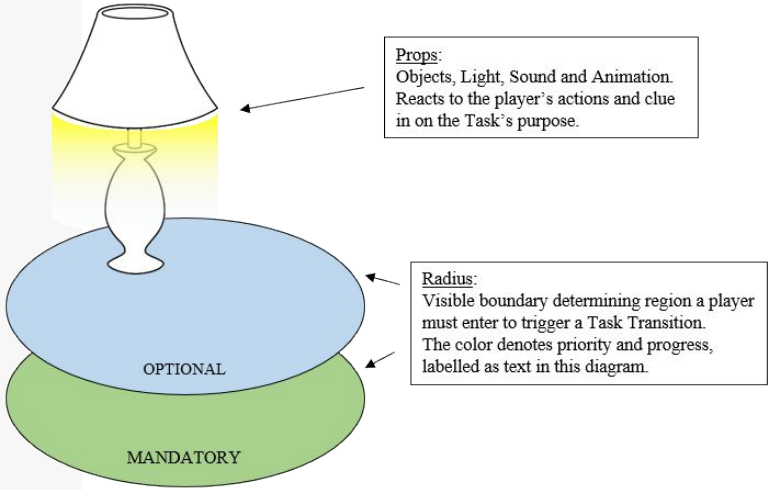
Game running on the Unity Engine, first person perspective, controlled entirely through hand gestures, using a Leap Motion Device

Gestures recorded and stored as Hidden Markov Models, using the Accord.NET Framework.





Culturally Significant Human Gestures: Emblems



In the game, Tasks are completed by performing Emblematic gestures. Users identify the task's priority and its context from its visible elements.

Locality: Common almost everywhere, but less so in Italy.

HAND WAVE (3)

Meaning: Hallo or goodbye.

Action: The hand is waved in the air but the palm is hidden from the companion. The movement of the hand is similar to the one used when embracing someone or patting them on the back.

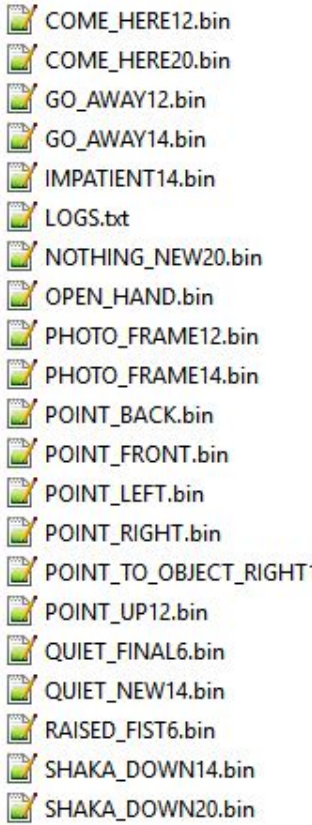
Background: This is the 'Italian Wave' and has a different origin, being derived from the act of hugging a companion and patting them on the back. The person waving in this way is performing a 'vacuum embrace'. In ordinary usage, the movements are usually fast, but a slowed down version is employed by the Pope when waving from his balcony. He uses the wave to symbolically embrace his flock.

Locality: Italy, including Sicily and Sardinia. Outside Italian territories it is rare, but may be seen in certain special contexts, such as the British Royal Wave on ceremonial occasions.

HAND 'WRITE'

Meaning: Please bring me the bill.

Action: The hand is held up towards a waiter and then mimes the act of writing.

