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Surface Geometry and Visual Support and their Effect on Affordance: A Comparison Across Three Age Groups

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Abstract

This study aims at understanding how changes in display's geometry might affect the appreciation of a task due to different affordances. We are also integrating the use of visual support, to understand if it supports the display's affordance or goes against it. The result indicates that higher levels of abstraction are understandable by older participants. The children showed they focused on the ergonomic features of a volume and could link a volume with the visualization and interaction of digital content. The result also shows that a complex visual support will undermine the affordance of a screen, but subtle signifiers would enhance the feature of a display and its affordance.

1. Introduction

With increasing ways to access information, the variety and complexity of interface designs, both digitally and physically, has increased [1]. May it be an educational artifact [2] or a large surface with original interactive possibilities [3], current design approaches and solutions toward interface representation and interaction capacities are ever increasing. Regarding the development of displays and interfaces, we aim with this study at understanding the relations, if there are any, between digital content and interface, and if the shape of a tangible interface can improve or decrease the perception (visibility, understandability, etc.) of its content as well as how visual support such as projected images might affect the affordances of an interface.

With this study we aim at understanding the differences in perception as well as interpretation of a surface's affordances, in relation to digital content and the way it might impact the interaction process. By doing this across different age groups, we hope to see consistency or leading characteristics in interpretation we could integrate in the design and conception of tangible displays and interfaces. We are looking into what could be the main interpretations across the different age groups as well as within each age group, and whether it improves the perception of digital content or simply obscures the content readability. These experiments might help us understand if there is a universality of object affordances for digital media content and how to approach the creation of tangible displays and interfaces for users of different age groups. We are taking into consideration that the differences in user age corresponds to different levels of cognitive analysis and shape interpretation [4].

The main objective of this research is to investigate the effects of changes in a display's geometry on its affordances, and see if these effects are observable across different age groups and observe if these results are persistent with and without visual support projected on the surfaces.

The results could help define design guidelines around which types of display geometry communicate adequate interaction possibilities.

The main methods to conduct in this study are: (1) have an overview of display geometry interpretation by three different age groups, (2) compare the leading interpretation across each age groups in terms of similarities and differences, and (3) compare the interpretation of a display's geometry with and without visual support for each age groups.

2.Cognitive load and object semantics

2.1 Cognitive load and artifacts

The primary way in which someone perceives an object can be divided into two categories: quantitatively, and qualitatively [5]. Since we are interested in how someone perceives an object's shape, we will be focusing on the second category, shape perception being part of qualitative interpretation, and more precisely on the observable function of an object. We chose not to work with children younger than 7 years old to avoid, or at least reduce, any possible misinterpretation or cognitive shortcuts when given the task to analyze the features of a given object's geometry [5], in our case displays.

In our experiment, described in section 3, we also took into consideration object perception principles by placing our three experimental display on a homogeneous background, side by side with no overlay in-between them, in order to make the recognition of these objects and their boundaries as simple as possible [6].

For comparison purposes, we chose to have two of the three experimental displays with an abstract representation (simple geometry), and a third display carrying more complex features (irregular surfaces, varying height elevation). Seeing similarities in abstract representations can aide the adaptive application of past experiences to new ones [7]. The geometry of an object can increase the effect of its affordance by displaying abstract representations of its content through tangible representation [8]. In addition, the symbolism of objects and shapes composes the way our minds processes information [9].

With regards to our decision to experiment with children not younger than 7 years old, we can note that the understanding of abstraction is not linear in child development, and children of similar ages might have unequal abilities to understand abstraction [5].

2.2 Affordances of interface and display

We are also aiming at understanding if there are differences in the way members of each age group perceive an object's affordances.
In this research we are approaching the term affordances as D.Norman defines it, centered around the capacity from an object to communicate on its function, unlike J.Gibson who considers affordance as the potential interactions and actions of an environment.
Norman says: "Affordances are the possible interactions between people and the environment" [10]. Norman also explains that the role of signifiers is to indicate the possible interaction offered by an object or something to interact with, for example: A plate on a revolving door indicating were you should push it. In this case, the signifier is the plate and the affordance is opening the door by pushing the plate.
In terms of usability and problem solving, performances can be improved with an adequate definition and conception of an object's or interface's affordances. There is a "...physical immediacy of a tangible model. Such an interface could help increase understanding a physical systems because the model is physical and its relationship to its environment is not simulated" [2]. The association of meanings with a physical, tangible representation [11] can reduce cognitive load in the problem solving process and allow the user to maintain a stable level of concentration on a given task [12].

