Open exhibits

Research Report: General Table Use
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Executive Summary

This reports details the findings of an investigation in the use of multitouch tables, including attraction, stay time, and use of the collections in conjunction with the tables. The research was done as part of the *Open Exhibits* project, a National Science Foundation funded project (#1010028) designed to develop, test, and disseminate a suite of original, open source, multitouch-enabled, exhibit software. The project goal was to transform the ability of museum professionals to assemble interactive computer-based exhibits for use in museums under the leadership of Principal Investigator Jim Spadaccini, Founder/CEO and Creative Director of Ideum, Inc., a company that develops commercial software and multitouch hardware primarily for museums and other public spaces.

The *Open Exhibits* project includes hardware and software development, an online community of practice, and research studies aimed at understanding the impact of multitouch technology in museum exhibitions.

KEY FINDINGS

How often do visitors use multitouch tables? While Ideum and others have been producing multitouch tables since 2008-2009, data collection for Open Exhibits research suggests that the tables are still novel to most museum visitors. During interviews from the late fall of 2012 in Albuquerque, most visitors (73-82%) had not seen a multitouch table previously. These rates are similar to other first-use rates at small-to-medium sized museums in small to medium population areas.

One of the questions within our research was whether having a table in the galleries impacts the amount of attention and the amount of time spent on other elements. In each of the galleries we studied, the multitouch table was not the most 'popular' object in the gallery, that was always an element of the collection. For instance, in the New Mexico Museum of Natural History and Science, over 86% of the visitors spent time with the Stegomastodon jaw, and roughly 63% used the multitouch table.

The stay time in each of the galleries was longer for the table than any other object in the galleries, averaging about 2 minutes at each site. While we've observed longer stay times at other multitouch tables, those tables tend to have more content or directed interactives than the collections-based content currently on the Open Exhibits tables.

We measured social interaction at each of the sites using a variety of behavior and verbal indicator, such as 'makes positive statements about surface technology' or 'emotionally reacts to exhibit'. Social interaction cues for visitor groups varied widely by site. At the Indian Pueblo Cultural Center, where the

table primarily controls access to short videos, 25% of the visitor groups had some form of social interaction. In comparison, at NMMNHS 80% of the visitor groups showed some form of social interaction.

Methodology

Between September 29, 2012 and January 6, 2013 data was collected from museum visitors in exhibition spaces that contained Ideum Multitouch (MT) tables with Open Exhibits (OE) software. Timing and tracking, focused observation, and semi-structured interview data was collected by one evaluator at Indian Pueblo Cultural Center (IPCC), Maxwell Museum of Anthropology (Maxwell), and New Mexico Museum of Natural History and Science (NMMNHS).

Visitors ages 7-85 were eligible to be observed and interviewed. The researcher recruited participants using a continuous random sampling method by imagining a line at the entrance of the exhibition and asking the next eligible visitor who crossed the line to participate in the research study. Once a visitor agreed and signed the consent form, the researcher started her stopwatch and unobtrusively followed the selected visitor through the exhibition, recording the path he/she took through the space as well as the time spent at the various exhibit elements. Detailed behavioral observations were made at the MT table, if applicable. When the visitor completed his or her visit, the researcher conducted a brief semi-structured interview, which concluded the visitor's participation in the study. The researcher then returned to the entrance to wait for the next eligible visitor to cross the imaginary line.

General Summary

Sample

Data was collected from a total of 91 visitors (see Table 1 for demographics). No refusal logs were kept.

The age range of participants at all three museums was similar, but the median age of participants at NMMNHS was younger. This is not surprising since some of NMMNHS's displays and programming are specifically geared toward child audiences.

While there was some racial/ethnic diversity among participants, most self-identified as Non-Hispanic White.

Table 1: Demographics

	N	Sex (F/M)	Age (Min/Max)	Median Age	Race/Ethnicity (White)
IPCC	30	53.3% (n=16)/ 46.7% (n=14)	9/74	57	66.7% (n=20)
Maxwell	29	55.2% (n=16)/ 44.8% (n=13)	10/75	57	79.3% (n=23)
NMMNHS	32	65.6% (n=21)/ 34.4% (n=11)	8/76	21	59.4% (n=19)

MT Table Use

Most participants had not used a MT table before (73.3% at IPCC, 82.8% at Maxwell, 81.3% at NMMNHS), and characteristics of table use varied by museum (see Table 2).

Table 2: MT Table Use

	N	Median Time	Exhibited

		(mm:ss)	Social Behavior
IPCC	40% (n=12)	1:52	25% (n=3)
Maxwell	72.4% (n=21)	2:30	66.7% (n=14)
NMMNHS	62.5% (n=20)	2:04	80% (n=16)

INDIAN PUEBLO CULTURAL CENTER

Introduction

The MT table at IPCC was located in an exhibition entitled *100 Years of State & Federal Policy: The Impact on Pueblo Nations*. The exhibition is comprised of two rooms divided by a partial wall; a small gallery in front and a larger gallery in the back. There is only one entrance to this exhibition, and it is located in the small gallery; a visitor may enter the back gallery from either side of the partial wall. The focus of this research study was the front room where the MT table was located, up against the partial wall (see Figure 1).

On the MT table were 12 dual-sided virtual cards which contained an image on one side and text on the other. They could be turned over by pressing a virtual (*i*) button on the card. Several of the cards also had a virtual play (▶) button that would cause a video to start playing on the monitor located on the wall directly behind the table.

Fig 1: MT Table at IPCC

Sample

Data was collected from 30 visitors. Females accounted for 53.3% (n=16) of the observations/interviews, and males accounted for the remaining 46.7% (n=14).

Participants' ages (estimated from year of birth) ranged from 9 to 74. The median age was 57.

Participants visited the museum in groups that ranged from 0 to 18 other people. The median number of companions was 1, and 93.22% (n=55) of companions were at least 18 years of age or older.

There was some racial/ethnic diversity in the sample, but the majority of participants were White (66.7%, n=20) (see Table 2).

Table 2: IPCC Sample Race/Ethnicity

	N=30*
White	66.7% (n=20)
African American/Black	6.7% (n=2)
Asian / Asian American	6.7% (n=2)
Latino(a) or Hispanic	6.7% (n=2)
American Indian/Native Alaskan	3.3% (n=1)
Multiple ethnicities	3.3% (n=1)
Prefer not to answer	3.3% (n=1)

**Missing (n=1, 3.3%)*

The majority of participants had not visited IPCC before (66.7%, n=20). Among those who had visited before (30.0%, n=9), the median number of visits in the last year was 1.