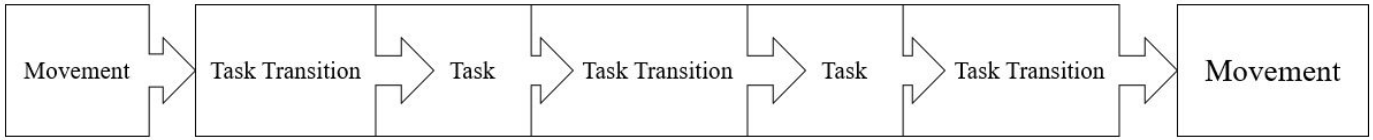


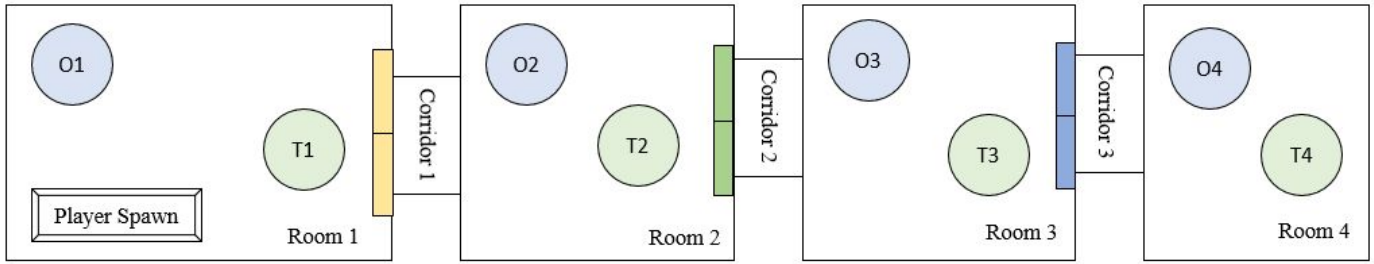
Culturally Significant Human Gestures: Emblems

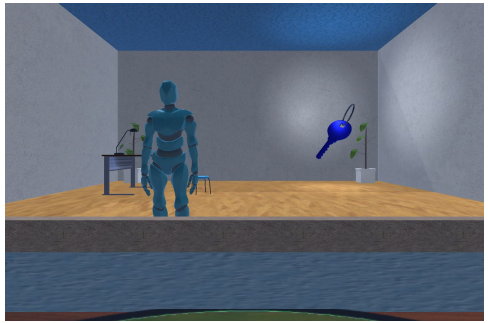
Sigle	Task	Cultural Group	Non-Cultural Group
M1	Move Forwards	Point Forwards (Index)	
	Move Backwards	Point Backwards (Thumb)	
	Turn Left	Point Left (Thumb)	
	Turn Right	Point Right (Thumb)	
T1	Call to Come Close	Closing a hooked Index	Wave
T2	Display Impatience at delay	Look at opposing wrist	Open hand forward
T3	Call for Help	Wave / Raise Index	Thumbs Up
	Direct Towards Object	Point At	Pointing, Finger gun style
T4	Celebrate Victory	Raising Fist Pump	Thumbs Up
O1	Silence	Index Over Lips	Thumbs Down
O2	Frame Photo of a flower	Square Corners with indexes and thumbs	Pinching the imaginary flower
O3	Pick Telephone	The "Shaka" hand	Raise hooked Index upwards
O4	Shoo Away	Strike air from inwards to outwards	Wave

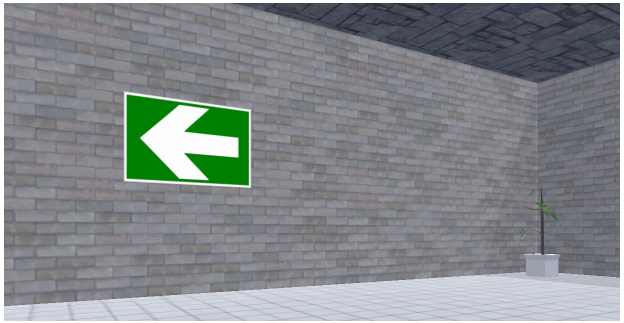
Cultural and Non-Cultural Groups differ in gesture set. The Cultural Group receives the expected, well-fit Emblems corresponding to the Task's expectations. The Non-Cultural Group receives meaningful, yet not first choice, gestures appropriate for the Task objective, yet not apt to communicate the Task's context.

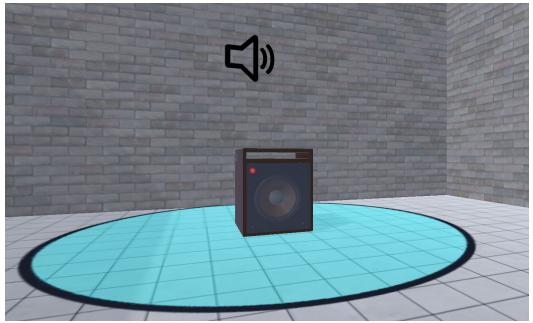
Game


Movement
Task Transition
Task
Task Transition
Task
Task Transition
Movement


O1
T1
Player Spawn
Room 1
Corridor 1
O2
T2
Room 2
Corridor 2
O3
T3
Room 3
Corridor 3
O4
T4
Room 4







Sample, Pre-test Cultural Validation

17 volunteers, aged 18 to 24, randomly distributed between the groups.

All of portuguese culture.

All student of University of Porto, but of varied faculties.