2.3 Related works

Physically interacting with a display has widened the scope of interactions available for users, by either augmenting the screen with tangible interfaces or allowing the display to adapt its geometry to directly generate dynamic physical representation of digital content [13].
Interaction with tangible interfaces on tabletop display allows more precise and varied affordances and feedbacks. Those artifacts can represent new actions or components to interact with [14], they can also work as handles and give an extra visual input to the users [15, 16]. They work as signifiers for flat displays that usually rely exclusively on visual signifiers for their user interfaces. This wide variety of interaction processes helps to get a better grasp and control under various conditions and needs [17].
The spectrum of interaction can be widened to enable the display to adapt its surface geometry for defined purposes. Users can either directly shape the display [18] to visualize digital contents, or use hand motion to navigate through contents and leave the display reshape itself accordingly [19, 20]. Such display can also be used as ways to physically interact with tangible representation of digital contents [21, 22] (3d models, city maps, etc.) or physical elements (building blocks, balls, devices such as smartphones, etc.).
In this paper we are focusing on displays with fixed geometry but our results are applicable to various shape displays.

3.Experimentation Method

3.1 Experiment overview

The following experiment aims at testing two key elements:

- What the relationship is between the geometry of a display and the tasks a participant would consider matching with the surface geometry.
- Comparison of participant answers between three age groups to observe differences in perception and cognition. How could it affect the design of an interface?

Results from this experiment will allow us to observe and analyze the following points of interest:

- Observing the impact of affordances on cognitive load.
- Observing the impact of affordances on interaction potential.
- Observing across three different age groups the differences in affordance perception.
- Observing the effect of visual aid within as well as across each groups.

For this experiment we chose to focus on three age groups: children (ranging from 7 to 10 years old), young adults (ranging from 22 to 30 years old) and adults (ranging from 31 to 54 years old). These groups represent three types of populations supposedly fluent in electronic device usage, but at a different level of involvement and understanding. We chose a group of children as we could consider they are still in an early phase of learning complex features regarding electronic devices. For example, when asked the question "do you use the Internet?", all children participants said no, but when we asked questions about online services such as Line (a Japanese messaging application) and other applications, they all answered yes, showing a disconnect between their understanding of what the Internet is and what Internet applications are. All young adults were fluent in each proposed task, the use of computers, smartphones and applications being part of their daily lives as undergraduate students at a research institute. The adult participants, all office workers, represented a population that is working daily with desktop PC, but might not be as fluent with technology as the young adult participants.

3.2 Participant repartition

The same experiment was conducted on the three age groups. One group representing children (P=51; 20 boys and 31 girls, from age 7 to 10 years old), one group representing young adults (P=38; 28 men and 10 women, from age 22 to 30 years old) and a group representing adults (P=16; 1 man and 15 women, from age 31 to 54). Compare to our previous research [23], we experimented with a larger amount of participants and we also added a third age group to broaden our understanding of the experimentation across different age groups.
Splitting the age limit at 30 years old for the young adult group and 31 for the adult group was involuntary. These groups actually represented participants that were for one group students and for the other group full time employe at a secretariat. We were considering

that due to there respective working environment, these two groups might have different approaches to our experimentation.

The oldest of our student participants was 30 years old and the youngest of the working participants was 31 years old.

Most participants were Japanese with a minority of Chinese participants. For the children group as well as the adult group, the instruction and experiment were conducted in Japanese by a native Japanese speaker to ensure the instructions were clearly understood. Results were translated to English afterward. For the young adults group, all participants were fluent English speakers or had a native Japanese translator to ensure the instructions were clearly understood. Each of the 105 participants signed up voluntarily for the experiment. Each children took part individually in the experiment, in order to make sure that there were no interferences between participants that could have modified their personal preferences. For some young adults as well as adults, we performed group experiment, where each participant had to fill in a questionnaire. Questions were the same as the one we would ask normally to a single participants. We had to proceed this way due to time constraint, especially for the adult group as we did our experimentation during regular working days. We also made sure each participants were isolated and saw the experiment and its content for the first time. All these precautions were for keeping their reaction as genuine as possible.