Participants were asked to indicate how often they visited museums, zoos, or aquariums, and most reported visiting monthly or 3-5 times a year (see Table 3). Therefore, most participants visited informal learning institutions with some regularity.

Table 3: Museum, zoo, or aquarium visit frequency

	N=30*
First time	0
Monthly	33.3% (n=10)
3-5 times a year	36.7% (n=11)
Once a year	13.3% (n=4)
Less than once a year	13.3% (n=4)

**Missing (n=1, 3.3%)*

Timing & Tracking

Sometimes participants traveled through the exhibition with companions, and at other times they explored independently. All but one of the participants (96.67%, n=29) walked in a path around the perimeter of exhibition. The other participant traveled a more winding path. A little over half of the participants (56.67%, n=17) walked mostly in a counterclockwise direction, while 33.33% (n=10) walked in a mostly clockwise direction.

The total time spent in the exhibition ranged from 8 minutes and 30 seconds to 48 minutes and 12 seconds; the median amount of time spent was 18 minutes and 4 seconds. Generally, participants spent a larger proportion of their time in the back gallery which did not contain the MT Table. This is unsurprising since that room is larger and contains more elements to attend to than does the front room. The front gallery contained 9 distinct elements to attend to, including the MT Table (see Table 4).

Table 4: Summary of Visitor Behavior*

	Minimum	Maximum	Median
Total time spent in exhibition (mm:ss)	08:30	48:12	18:04
Time spent in back gallery (mm:ss)	00:00	36:39	14:22
Time spent in MT Table gallery (mm:ss)	00:38	13:51	05:42
Number of elements attended to in MT table gallery (out of 9)	1	9	5
Percentage of elements attended to in MT table gallery	11.1%	100%	55.6%
Percentage of total time spent attending to elements in MT table gallery	3.3%	89.8%	23.1%

** This does not include Ps who only looked at MT table, but did not use (n=1)*

All 9 elements were attended to by at least one participant (see Tables 5 and 6). The only interactive element was the MT table. See Figure X for a visual representation.

Table 5: Percentage of Visitors Attending to Each Element

	Percent Attending
Sovereignty Wall	86.7%
Language Wall*	70%
Health and Wellness Wall	66.7%
Introduction Wall*	60%
Display Case 2 (1 pot) with Wall Panel	53.3%
Esther Martinez Memorial*	50%
Display Case 1 (3 pots)	46.7%
Multitouch Table with Wall Screen†	40%
Central Banner	30%

**Due to their close proximity, there was some overlap in attending to these elements. The visitor was recorded as attending to only one primary element in these cases.*

†This does not include Ps who only looked at MT table, but did not use (n=1)

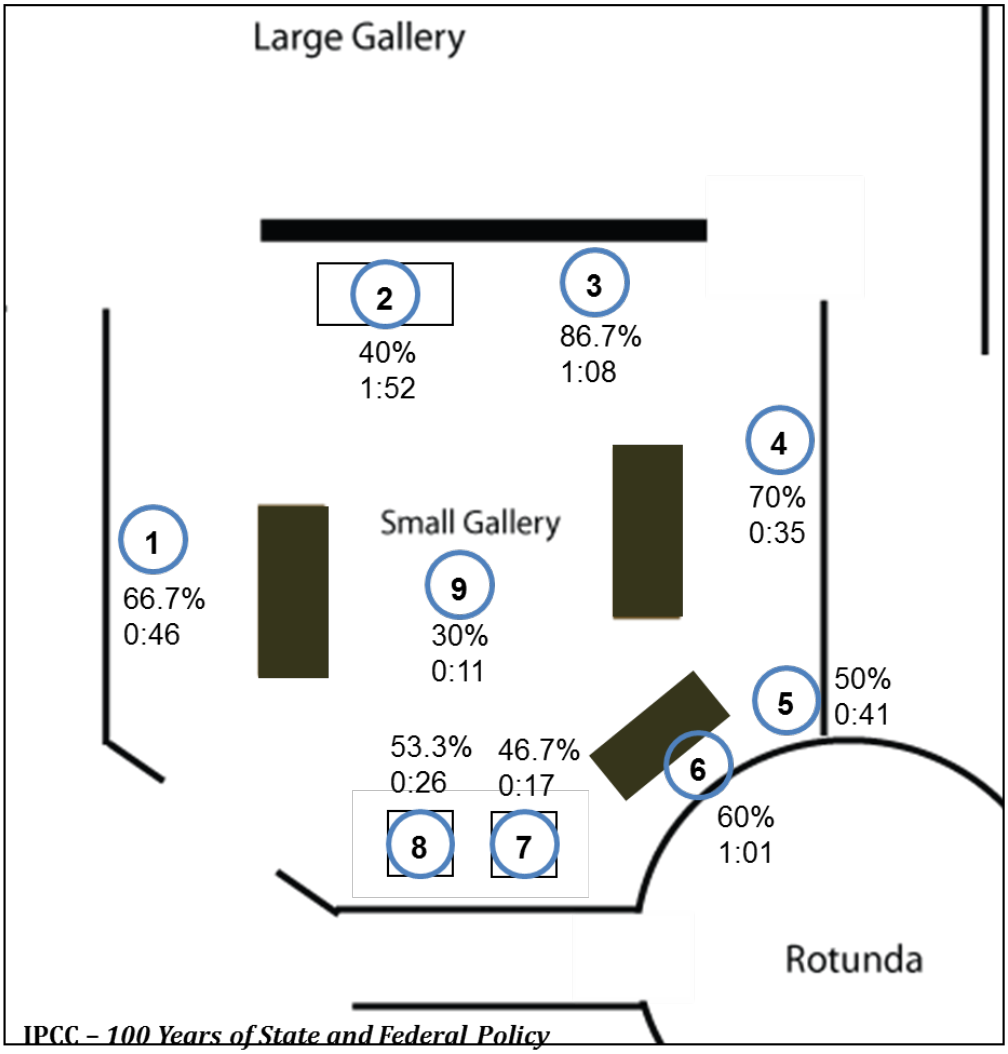
Table 6: Median Time Spent by Visitors Attending to Each Element