None had first-hand experience with the technology.

One drop-out after first trial.
One potential outlier in Non-Cultural Group.

	O1	T1	O2	T2	O3	T3.1	T3.2	O4	T4
V1	Y	Y	N	N	Y	N	Y	Y	Y
V2	Y	Y	N	Y	Y	Y	Y	Y	Y
V3	Y	Y	Y	N	Y	Y	Y	Y	N
V4	N	Y	N	Y	Y	Y	Y	Y	Y
V5	Y	Y	N	Y	Y	Y	Y	Y	Y
V6	Y	Y	N	N	Y	N	Y	Y	Y
V7	N	Y	N	N	Y	Y	Y	Y	Y
V8	Y	Y	N	N	Y	Y	Y	Y	Y
V9	Y	Y	N	N	Y	N	Y	Y	Y
V10	Y	Y	N	N	Y	N	Y	Y	Y
V11	Y	Y	N	N	Y	Y	Y	Y	Y
V12	Y	Y	N	N	Y	N	Y	Y	Y
V13	Y	Y	N	N	Y	Y	Y	N	Y
V14	Y	Y	N	N	Y	Y	Y	Y	Y
V15	Y	Y	N	N	N	N	Y	Y	Y
V16	Y	Y	N	N	Y	Y	Y	Y	Y
V17	Y	Y	N	N	Y	Y	Y	Y	N

Results

- Task Execution with minor guidance

Learning Rate and Capacity

On the first game, the Cultural Group had a significantly higher performance observation versus the Non-Cultural.

The majority of the Non-Cultural Group have rejected or found issues with more than one of the tasks prior to completion.

Most of the Non-Cultural Group volunteers required a reminder of the Gesture Set during the Task Comparison Survey. Two requested to keep the explanation sheets and were denied.

Cultural	O1	T1	O3	T3.1	T3.2	O4	T4
errors	2	0	0	0	0	0	0
failures	1	0	0	0	0	0	0

Non-Cultural	O1	T1	O3	T3.1	T3.2	O4	T4
errors	7	1	3	5	6	2	2
failures	3	1	3	2	1	1	1

Cultural Group	O1	T1	O2	T2	O3	T3.1	T3.2	O4	T4
V1	Y	Y	Y	Y	Y	Y	Y	Y	Y
V3	Y	Y	Y	Y	Y	Y	Y	Y	Y
V5	Y	Y	Y	Y	Y	Y	Y	Y	Y
V6	Y	Y	Y	Y	Y	Y	Y	Y	Y
V9	Y	Y	Y	Y	Y	Y	Y	Y	Y
V11	Y	Y	N	Y	Y	Y	Y	Y	Y
V13	Y	Y	Y	Y	Y	Y	Y	Y	Y
V15	Y	Y	Y	Y	Y	Y	Y	Y	Y
V17	Y	Y	Y	Y	Y	Y	Y	Y	Y

Non-Cultural Group	O1	T1	O2	T2	O3	T3.1	T3.2	O4	T4
V2	Y	Y	N	Y	Y	Y	Y	Y	Y
V4	N	Y	Y	Y	N	Y	Y	Y	Y
V7	Y	N	N	Y	Y	Y	N	Y	Y
V8	N	Y	N	Y	Y	Y	Y	Y	Y
V10	Y	Y	N	Y	N	Y	Y	Y	Y
V12	Y	N	N	Y	Y	N	N	Y	Y
V14	Y	Y	N	Y	N	Y	Y	Y	Y
V16	Y	Y	N	Y	Y	Y	Y	N	Y

Results

- Task Execution with no guidance

Retention and Memorization

After a long time without experiencing the game, the Cultural Group managed to maintain their performances.

The Non-Cultural Group ended up showcasing a worse performance with further errors and failures.

The majority of user error committed by the Non-Cultural Group was related to performing the wrong gestural command. The majority of these, in turn, involved using Gestures

Both groups requested a similar amount of help, and reported similar levels of confidence. However, the Non-Cultural Group's certainties can be applied to as misplaced (Wrongful Recognition).