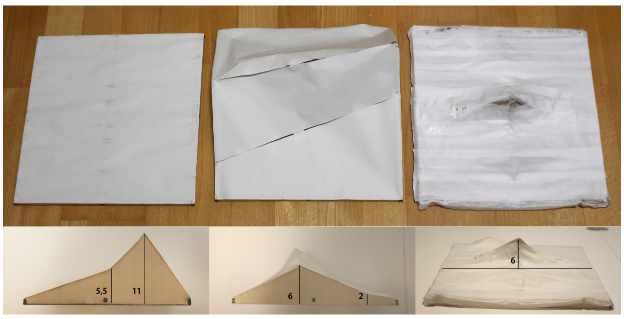

Figure 1. Top picture, the three displays (from left to right: flat, split, mountain). Bottom picture, measurement (in cm) for the right side and left side of the split display and height of the mountain.

3.3 Experiment contents

In order to understand how the geometry of a display can have an importance on the completion and interpretation of a task, we prepared a set of simple questions. We had some pre-existing assumption we wanted to experiment on while comparing them to a more traditional display geometry. (1) We wanted to see if participant could associate the geometry of a mountain with tasks related to geography, and (2) if a geometry visibly divided in three parts and slightly slanted would offer any sort of meaningful visual or physical support to organize groups of information of digital data (browsing through digital contents, playing games). Each participant was given three displays, each with a square base of 30 cm by 30 cm as shown in Fig.1, with a significantly different geometry; the flat surface to simulate an ordinary display; the surface with a small elevation split in three planes; and the surface shaped like a mountain. These three types of geometry represent two signifiers we wanted to study: dividing a surface into smaller elements, and representing a subject, in our case a mountain.

We wanted to see how these signifiers would affect participants interpretation of a task compared to a flat surface with no signifiers.

We also prepared a set of nine tasks, usually achievable on a desktop PC or tablet PC: (1) reading a text, (2) typing a text, (3) writing a text, (4) watching a video, (5) playing a video game, (6) looking at a geographical map, (7) consulting a weather forecast, (8) browsing social media, and (9) doing a school report.

These nine tasks were chosen since they represent major interaction we do with devices on a regular basis. Although, each age groups were subject to the same set of questions and requests, we did an adaptation for the children questions. We changed the title of question number (8) browsing social media for the young adults and adults to (8) browsing internet for the children as at this age few of them would have actually been active on social media, hence making the question less relevant for their age group.

We proceeded the same way for the adults group regarding question number (9) doing a school report, we changed it into (9) doing a work report. We did this modification since non of them are in school anymore, so it might be easier for them to relate to the question if it fits their working environment.

Three tasks out of nine were chosen to match a particular display geometry in order to see if the participants would find a connection between the surface's geometry and the features of the task they were facing. The cases of viewing a geographical map and consulting a weather forecast were chosen to match with the mountain shaped display.

We wanted to see if the candidates of each age groups would make the connection between the mountain geometry and the geographical features of both tasks. The case of typing was chosen to match the split display where the slanted, elevated surface could be seen as a support for the participant's hands as they pictured themselves typing, mimicking the feature of a keyboard.

We chose those three in order to find how our two signifiers were going to perform.

We specifically chose the word "typing" to indicate the need of pressing keys, as opposed to "writing" in which case we were indicating to the participant the action of writing by using a pencil. The interaction process and interface requirements are different in each case, which is why we put an emphasis on both methods of producing text. We would assume the best suited surface for writing with a pencil would be a flat surface, but we were curious to observe the effects of each display's surface on typing if a flat surface was preferred or if the geometry of the two other displays could lend themselves to making typing more practical, if needed be.

With those three display surfaces and nine tasks, we

required each participant to match each of the above mentioned tasks with the display they considered the best in terms of geometry to suit the task features.
For each age groups, the experiment was conducted with the display's surface blank, in order to force each participant to concentrate solely on the geometry of the display and their own way of imagining the tasks. After experimenting visual support (see Fig.3) only with the children group for our previous research [23], we also conducted the experiment a second time by adding a video projection on each surface for all three groups, showing a basic visual representation of each tasks, like a screen capture of a video or a map. By "basic visual representation" we mean each images were not designed to enhance the features of any particular display. Only the image positions were changed to avoid major image deformation. For that, we used a video projector and displayed images on the three surfaces at the same time, see Fig.2.

Figure 2. Two examples of the three displays with visual support. Above: representation of the watching video task, and Below: representation of the geographical map task.