	Median (m:ss)
Multitouch Table with Wall Screen†	1:52
Sovereignty Wall	1:08
Introduction Wall*	1:01
Health and Wellness Wall	0:46
Esther Martinez Memorial*	0:41
Language Wall*	0:35
Display Case 2 (1 pot) with Wall Panel	0:26
Display Case 1 (3 pots)	0:17
Central Banner	0:11

**Due to their close proximity, there was some overlap in attending to these elements. The time recorded was for one primary element in these cases.*

† This does not include Ps who only looked at MT table, but did not use (n=1)

Figure X: Visitation of Elements at IPCC



Key	
1	Health and Wellness Wall
2	MultiTouch Table with Wall Screen
3	Sovereignty Wall
4	Language Wall (with video screen)
5	Esther Martinez memorial
6	Introduction Wall
7	Display Case 1 (3 pots)
8	Display Case 2 (1 pot) with Wall Panel
9	Central Banner
___% = Percentage of visitors attending to element	
__:__ = Median stop time	

MT Table Use

Most participants had not used a MT touch table before (73.3%, n=22), and only 22.7% (n=5) of those had ever even seen one before.

Less than half of the participants used the MT table during the observation period (40%, n=12). Those who did not use the table where asked why they were not attracted to it. The majority of them indicated that they had not noticed the MT table. Those who did use the MT table were asked why they were attracted to it, and no clear majority answer was given (see Table 7).

Table 7: Table Attraction*

Why Not Attracted	n=18	Why Attracted	n=11
Did not notice table	66.7% (n=12)	**Curiosity/Novelty**	45.5% (n=5)
Not interested in video/technology	16.7% (n=3)	**It was an interactive display**	36.4% (n=4)
Did not realize it was touch screen	11.1% (n=2)	**It was the next thing in my path**	18.2% (n=2)
Another visitor was using it	5.6% (n=1)		

**Missing (n=1)*

Time spent using the table ranged from 1 minute to 4 minutes and 48 seconds. The median time was 1 minute and 52 seconds. One participant visited the table twice, while all the other participants who visited the table did so only once.

Participants found the table content to be slightly interesting (Mean=5.38) on a scale from 1 (not very interesting) to 7 (very interesting).

Focused observations of participants using the MT table were made for a variety of social and non-social behaviors. Of those who used the MT table, 25% (n=3) engaged in at least one social behavior. A breakdown of the number of participants who engaged in specific behaviors is as follows:

Nonsocial Behaviors	N	Social Behaviors	N
Emotionally reacts to exhibit: Positive (smiles, laughs, etc.)	25% (n=3)	**Calls attention to/ points at content in exhibit**	8.3% (n=1)
Emotionally reacts to exhibit: Negative (frustration, disappointment, etc.)	8.3% (n=1)	**Calls attention to/ points at technology in exhibit**	0
Moves objects around for fun (drag, twirl, toss, resizing, etc.) (P1)	33.3% (n=4)	**Reads aloud to another person**	0
Turns item over (photo to text or vice versa)	41.7% (n=5)	**Makes positive statements about surface technology**	0
Resizes an item (i.e., makes bigger or smaller)	0	**Makes negative statements about surface technology**	0
Watches a video	75% (n=9)	**Watches another visitor use the surface**	16.7% (n=2)
Plays a video (i.e., press video button)	75% (n=9)	**Helps/assists/instructs (how to use, do something)**	0
Makes connection between surface content and the overall exhibition	0	**Discusses a concept (facilitate learning)**	0
		Interacts with visitor outside the group	8.3% (n=1)

[N=12]

After the observation period, participants who used the MT table were asked about their experience doing so (n=10; 2 visitors discontinued participation).

Participants were asked what they found surprising about the MT table, and the majority indicated that nothing about it surprised them (70%, n=7). The others (30%, n=3) referenced table technology:

- *That it moved. That there's a magnifying glass thing.*

- *Yes. I wasn't sure what to do with it. Then I touched it and saw picture. It's really cool.*
- *How you could move things around. It was basic, simple, easy to figure out, intuitive.*

When asked what they enjoyed most about the MT table, the majority of respondents (70%, n=7) mentioned table technology/functionality. Some examples are as follows:

- *You could see the pictures, and then use the 'i' [info] button to read more about the ones you wanted.*
- *It had half a dozen items. It wasn't too cluttered. Enough variety, but limited. So it wasn't too many choices. It was neat, new technology.*
- *The ability to select things to look at in a non-serial fashion.*

Respondents were also asked if they found anything confusing about the MT Table. The majority of respondents (60%, n=6) reporting that nothing was confusing about the table. One person (10%) replied "Don't know", and the rest (30%, n=3) were confused about how to use the table:

- *It's hard to know if I missed anything because things are overlayed and hidden.*
- *It didn't seem to respond properly. Maybe I didn't really understand how to work it [e.g., the buttons].*
- *Initially, just getting used to it, comfortable [with the gestures, controls, etc.].*

When given the opportunity to suggest improvements to the MT Table, participants often provided answers that could be categorized into more than category. As such, the following percentages total more than 100%. One person (10%) responded "Don't know", and 30% (n=3) suggested providing instructions on how to use the MT Table. Some people (40%, n=4) suggested technology that they didn't realize was already available on the table such as zooming and rotating items. Half (50%, n=5) of the respondents suggested changes to the amount or organization of content. Examples include:

- *Maybe different categories of information. Maybe a history section, or a timeline, something to separate the different subjects. It seemed like random photos put together. I wasn't sure what was what.*
- *Maybe if there was an index or something that didn't move that you could use to go to an item scattered on the desk.*
- *Maybe more things to hit and page through. More items on the table.*

When asked about what questions they would ask the developer of the table if given the opportunity, again some respondents' answers fell into more than one category. Also, no clear majority emerged. Some respondents (40%, n=4) wondered why the particular content and amount of content was chosen. Others (30%, n=3) inquired about the technology, didn't have any questions (30%, n=3), or wanted to know where the inspiration for the display came from (20%, n=2).

