Studying Different Methods of Providing Input to a Collaborative Interactive Museum Exhibit Using Mobile Devices

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Motivation & Goals

Museums receive hundreds of thousands of visitors every year, and the mobile devices they carry with them expand the range possibilties for museum exhibit design.

We wish to design interactive exhibits that take advantage of the presence of these devices to help museum exhibits "scale up" to support variable-sized groups of visitors and to suport collaborative interactions within those groups.

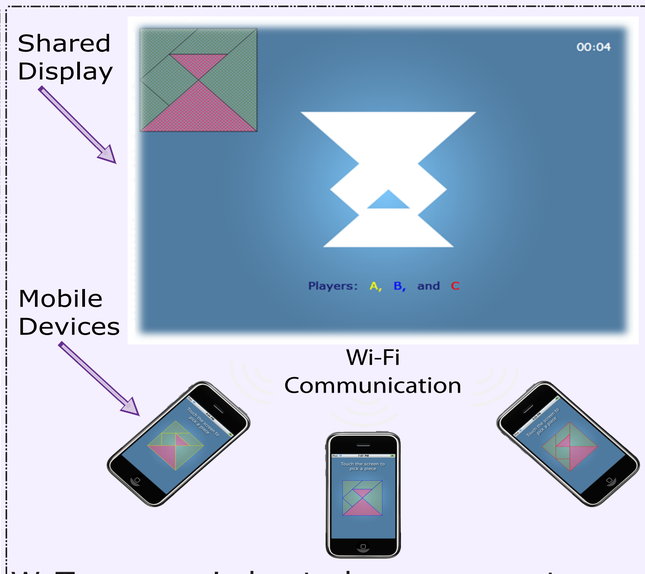
The choice of user input methods can impact learnability and sociability, so our research project, WeTangram, aims to evaluate three different approaches to providing input to an interactive exhibit via mobile devices, investigating three areas.

(1) The learnability of tested interfaces

(2) The impact of the input method on sociability and joint efforts to achieve a common goals

(3) The feasibility of input method for use in museum exhibits

Application Overview



WeTangram, is an application based on the physical Tangram puzzle. We chose this as a test case because it has few rules to learn, but requires a full range of 2-D movement: both translations and rotations.

WeTangram, is hosted on a computer hidden in an exhibit presented on shared display.
Once all of the participants are connected with the exhibit and identified using a nickname and a color, they will attempt to complete a tangram shape in the least possible time.
Each participant can move or rotate only 1 piece at atime from the set of 7 pieces via the mobile device.

Experimental Conditions

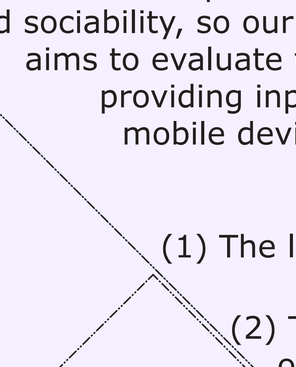
Participants

For this study, we recruited 30 individuals from UIC as 10 groups of 3 people.
The participants had to be active users of touch screen mobile devices to ensure they were familiarized with the use of them.

This experiment evaluated three different input styles for an iPod Touch/iPhone interface to a shared museum exhibit:

Directional_KeyPad

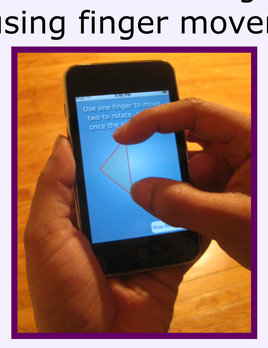
It displays directional keys on the mobile device screen for users to move or rotate a tangram piece.



K

Multi_Touch

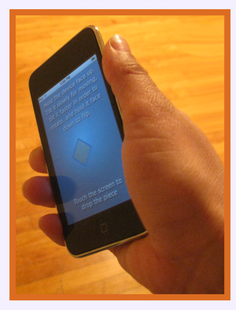
It allows users to move and rotate tangram pieces using finger movements.



M

Device_Tilt

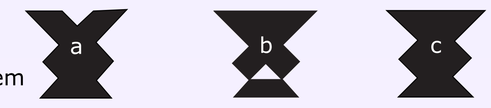
It allows users to move and rotate tangram pieces by tilting the device.