These tasks were not physically performed by the participants, similarly to the first part of the experimentation where the display's surface were blank, here participants had to mentally picture themselves performing each tasks. We wanted to make sure that the only differences between experimentation one and two was the addition of visual supports.
Last time, children results varied significantly from the experiment without visual support to the experiment with visual support, so we wanted to enlarge our understanding of that effect by testing it on each age groups. During our last experimentation [23], we did not performed this test with the young adult group (of 24 participants), this is why we only have 14 participants for the visual support experiment (see Fig. 04) and 38 participants for the experiment without visual support (24 participants plus 14 participants from two separated experimentation sessions) (see Fig. 5).

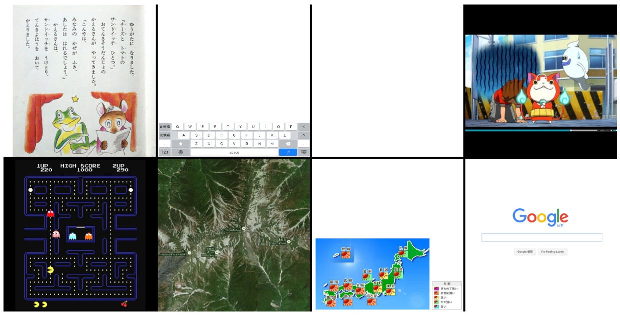

Figure 3. Images used for visual support. From left to right, top to bottom: Reading, Typing/Work report, Writing, Watching video, Playing video game, Geographical map, Weather forecast, Internet.

3.4 Experiment procedure

The experiment procedure went as follows. The three displays were placed in front of the participant (see Fig. 4). We then asked each participant to choose which surface they would use as a display for each task. For example: "If you have to type a text, which surface in front of you seems to be the most suitable?" For each answer, we also asked them to indicate their thought process as to why the chosen surface would fit the best the task given , in term of visibility, practicality, or other interpretation.

4.Results

4.1 Visible preferences

We can learn from this experiment by both analyzing separately each result as well as cross-analyzing them to see leading trends for each age group and common leading trends in general across all three groups.

Figure 4. Our experiment installation. For the question without visual support, we would shut down the projector in order to keep an identical set up for each participants. Here the installation for the children experimentation.

For the young adults with no visual support we can see two major preferences in term of display geometry (see Fig.5). The flat display is preferred in seven out of nine cases.

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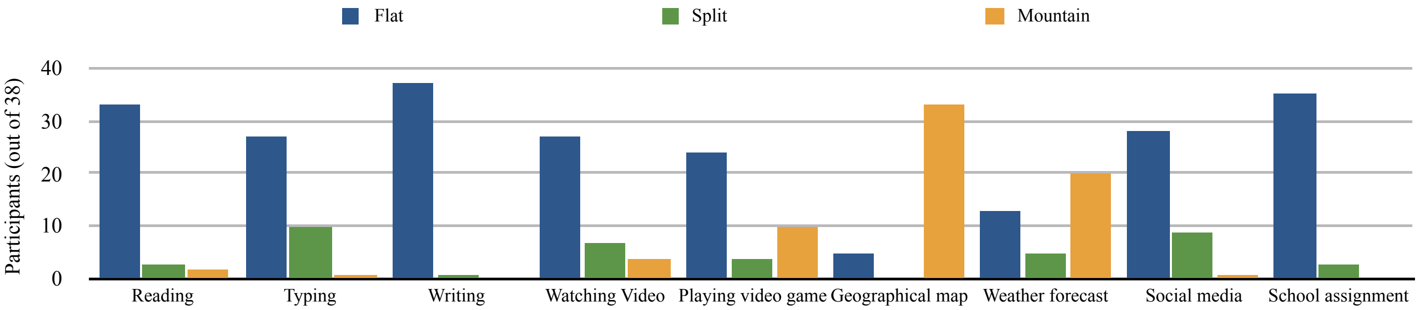

Figure 5. Results from the experiment with the young adult group.