Finally, participants were asked whether there was a main message to the content on the table. Some respondents weren't sure (40%, n=4); half of the remaining respondents (30%, n=3) thought that there was, and the other half (30%, n=3) thought that there was not a main message to the table content. Examples of explanations are as follows:

- Not Sure
    - *I wasn't here long enough to judge*
    - *I didn't spend a lot of time on it. Preservation of languages?*
- Yes

    - *About history, Indian history.*
    - *Along with everything else in here, rights and self-determination of Native Americans*
- No
    - *Didn't see one. It seemed to be individual interviews, getting to know individuals on a personal level.*
    - *I just saw old, bringing it up to current, 1700-current, Indian history items.*

MAXWELL MUSEUM OF ANTHROPOLOGY

Introduction

The MT table at the Maxwell is located in an exhibition entitled *An Experiment in Viewing*. It is a small space with a large, poorly defined entrance (see Figure 3), and a clearly defined exit. Because of the layout of the museum, it was common for visitors to enter the exhibit from the exit.

Fig 3: MT Table at the Maxwell

The exhibition contains a broad range of objects, culturally and geographically, along with photographs of people using similar objects in context. On the MT table were 12? dual-sided virtual cards which contained an image on one side and text on the other. The images displayed on the table were the same images that were displayed on the walls, and the cards could be turned over by pressing a virtual (*i*) button. The cards also had a virtual close button (x), that when pressed would cause that card to disappear from the screen and be replaced by another card that would fly in from the side of the screen.

Sample

Data was collected from 29 visitors. Females accounted for 55.2% (n=16) of the observations/interviews, and males accounted for the remaining 44.8% (n=13).

Participants' ages (estimated from year of birth) ranged from 10 to 75. The median age was 57.

There was some racial/ethnic diversity in the sample, but the majority of participants were White (79.3%, n=23) (see Table 8).

Table 8: Maxwell Sample Race/Ethnicity

	n
White	79.3% (n=23)
Latino(a) or Hispanic	10.3% (n=3)
American Indian/Native Alaskan	6.9% (n=2)
Multiple ethnicities	3.4% (n=1)

The majority of participants had not visited the Maxwell before (79.3%, n=23). Of those who had (20.7%, n=6), the median number of visits in the last year was 1.

Participants were asked to indicate how often they visited museums, zoos, or aquariums, and most reported visiting monthly or 3-5 times a year (see Table 9). Therefore, most participants visited informal learning institutions with some regularity.

Table 9: Museum, zoo, or aquarium visit frequency

	n
First time	0
Monthly	17.2% (n=5)
3-5 times a year	65.5% (n=19)
Once a year	13.8% (n=4)
Less than once a year	3.4% (n=1)

Timing & Tracking

Some participants entered the exhibition as part of a group, and others were alone. Those who were in groups sometimes traveled the exhibition with group members, and sometimes explored independently. The majority of participants entered the exhibition from the exit (58.6%, n=17). The remaining 41.4% (n=12) entered from the entrance, although not always in the same spot. Almost all of the participants primarily walked the perimeter of the exhibition (96.6%, n=28), and one participant (3.4%) took a more zig-zag/looping path. The majority of participants walked primarily in a clockwise direction (69%, n=20), while the remaining participants (31%, n=9) walked mostly in a counterclockwise direction.

The total time spent in the exhibition ranged from 1 minute and 9 seconds to 17 minutes and 11 seconds. The median time was 5 minutes and 1 second (see Table 10).

Table 10: Summary of Visitor Behavior*†

	Minimum	Maximum	Median
Total time spent in exhibition (mm:ss) (n=26)	1:09	17:11	5:52
Number of elements attended to (out of 13)	2	12	8
Percentage of elements attended to	15.4%	92.3%	61.5%
Percentage of total time spent attending to elements (n=26)	22.6%	97.7%	84.2%

**N=29 unless otherwise noted; complete timing and tracking data was not collected for 3 Ps*

† This does not include Ps who only looked at MT table, but did not use (n=1)

All 13 elements were attended to by at least one participant (see Tables 11 and 12). The only interactive element was the MT table. See Figure X for a visual representation.

Table 11: Percentage of Visitors Attending to Each Element

	Percent Attending
Cotton blouse & side-blown flute prints*	75.9%
Multitouch table*†	72.4%
Jewelry prints*	69%
Ketoh- bowguard prints*	65.5%
Headdress prints*	62.1%
Polychrome ceramic olla prints*	62.1%
Bone hair pipe necklace prints*	55.2%
Winnowing basket prints*	55.2%
Piñon pitch basket prints	51.7%
Display case 2*	44.8%
Display case 1	34.5%
Display case 3*	34.5%
Intro panels	6.9%

**Due to their close proximity, there was some overlap in attending to these elements. The visitor was recorded as attending to only one primary element in these cases.*

†This does not include Ps who only looked at MT table, but did not use (n=1)

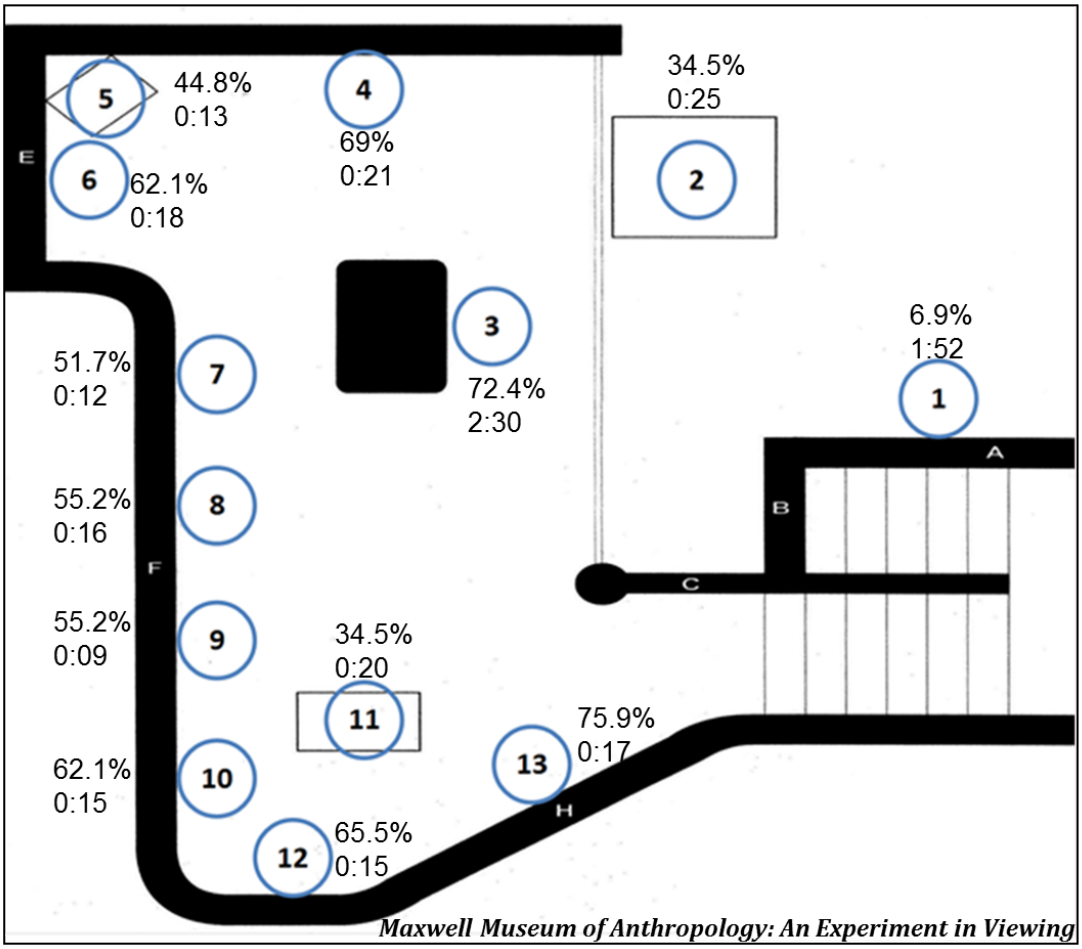
Table 12: Median Time Spent by Visitors Attending to Each Element