T

Because we used a repeated-measures experiment design, we used paradoxical tangram problems: seemingly-identical tangram figures. They are of roughly similar difficulty levels, but solving one puzzle will not help one know how to solve the others.

Figure 1. Paradoxical Tangram Problem



Procedure

Groups were given instructions and asked to answer a pre-study questionnaire. Following this, each group tested the application using the three different input styles and three different paradoxical tangram shapes.
To balance the practice effect, we used an incomplete repeated measures design, rotating the orderings for the input interface styles and the tangram silhouettes using the Latin Square technique as shown in Table 1. In each group, after the three trials were completed, every participant individually filled out a post-questionnaire.

Table 1. List of conditions that were tested. (K) Directional_KeyPad, (M) Multi_Touch, and (T) Device_Tilt. a, b, & c represent the Paradoxical Tangram problem depicted in Fig 1.

Participants	1st Trial	2nd Trial	3rd Trial
Group 1	Ka	Mb	Tc
Group 2	Ta	Kb	Mc
Group 3	Ma	Tb	Kc
Group 4	Kc	Ma	Tb
Group 5	Tc	Ka	Mb
Group 6	Mc	Ta	Kb
Group 7	Kb	Mc	Ta
Group 8	Tb	Kc	Ma
Group 9	Mb	Tc	Ka
Group 10	Ka	Mb	Tc

Evidence

(1) Learnability

We collected subjective reflections.

Gathered subjective reflections using a Likert scale in a post-questionnaire

(2) Sociability & Collaboration

We videotaped participants behavior.

Counted the # of speaking turns (Amount of Verbal Communication) & Compute the Distribution of Conversation & Gathered subjective reflections using a Likert post-questionnaire

(3) Museum Feasibility

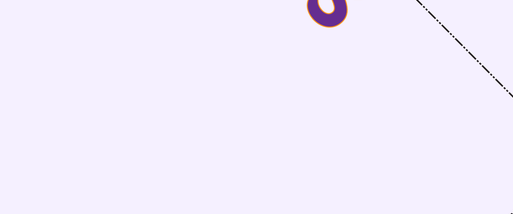
We logged data.

Total Solution Time & Gathered subjective enjoyment ratings using a Likert post-questionnaire

Results of the Study

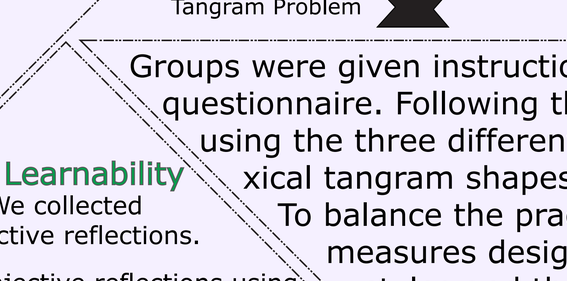
Learnability

Ranking in terms of Ease of learning.

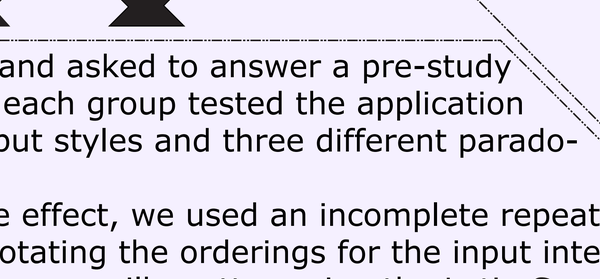


Directional_KeyPad Multi_touch Device_Tilt

Interface is useful to move a Tangram piece.