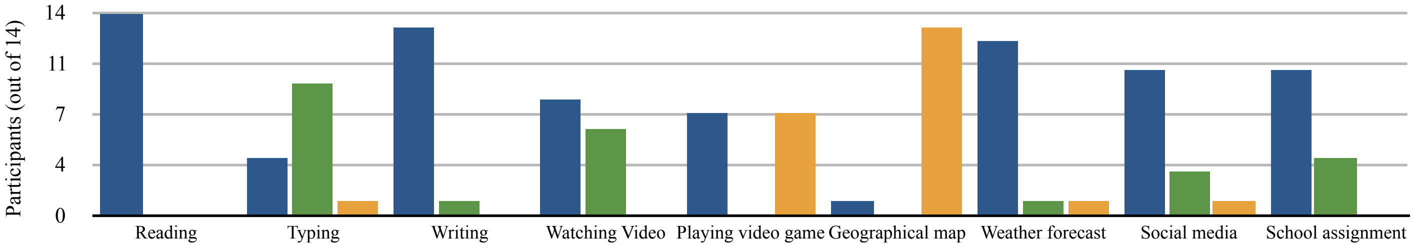

Figure 6. Results from the experiment with the young adult group with visual support (from a video projector).

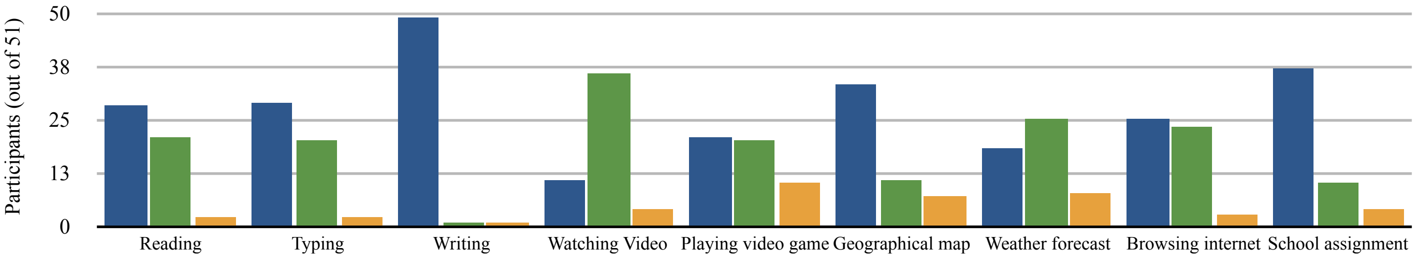

Figure 7. Results from the experiment with the children group.

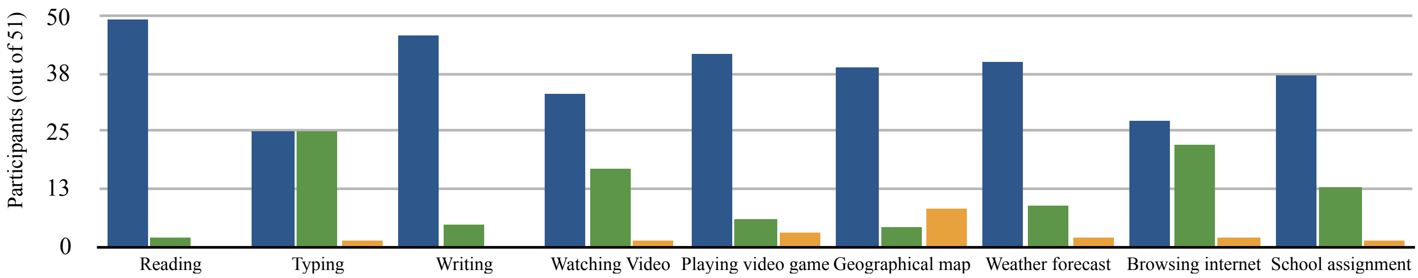

Figure 8. Results from the experiment with the children group with visual support (from a video projector).

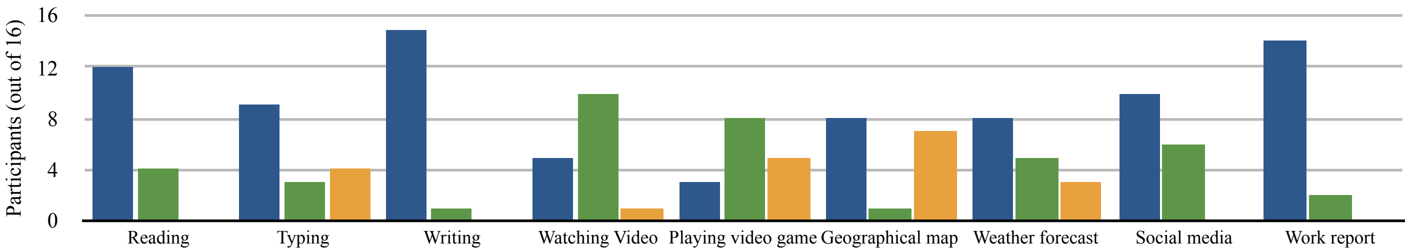

Figure 9. Results from the experiment with the adult group.