	Median (m:ss)
Multitouch table*†	2:30
Intro panels	1:52
Display case 1	0:25
Jewelry prints*	0:21
Display case 3*	0:20
Headdress prints*	0:18
Cotton blouse & side-blown flute prints*	0:17
Bone hair pipe necklace prints*	0:16
Ketoh- bowguard prints*	0:15
Polychrome ceramic olla prints*	0:15
Display case 2*	0:13
Piñon pitch basket prints	0:12
Winnowing basket prints*	0:09

**Due to their close proximity, there was some overlap in attending to these elements. The time recorded was for one primary element in these cases.*

† This does not include Ps who only looked at MT table, but did not use (n=1)

Figure X: Visitation of Elements at the Maxwell



Key	
1	Intro panels
2	Display case 1
3	Multitouch table
4	Jewelry prints
5	Display case 2
6	Headdress prints
7	Piñon pitch basket prints
8	Bone hair pipe necklace prints
9	Winnowing basket prints
10	Polychrome ceramic olla prints
11	Display case 3
12	Ketoh- bowguard prints
13	Cotton blouse & side-blown flute prints
___% = Percentage of visitors attending to element	
__:__ = Median stop time	

MT Table Use

Most participants had not used a MT touch table before (82.8%, n=24).

A majority of the participants used the MT table during the observation period (72.4%, n=21). Those who did not use the table were asked why they were not attracted to it. Half of the participants reported that they did not realize it was a touch table. Those who did use the table were asked what attracted them to it, and some people provided more than one reason. No clear majority emerged, and the most common reasons for being attracted to the table were the content and curiosity/novelty of the device (see Table 13).

Table 13: Table Attraction

Why Not Attracted	n=8	Why Attracted	n=21
Did not realize it was touch screen	50% (n=4)	**Content**	38.1% (n=8)
Not interested	25% (n=2)	**Curiosity/Novelty**	33.3% (n=7)
Redundant content	25% (n=2)	**Touch to Explore sign**	28.6% (n=6)
		Another person in the group was using it	19% (n=4)
		It was an interactive display	19% (n=4)

Time spent at the table ranged from 21 seconds to 9 minutes and 40 seconds. The median time was 2 minutes and 30 seconds (n=20; time at table was not recorded for 1 P). One participant visited the table three times, 2 participants visited the table twice, and all the other participants who visited the table did so only once.

Participants found the table content to be slightly interesting (Mean=5.71) on a scale from 1 (not very interesting) to 7 (very interesting).

Focused observations of participants using the MT table were made for a variety of social and non-social behaviors. Of those who used the MT table, 66.7% (n=14) engaged in at least one social behavior. A breakdown of the number of participants who engaged in specific behaviors is as follows:

Nonsocial Behaviors	N	Social Behaviors	N
Emotionally reacts to exhibit: Positive (smiles, laughs, etc.)	42.9% (n=9)	**Calls attention to/ points at content in exhibit**	23.8% (n=5)
Emotionally reacts to exhibit: Negative (frustration, disappointment, etc.)	14.3% (n=3)	**Calls attention to/ points at technology in exhibit**	14.3% (n=3)
Moves objects around for fun (drag, twirl, toss, resizing, etc.) (P1)	4.8% (n=1)	**Reads aloud to another person**	23.8% (n=5)
Turns item over (photo to text or vice versa)	85.7% (n=18)	**Makes positive statements about surface technology**	14.3% (n=3)
Resizes an item (i.e., makes bigger or smaller)	23.8% (n=5)	**Makes negative statements about surface technology**	9.5% (n=2)
~~**Watches a video**~~	---	**Watches another visitor use the surface**	33.3% (n=7)
~~**Plays a video (i.e., press video button)**~~	---	**Helps/assists/instructs (how to use, do something)**	28.6% (n=6)
Makes connection between surface content and the overall exhibition	33.3% (n=7)	**Discusses a concept (facilitate learning)**	38.1% (n=8)
		Interacts with visitor outside the group	4.8% (n=1)

[N=21]

After the observation period, participants who used the MT table were asked about their experience doing so (n=21).