Cultural	O1	T1	O3	T3.1	T3.2	O4	T4
error	0	2	2	0	0	0	0
failure	0	0	0	0	0	0	0

Non-Cultural	O1	T1	O3	T3.1	T3.2	O4	T4
error	6	5	8	7	5	5	1
failure	3	2	6	5	3	5	1

	O1	T1	O3	T3.1	T3.2	O4	T4
Total Mistakes	6	5	8	7	5	5	1
Gestural Mistakes	6	4	3	5	4	5	1
Emblematic Substitutions	6	3	2	5	4	5	1
External Emblematic Substitutions	2	1	2	5	4	3	1

	Natural	Difficult
Cultural	91.4%	74.7%
Non-Cultural	71.9%	64.4%

Results

- Usability Survey
- Global Experience Survey

Satisfaction and Immersion

Usability parameterized by System Usability Scale demonstrably indicates that the Cultural Group felt more assuredness and satisfied with their experience.

Global Experience survey of achievement, comfort, sharing and immersiveness indicators have not yielded significant evidence to support a difference between the groups.

Cultural	SUS Score
V1	87.5
V3	80
V5	90
V6	85
V9	90
V11	87.5
V13	85
V15	85
V17	92.5

Cultural Group	score
Emotional Impact	43.75
Internal Expectations	37.50
Self-Consciousness	47.92
External Expectations and Sharing	43.75
Recall and Recognition	43.75
Enjoyment and Repeatability	43.75
Subjective Sense of Comfort	43.75
Technological and Methodological Impact	40.63
Symbolic Feedback and Sense Making	37.81

Total
382.60

Mean
42.51

Std Deviation
3.31

Non-Cultural	SUS Score
V2	65
V4	77.5
V7	72.5
V8	80
V10	80
V12	87.5
V14	65
V16	75

Non-Cultural Group	score
Emotional Impact	50.00
Internal Expectations	28.13
Self-Consciousness	45.83
External Expectations and Sharing	43.75
Recall and Recognition	24.31
Enjoyment and Repeatability	46.88
Subjective Sense of Comfort	47.92
Technological and Methodological Impact	34.38
Symbolic Feedback and Sense Making	21.41

Total
342.59

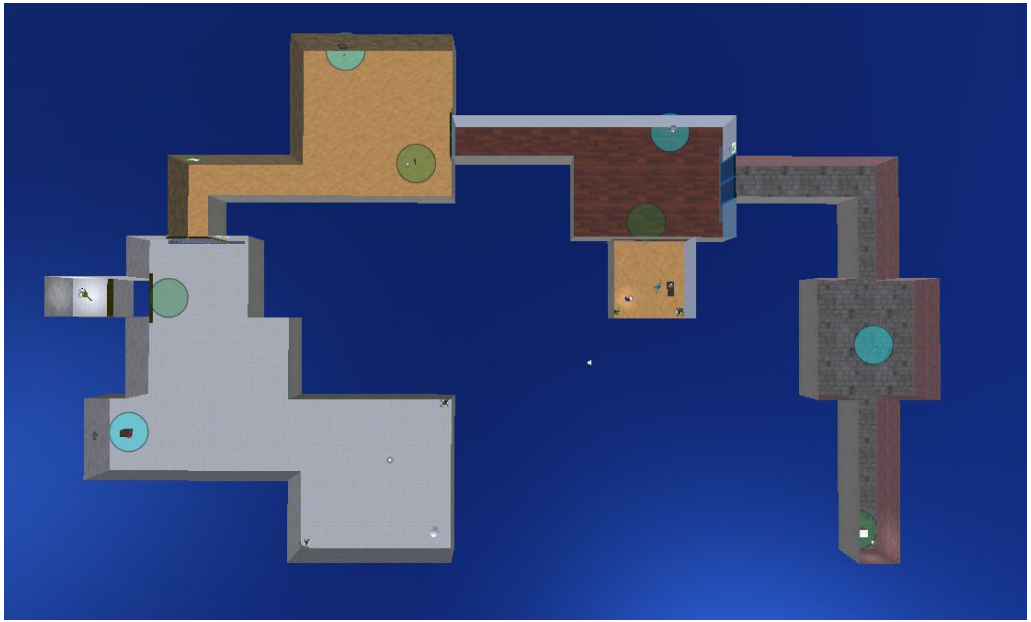
Mean
38.07

Std Deviation
11.12

Future Work - Investigate using a Shamanic Interface Application:

- Focusing on contributes to attainability of higher Richness and Depth of interaction.
- Focusing on user cultural leads to higher discoverability of uninstructed gestural commands.
- Verify Technological Interest (or potential other factors) as a mitigator of cultural impact.
- Usage of more immersive technology and higher focus on affective virtual environments towards improved memorability.

Thank You!



https://youtu.be/zrCoV-caw4w