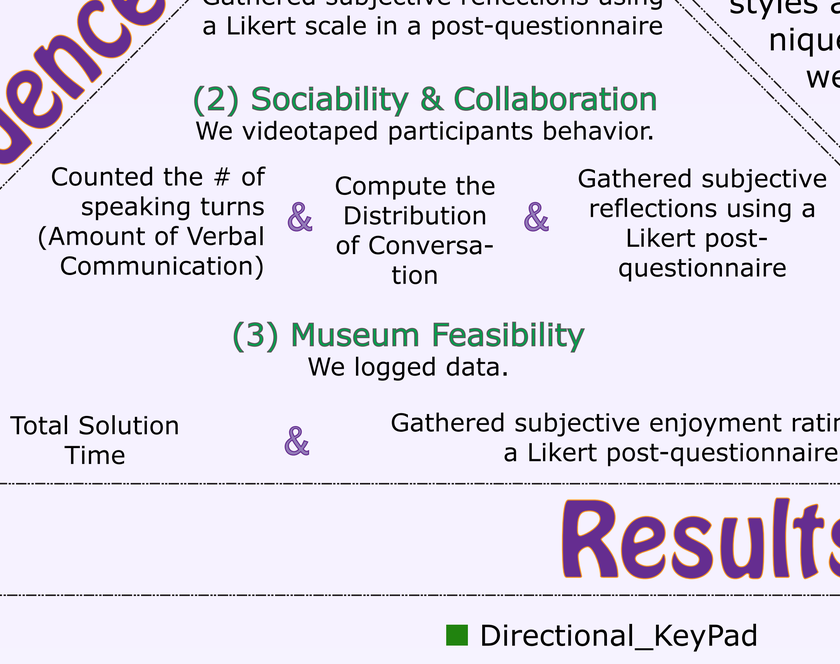


Interface is useful to rotate a Tangram piece.

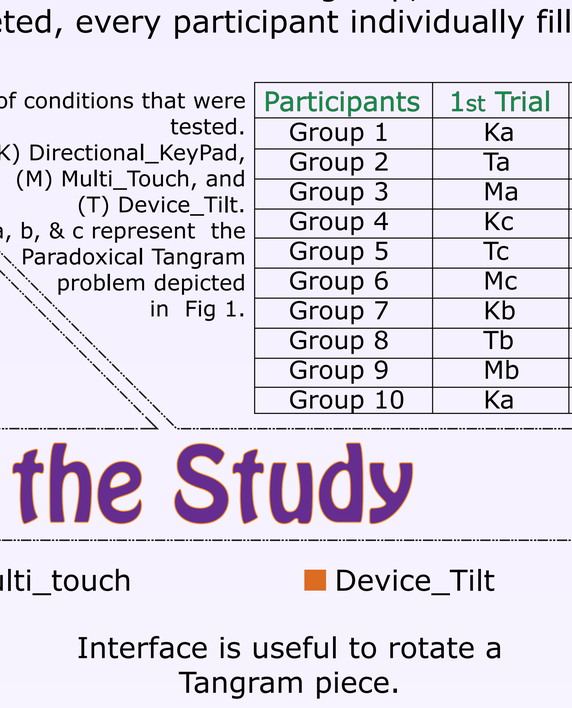


Ranking in terms of Ease of use.

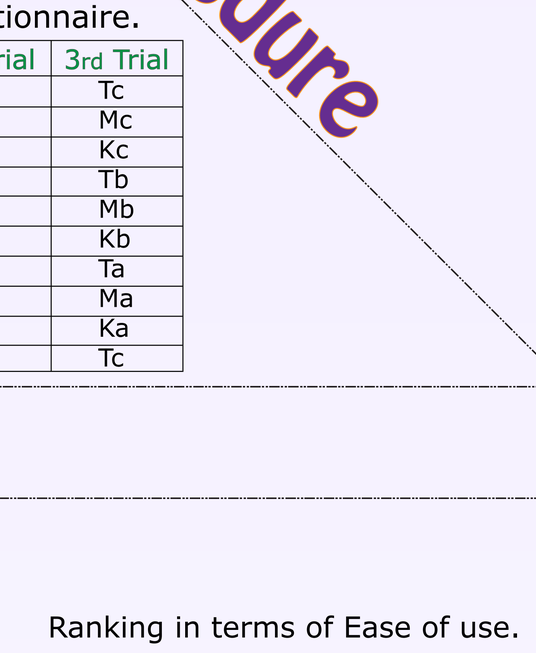
Museum Feasibility



Ranking in terms of enjoyment.



Ranking in terms of preference to use to control a museum exhibit.



Sociability & Collaboration

R/M = Remarks per minute.

Average R/M	Directional_KeyPad		Multi_Touch		Device_Tilt	
	AVG	DS	AVG	DS	AVG	DS
Overall Talk R/M	5.53	2.71	4.78	1.64	4.76	2.36
On Task Talk R/M	4.75	2.30	4.27	1.77	3.92	2.06
Interface Talk R/M	0.15	0.22	0.76	1.13	0.91	1.21
Solve problem Talk R/M	4.61	2.17	3.51	1.49	3.01	2.10

Acknowledgements

We would like to thank the members of the LTG Lab for their opinions and suggestions while designing WeTangram application and for their help in conducting these experiments.