Participants were asked what they found surprising about the MT table, and some answers fell into more than category. Technology was mentioned by the majority of respondents (71.4%, n=15). A little fewer than half of the participants mentioned being surprised by content (42.9%, n=9), and the remaining respondents (19%, n=4) indicated that nothing about the table surprised them. Examples of answers are as follows:

Technology

- *The resolution of images is really nice, even when blown up.*
- *I had to figure out how to use it. It's trickier than most things in a museum, but that's not necessarily a bad thing.*
- *It's always surprising when something disappears. I want to get it back, but then you discover other things.*

Content

- *It gave you a lot more info about what's on the wall. Would have been nice to see info on wall instead of table.*
- *It was not just images. You could tap on it and find more info.*

When asked what they enjoyed most about the MT table, participants mentioned the content (66.7%, n=14), the technology (52.4%, n=11), or both. See below for examples:

Content

- *Probably that it really describes what the picture is or what the person was.*
- *The picture caught my attention, and the text was good. It explained what I was curious about.*
- *That it did provide me with a path to get more information about an object. I expected it to lead me to other related images.*

Technology

- *I like that it's interactive. You can press the buttons and get more info.*
- *It was different. It was more fun. You can interact with it. It gets your attention.*
- *It was nice you could enlarge, shrink, turn things to face you.*

When asked whether anything about the table was confusing, about half of the respondents reported that nothing was confusing (52.4%, n=11). The remaining participants indicated that they were confused about how to use the table (38.1%, n=8) or the content (9.5% n=2). See examples below:

How to use

- When I close an image, I don't know where it goes.
- The 'x' is confusing. Because sometimes X marks the spot. In this case it's exit.
- Yes. At first I wasn't sure what button to push. But it was obvious after I looked at it.

Content

- Yes. The overlapping parts of it. The items covering each other. You couldn't see picture you're reading about. Not whole picture anyway. It was hard to match write up of photo with picture. The photo and write up was at different angles and covered up.

Participants also were asked to suggest ways to improve the MT table. No clear majority answer emerged, and participants' answers often fell into more than one category. The most common suggestions were related to content (47.6%, n=10) and technology (23.8%, n=5). A few respondents suggested adding instructions (19%, n=4), and others suggested technology they didn't realize was already available on the table, such as resizing (9.5%, n=2). Some participants did not offer any suggestions at all (28.6%, n=6). See below for examples:

Content

- *Maybe if there was a sequence or order to it. But that might take away the joy of the discovery.*
- *Would like to be able to see more examples of things that interest her (e.g., earrings). "Tap on keywords or object and get more layers of info. More examples, more uses, the people using the object. To learn about culture, object, related objects.*

Technology

- *Adding audio, multimedia stuff. Maybe video, audio descriptions. Maybe if it was a wall mount instead because you're used to looking at things on walls in museums.*

When asked about what questions they would ask the developer of the table if given the opportunity, no clear majority answer emerged. The most common answer was don't know/nothing (42.9%, n=9), followed by questions about the work that went into making the device (23.8%, n=5), and future plans (23.8%, n=5). Two participants had questions about how to use the device (9.5%). See below for examples:

Making of device

- *Maybe where they found the research, their sources. How long it takes to prepare a display like that?*
- *Is this a computer program, from IT or an engineer? Computer scientist, engineer? Who is doing this?*

Future plans

- *Don't know. I'd be interested to know the future. To what level can we interact with things? Right now it seems limited to novelty of the technology. It doesn't really provide new info that isn't already in analog display. It needs to do more than just show images. But it is fun.*
- *Do they expect this to be able to offer more depths of info? What's next? What else are they going to do with it?*

Finally, participants were asked whether they thought the table content had a main message. A little over half of the respondents that that there was (52.4%, n=11), while the remaining participants that that there wasn't (14.3%, n=3), or weren't sure (33.3%, n=7). See below for explanations:

Yes

- *It tied into the displays you have in here. You can see the necklaces and get info. The info it provided.*
- *I'm assuming that the whole gallery is about comparing/contrasting different cultures and the artifacts they have.*
- *Images related to attire and jewelry from tribal communities.*

No

- *It's just objects from around the world.*

Not Sure

- *I noticed it immediately, that it's the content on the walls. I thought maybe this could be a future thing where you can't bring items physically, so you bring them digitally to a museum.*

New Mexico Museum of Natural History and Science

Introduction

The MT table at NMMNHS was located in the Evolving Grasslands (Tertiary, 65 m.y.a. to 1.8 m.y.a.) hall, which is stop #6 on the museum's self-guided Walk Through Time tour. The hall consists of two rooms separated by a partial wall, and visitors frequently enter the hall through both the entrance and the exit. As such, the researcher spent some time recruiting participants from the entrance, and some time at the exit. Both rooms contain large murals as well as specimens on display; the front room contained the MT table.

On the table were 7 dual-sided virtual cards which contained an image on one side and text on the other. Some of the images displayed on the table were directly related to the images/specimens in the hall, while others displayed pictures and information about New Mexico's natural history. The cards could be turned over by pressing a virtual (i) button. The cards also had a virtual close button (x), that when pressed would cause that card to disappear from the screen and be replaced by another card that would fly in from the side of the screen. All of the cards had frames that were color-coded to a non-interactive timeline image that ran along the bottom of the screen.

Fig. 6: MT Table at NMMNHS

Sample

Data was collected from 32 visitors. Females accounted for 65.6% (n=21) of the observations/interviews, and males accounted for the remaining 34.4% (n=11).

Participants' ages (estimated from year of birth) ranged from 8 to 76. The median age was 21.

Participants visited the museum in groups that ranged from 0 to 5 other people. The median number of companions was 1.5, and 77.8% (n=49) of companions were at least 18 years old.

There was some racial/ethnic diversity in the sample, but the majority of participants were White (59.4%, n=19) see Table 14.

Table 14: NMMNHS Sample Race/Ethnicity

	n
White	59.4% (n=19)
Latino(a) or Hispanic	28.1% (n=9)
Multiple ethnicities	6.3% (n=2)
American Indian/Native Alaskan	3.1% (n=1)
Prefer not to answer	3.1% (n=1)

Slightly less than half of the participants had not visited the museum before (43.8%, n=14). Among those who had visited before (56.3%, n=18), median number of visits in the last year was 1.

Participants were asked to indicate how often they visited museums, zoos, or aquariums, and about half reported visiting 3-5 times a year (see Table 15).

Table 15: Museum, zoo, or aquarium visit frequency

	N=32
First time	0
Monthly	15.6% (n=5)
3-5 times a year	53.1% (n=17)
Once a year	28.1% (n=9)
Less than once a year	3.1% (n=1)

Timing & Tracking

The majority of participants started walking through the hall in a clockwise fashion (62.5%, n=20), and the remainder started out in a counterclockwise fashion (37.5%, n=12). Participants walked through the hall mostly in a path around the perimeter (68.8%, n=22), through the middle of the rooms (46.9%, n=15), zig-zagging/looping around (18.8%, n=6), or traveling in a combination of two or more of these patterns.