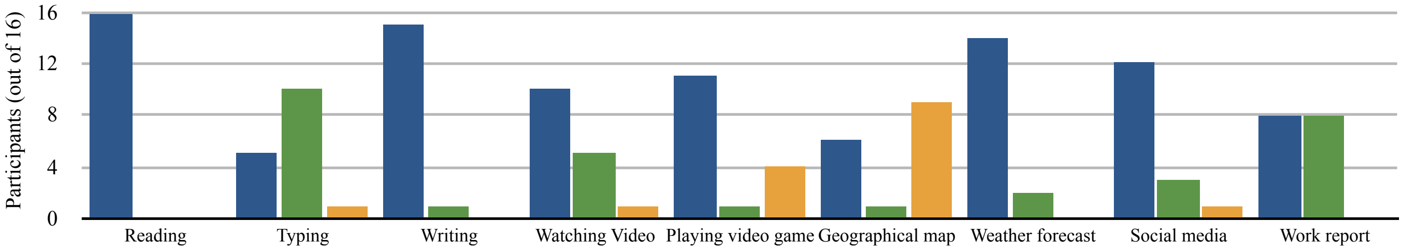

Figure 10. Results from the experiment with the adult group with visual support (from a video projector). For the six figures above, the vertical axes represent the number of participants in each group and the horizontal axes represent the nine tasks proposed to each participant.

What is interesting, is that in the two other cases, a majority of participants chose to associate content related to geography or maps and weather forecasts with the display shaped like a mountain. Thus, this could confirm our prediction concerning the pairing of a mountain surface and geographical content and that our mountain signifier affected the display's affordance. A small third of the participants chose the split display in the case of typing a text, indicating that the signifier is most likely not strong enough as it is.

Results from the children test shows that there is a homogeneous repartition of choices between flat and split display (see Fig.7). There is an even repartition in terms of display choices for the case of playing video games and browsing internet. Unlike in the young adults case, our prediction about the pairing of a mountain display and geographical content was refuted, children showed a preference to consulting a map with a flat surface and the weather forecast with a small majority toward the split display.

In the case of reading and typing for children, there is an even repartition between the flat display and the split display, not showing a distinct preference.

For the adults group (see Fig.9), beside a large proportion of the result dedicated toward flat surface, adults seems to prefer using a split display for watching video and playing video games. Unlike the two other groups, adults decision is equally divided between flat surface and mountain surface for the task of looking at a geographical map.

A major difference between the young adults and the two other groups is the tendency to prefer using the split display when it comes to watching a video for children and adults. Participants in those cases indicated that it made the action of looking at the content easier thanks to the surface being angled toward them, making it easier to look at without experiencing pain in the back of their neck.

The result became accentuated during the second experiment for each groups. Now assisted with images projected from above, the participants gave significantly different answers regarding the display they preferred to chose for each cases.

For the young adults group (see Fig.6), our number of participant being lower we can't consider these results as representative, but they are giving us a indication of a probable behavior. With an actual map projected on the surface, there was a large choices of mountain display for geographical map. Contrary to that, there was a large shift toward the flat display regarding weather forecast. Typing showed a preference for split display and watching video got an average of flat and split display. Lastly, playing video games showed an average of flat and mountain surface, participants explaining that if the games was taking place in a mountain scenery, it would make an interesting game.

For the children group, Fig.8 shows that the mountain display is virtually unused by the children.

The tasks of typing and browsing the Internet display similar results compared to the test without projection, with an even repartition between flat display and split display.

The results in the case of typing remained similar in both experiments. Overall, there is a massive shift toward the use of the flat display for every single case.

For the adults group (see Fig.10), typing and work report (being roughly the same task) indicate preferences toward the split display. Lastly, geographical map task has a small majority for the mountain display.

Another overall indicator across the three groups and two experiments is the rare employment of the mountain display, clearly the third choice for participants of each age groups besides the case of looking at a geographical map and consulting a weather forecast for young adults and geographical map only for the adults.