The total time spent in the exhibition ranged from 1 minute and 34 seconds to 11 minutes and 39 seconds; the median amount of time spent in the hall was 4 minutes and 45 seconds (n=29; complete timing & tracking data was not collected for 3 Ps). There were 14 elements to attend to in the hall, including the MT table (see Table 16).

Table 16: Summary of Visitor Behavior*†

	Minimum	Maximum	Median
Total time spent in exhibition (mm:ss)	1:34	11:39	4:45
Number of elements attended to (out of 14)	2	11	7
Percentage of elements attended to	14.3%	78.6%	50%
Percentage of total time spent attending to elements	30%	93.3%	79.3%

**N=29; complete timing and tracking data was not collected for 3 Ps*

† This does not include Ps who only looked at MT table, but did not use (n=6)

All 14 elements were attended to be at least one participant (see Tables X and X). The only interactive element was the MT table. See Figure 7 for visual representation.

Table 17: Percentage of Visitors Attending to Each Element

	Percent Attending
Stegomastodon jaw*	86.2%
Diatryma (Giant Bird)*	75.9%
Miocene trackways*	75.9%
Multitouch Table† (N=32)	62.5%
Duschesenodus (Brontothere jaws)*	62.1%
Volcano Victim*	62.1%
Late Miocene backlit*	51.7%
Early Miocene backlit*	48.3%
NM Fossil Riches*	44.8%
Miocene mural keys*	37.9%
Late Eocene backlit*	34.5%
Eocene Mural keys*	31%
Early Eocene backlit*	27.6%
Horse Mural*	20.7%

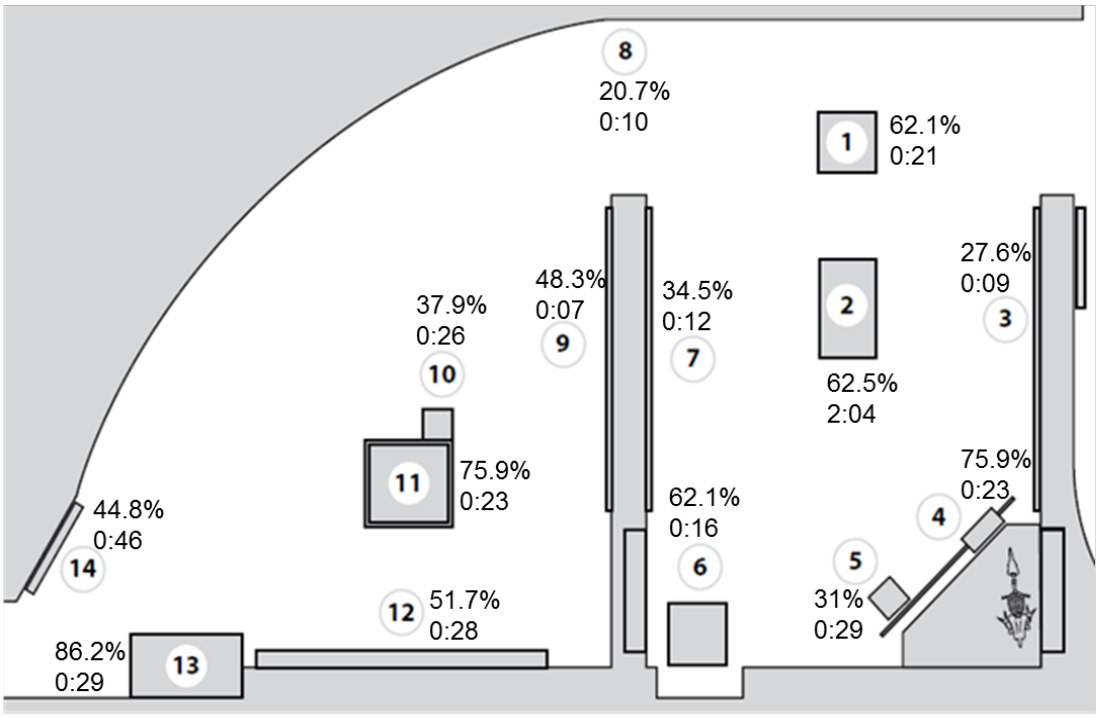
**Due to their close proximity and/or interrelated nature, there was some overlap in attending to these elements. The visitor was recorded as attending to only one primary element in these cases.*
†This does not include Ps who only looked at MT table, but did not use (n=6)
N=29 unless otherwise noted. Complete timing & tracking data was not collected for 3Ps.

Table 18: Median Time Spent by Visitors Attending to Each Element

	Median (m:ss)
Multitouch Table† (N=32)	2:04
NM Fossil Riches*	0:46
Eocene Mural keys*	0:29
Stegomastodon jaw*	0:29
Late Miocene backlit*	0:28
Miocene mural keys*	0:26
Diatryma (Giant Bird)*	0:23
Miocene trackways*	0:23
Duschesenodus (Brontothere jaws)*	0:21
Volcano Victim*	0:16
Late Eocene backlit*	0:12
Horse Mural*	0:10
Early Eocene backlit*	0:09
Early Miocene backlit*	0:07

**Due to their close proximity and/or interrelated nature, there was some overlap in attending to these elements. The time recorded was for one primary element in these cases.*
† This does not include Ps who only looked at MT table, but did not use (n=6)
N=29 unless otherwise noted. Complete timing & tracking data was not collected for 3Ps.

Figure X: Visitation of Elements at NMMNHS



Key	
1	Duschesenodus (Brontothere jaws)
2	Multitouch Table
3	Early Eocene backlit
4	Diatryma (Giant Bird)
5	Eocene Mural keys
6	Volcano Victim
7	Late Eocene backlit
8	Horse Mural
9	Early Miocene backlit
10	Miocene mural keys
11	Miocene trackways
12	Late Miocene backlit
13	Stegomastodon jaw
14	NM Fossil Riches
___% = Percentage of visitors attending to element	
__:__ = Median stop time	

NMMNHS: Evolving Grasslands

MT Table Use

Most participants had not used a MT touch table before (81.3%, n=26), and only 11.5% (n=3) of those had ever even seen one before.

A majority of the participants used the MT table during the observation period (62.5%, n=20). Those who did not use the table were asked why they were not attracted to it. Most participants indicated that they had not used the MT table because they did not notice it or did not realize it was a touch screen display. Those who did use the table were asked why they were attracted to it, and no clear majority answer was given.

Table 19: Table Attraction*

Why Not Attracted	n=12	Why Attracted	n=19
Did not notice table	33.3% (n=4)	**Content**	26.3% (n=5)
Did not realize it was touch screen	25% (n=3)	**Curiosity/Novelty**	26.3% (n=5)
Not interested	16.7% (n=2)	**It was an interactive display/touch screen**	26.3% (n=5)
Other	16.7% (n=2)	**Another person in the group was using it**	10.5% (n=2)
Too crowded	8.3% (n=1)	**Touch to Explore sign**	10.5% (n=2)

**Missing (n=1)*

Time spent at the table ranged from 46 seconds to 5 minutes and 7 seconds. The median time was 2 minutes and 4 seconds. One participant visited the table three times, 1 participant visited the table twice, and all the other participants who visited the table did so only once.

Participants found the table content to be slightly interesting (Mean=5.15) on a scale from 1 (not very interesting) to 7 (very interesting).

Focused observations of participants using the MT table were made for a variety of social and non-social behaviors. Of those who used the MT table, 80% (n=16) engaged in at least one social behavior. A breakdown of the number of participants who engaged in specific behaviors is as follows:

Table 20: Social/Nonsocial Behaviors

Nonsocial Behaviors	N	Social Behaviors	N
Emotionally reacts to exhibit: Positive (smiles, laughs, etc.)	65% (n=13)	**Calls attention to/ points at content in exhibit**	30% (n=6)
Emotionally reacts to exhibit: Negative (frustration, disappointment, etc.)	5% (n=1)	**Calls attention to/ points at technology in exhibit**	20% (n=4)
Moves objects around for fun (drag, twirl, toss, resizing, etc.) (P1)	55% (n=11)	**Reads aloud to another person**	15% (n=3)
Turns item over (photo to text or vice versa)	70% (n=14)	**Makes positive statements about surface technology**	10% (n=2)
Resizes an item (i.e., makes bigger or smaller)	85% (n=17)	**Makes negative statements about surface technology**	5% (n=1)
~~**Watches a video**~~	---	**Watches another visitor use the surface**	50% (n=10)
~~**Plays a video (i.e., press video button)**~~	---	**Helps/assists/instructs (how to use, do something)**	15% (n=3)
Makes connection between surface content and the overall exhibition	5% (n=1)	**Discusses a concept (facilitate learning)**	35% (n=7)
		Interacts with visitor outside the group	0

[N=20]

After the observation period, participants who used the MT table were asked about their experience doing so (n=19; complete interview data was collected for 1 P).

Participants were asked what they found surprising about the MT table, and some answers fell into more than one category. A little over half of the participants mentioned being surprised by some aspect of the table's technology (57.9%, n=11). A few participants were surprised by the content (36.8%, n=7), and a minority reported not being surprised by anything (26.3%, n=5). Some examples are as follows:

Technology

- *That they have one this big, that's touch screen.*
- *When I was able to turn the pictures it was pretty cool.*
- *The table itself. It's like something from Star Trek.*

Content

- *I was surprised about the facts and different species of animals, what they've evolved into.*
- *That it showed you a lot of stuff. That it teaches you about how they were born, animals.*

When asked what they enjoyed most about the MT table, respondents mentioned content (63.2%, n=12), technology (63.2%, n=12), or both. Examples include:

Content

- *I liked how you could see a picture and then read information about it. It helps you imagine it better.*
- *The variety of all kinds of different animals and stuff. It was pretty interesting.*
- *The pictures.*

Technology

- *That you could move things around, that it's interactive.*
- *The interaction, the touch screen.*
- *Don't know. Not the content so much. Trying to grab the image, it was fun to move them around.*

Participants also were asked if they found anything confusing about the MT table. The most common response was that nothing about the table was confusing (52.6%, n=10). Other participants were confused about how to use it (42.1%, n=8), the content (15.8%, n=3) or both. The non-interactive timeline image was particularly confusing, because many users expected it to do something other than serve as a frame of reference. See example answers below:

How to use

- *At the beginning, yeah, to figure it out. I wasn't sure at first what was touch activated. Wasn't sure if timelines would bring up info.*
- *At first I wasn't sure how it worked. I didn't know I could move items and not have to walk around the table to read stuff at different angles.*

Content

- *Yeah. I'm still wondering about bars at the end (i.e., timeline) and what they do. The order of pictures randomly appearing. The color-coding.*

When given the opportunity to suggest ways in which to improve the table display, some participants did not offer any suggestions (36.8%, n=7). Others suggested changes to table technology (42.1%, n=8), changes to content (26.3%, n=5), the addition of instructions on how to use (26.3%, n=5), or a combination of these. Examples are as follows:

Technology

- *If it wasn't/didn't get so big [the pics], because some people can't control them. It could be easier to control the images.*
- *Maybe could have pictures come out from touching different parts of timeline.*

Content

- *Probably put more stuff, more pictures, games to play about dinosaurs.*
- *By putting a video, an educational video about things in this part of the museum.*

Instructions

- *If it had directions telling you how to use it, and explaining the color-coding.*
- *Making it more understandable. A plaque showing you how to use it. Instructions.*

When asked what questions they would ask the developer of the table if given the opportunity, some participants answers fell into more than one category. A slight majority wondered about the work/decisions that went into making the device (57.9%, n=11). The next most common answer was nothing (26.3%, n=5), followed by questions about content (15.8%, n=3), and questions about availability (10.5%, n=2). See examples below:

Making of

- *Why did they make it so that if you press the 'x' button, it goes away and takes a while to come back?*
- *How did he make it? Where did he come up with the idea?*
- *Mostly how it worked. Is it a giant iPad or something not related to that?*

Content

- *What kind of dinosaur was here in New Mexico?*

Availability

- *What other products they have. Are there any more located in other museums? What kind of facts can you store on them?*

Participants also were asked whether they thought there was a main message to the content on the table. Almost half reported that they thought the table did have a main message (42.1%, n=8), almost half reported that they were not sure whether it did or not (42.1%, n=8), and the remainder thought the table's content did not have a main message (15.8%, n=3). Examples of explanations are as follows:

Yes

- *Information about different animals in different eras is what I took away from it.*

No

- *It was more informational. Kind of supports the murals and things in the exhibit.*

Not Sure

- *"History/information about things. It wasn't centered around a species or animal."*