4.2 Differences and similarities between age groups

The major observable difference concerns the rare use of the mountain surface for task (6) by the children in both visual and non-visual support experiments. For the young adults group its shape seemed to have strongly oriented their decision to choose the combination mountain and geography because of geometric similarities, the same can be said for the adults group, in both case there is an average or above average choices of mountain display. Children placed an emphasis on usability, as according to them, a flat digital map would be more practical to consult because it looked like a regular paper map or like the map on their parent's smartphones.

Overall, besides an underwhelming use of the mountain surface as a support for maps, results from all three age groups ended up with a similar focus on flat surface if there was any detailed visual content displayed on the surface such as texts, images and videos .

4.3 Visual support places an emphasis on visibility

As indicated earlier, with the projection of visual support to understand what each task would look like, all three groups had a massive shifts toward the flat display. In general, the main comments concerned the poor visibility available with the mountain and split display; the lack of a direct overview of the content (being partly hidden behind the higher section of the displays); and the deformation of the content in some cases (reading, video, video game, map and weather forecast).

Where participants were focusing on usability and comfort during the experiment with no visual support for children and practicality for the two other groups, their main concern became visibility during the experiment with visual support.

4.4 Interpretation of the display affordances

Within the answers we received, we can see some emerging interpretations by the participant with a novel way of combining one display with one task. Two of the most common comments were associated with the split display.

Participants found in this geometry two major ways of visualizing and interacting with the content. When given the task of typing as mentioned above, participants who chose the split display explained that the slanted part of the surface could be used as a hand support for typing, this across all three groups, especially when provided with the visual support of a keyboard projected on the surface. When the participants were given the task of watching video, participants in each group and children in particular showed an interest in that geometry, explaining that it

Table 1. Interpretations and answers from participants

	Split display	Mountain display:
Young adults	- The angled screen is better for watching a video. - Top part could be a screen and bottom part could house the button or controller in case of a video game. -The volume could be used as a 3D representation of graphs for weather forecast. - Each part could be used to display slices of a landscape: Land, rain snow or wind, sky. - Could be used to have content of different kinds (categories, information) on each surface for social media. -The different areas of the display could represent content organized by country (Facebook contacts from different countries in that case). - It could be used to protect your information, with the blind spot the geometry creates, you can hide your private information from others (referring to the front of the display, hidden when a second viewer is facing from the opposite direction). - The content on the display could be split, part screen and part typing.	- The surface could be dynamic to amplify player emotion in a video game. - The volume could have more impact with a 3D effect to make the game look more real. - If it's a game with a mountain scenery, it would be easier to understand how to play the game.
Children	- Easy to look at with the slanted surface for a book or a text. - It look like a small television so it's probably easier for watching video. - It look like a small television, it reminds me of my television in my home when we watch weather forecast.	- If the display was much bigger, we could sit on a small mountain and watch the video on one of the bigger mountains, like a large couch to watch TV. - The forecast could be divided into each town if the geometry of the display could be changed to match the real cities' topographies. - The mountain can represent a country. If it's raining on the map, it's easy to understand where in the real world. The higher the mountain elevation goes, more clouds could be visible. Displaying the different layers of cloud depending on their position (elevation) in the sky.
Adults	- Easy to look at with the slanted surface as it look like a mini television for watching videos. - The slanted part of the screen can be used as a support for my hand. The shape look like a keyboard in a way.	- If the shape of the map can change according to the mountain images projected, it could be easier to understand the geography of an area compare to a regular map

might be easier to watch a video since the surface was angled toward them compared to the flat display facing upward.

Table 1. represents the interpretations and answers we received from participants regarding how the geometry of the map or split display could shape its content.

5.Analysis

5.1 Interferences from the visual support

Regarding the massive shift in terms of surface choices during the children's experiment with visual support, this could be due to the projection of images that were not on par with what each children had expected when they had to imagine the task during the experiment without visual support. They were suddenly mainly focusing on the visibility and readability of the images projected on the displays. This is a behavior we faced in a previous project [24], where the relation between the imagination of children based on a physical object (wooden block for our previous project) and a 3D-rendered visual representation were disappointing for them. At the time, children had indicated to us that the visuals they were given to look at did not correspond to what they had imagined. This could be an interfering factor and an explanation of the shift in choices in the children group during the experiment with visual support.

The following are comments provided by the children regarding the image projected on the three displays during the experiment with visual support:

- For watching a video and the geographical map, the mountain and split display projection are not clear, the images are distorted and hard to see.
- For the weather forecast, it's hard to see that it's a mountain (comment regarding the mountain display).
- For playing a video game, we can't see the opposite side of the split surface.

We could divide these comments into two points of concern. The first point relates to the technique used to project images on the display surfaces. During the experiment, images projected did not receive any treatment to match or counteract the geometry they were being projected on. This resulted in images being slightly stretched and a bit challenging to appreciate. A solution could be to use more than one projector to properly wrap the images around the different types of geometry and elevation for each of the display types.

The second point is centered greatly around image visibility. This might indicate that images not properly designed to match the display's geometry are disrupting the display's affordances. It might also indicate a need from the viewer to wander around the display and enjoy the image from a different vantage point. For example, with the projection of the map not matching the split display geometry and showing mostly on the other side, roughly all participants then had difficulty watching the content in its entirety because it was being hidden by the display elevation (see Fig.2). A solution to reduce these blindspots would be to allow each participant to move freely around the display, letting him or her look at the display from the angle he or she deems the most suitable.

In the case of typing a text using the split display, the fact that we chose to display the image of an actual keyboard (taken from a tablet PC) might have worked as a subtle visual signifiers, indicating the participants that not only they can place their hands there due to the geometry of the display, they also have enough space to type freely as they would do on a regular keyboard or on one from a tablet PC. The same effect of visual signifier could be said for the geographical map. The adults and children group showed a small augmentation of mountain surface. We also received comments, explaining that without visual support it was difficult for some of them to understand the shape of the display, but with the visual support it look like a real mountain (see Fig.2).

5.2 Display affordances interpretation

Interesting answers were given by participants from the three age groups providing some personal interpretations of each display regarding the 9 tasks. A major focus, outside of comfort of use and visibility, was given to the segmentation of the content with the split display. The visual delimitation of the three planes seemed to indicate to the participant the possibility to display either different categories of content, or different elements of an interface like buttons or a keyboard. The comments on the mountain display indicates that it could be useful if the display geometry could match real geographical topography and change accordingly. Although we had a limited number of participants, these results gives us a general idea of what kind of behavior can be observable. These results also corroborate our proposition about the two signifiers we wanted to study: dividing a surface into smaller elements and representing a subject. Signifiers seemed to indeed have an effect on how the participants were interpreting each display's affordances for digital content. The addition of visual support tends to indicate that regular images interfere greatly with the affordance of a display, the participant being focused on understanding the image being presented to him. If the image projected doesn't have any specific feature to be enhanced by the display's geometry, the participant will prefer viewing it on a flat surface. The result with the mountain display and visual support could indicate that, if the image projected, however complex it is, will be easy to understand if the geometry of the display matches it. Localized visual input like a keyboard seems to work as a visual signifier and enhance the geometry's affordance, this might indicate that discreet visual signifier can enhance the feature of a display.

6.Conclusion

Due to our limited amount of participants in each group, we cannot strictly consider our results and analysis as fully representative of significant differences in perception within and between all three age groups. The similar observation is applicable to the comments we received from the participants as it may not represent a consistent point of reference for future work on tangible display design. We can only assume that there seems to be some differences across the three age groups, as the children were focusing more on practicality, the young adults on alternative interpretation, showing a higher level of interest for the different geometries and the adult group on productivity and efficiency.

One common element of answers from these experiments is that a more abstract representations of a volume may provide easier mental support for participants [7]. The rare tendency to choose the mountain display and preference toward the split display as an alternative solution might be an indication of that. We can also consider that the size of our study's displays might have been underwhelming for particular surfaces like the mountain, and scaling up to higher dimensions (50 cm by 50 cm or bigger) may change the way participants perceive the volume.

After having tested the effect of signifiers on tangible display, our next step will be to conduct a similar experiment with actuated surfaces, allowing for finer geometry changes and real time adaptation to participants suggestions. We will integrate the knowledge we gathered from this research and apply it to larger display sizes to see if any changes in behavior occurs from all three groups. Broadening our participants range to a fourth older group might also provide us with new element of comparison.

To conclude, small visual signifiers might provide participants with sufficient incentives in addition to the display's affordance as observed with the action of typing a text with visual support. We will consider using custom made visual for our next experimentation in order to evaluate by how much it enhances the signifiers we chose for the display's geometry.

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