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ABSTRACT

Every submission should begin with an abstract of about 150 words, followed by a set of Author Keywords and ACM Classification Keywords. The abstract and keywords should be placed in the left column of the first page under the left half of the title. The abstract should be a concise statement of the problem, approach, and conclusions of the work described. It should clearly state the paper's contribution to the field of HCI.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous; See http://acm.org/about/class/1998/ for the full list of ACM classifiers. This section is required.

Author Keywords

Authors' choice; of terms; separated; by semicolons; include commas, within terms only; required.

INTRODUCTION

- Teknologi

- Hvorfor er teknologien mobile?

- Hvorfor er vores tilgangsvinkel relevant/app ide fed?

- Hvad var vores allerførste tanker? (måske andet afsnit?)

This report focuses on an application for the newly released Microsoft Hololens. The Hololens was released around march 2017, and the fact that the product is in its infant stage and is based on a very new technology opens up possibilities and removes any preconceived notions about which applications and uses the Hololens might have.
The technology is relevant with regards to mobile computing in one very apparent way, in that it is a wearable, computing unit. Other than that, it offers alternate reality (AR) possibilities because of its partly see-through screens. Since the Hololens is still a new technology, the mobility and computing power of the product will most likely increase, making it

resemble a ubiquitous computer more and more. One of the possible end goals for the Hololens might be integration into wearable lenses or implanted directly into the eyes.

The application this report will cover revolves around LEGO. LEGO is a way for kids and adults to build constructions, vehicles and scenery, all in a very physical and three-dimensional way. This, then, seemed like a natural choice for an AR application, since the application layer between the user and the world could expand naturally on the possibilities and limitations of the physical, "real-world" LEGO.
The application in itself should be a sort of digital playground in which a user could interact with LEGO in ways they would find natural. Sticking pieces together the way they do in real life, stacking and constructing, all interactions that the user knows well from having played around with real LEGO.

SKETCHING

The structure can look like this:

- Present the chosen design challenges and some of the initial concerns in the beginning phase

- Each challenge is outlined with:

  - Sketches
  - Design thoughts for the sketch - what was the thought behind this sketch?
  - summary of the group discussion for this case - what worked, what didn't and why?

- Conclude what the final sketches are - what do they accomplish, and what do they lack(maybe reference what might be discussed in future work)?

How do we access the application? (Menu)

The menu is an essential part of any application. It outlines the possibilities for the user in a simple fashion. The menu is something every user has experience with, as it is the first thing a user is met with when running an application. This means that the menu has to contain of certain classic elements.

A user needs a way to close the application. On mobile phones nowadays this can be done with 'return' buttons on the phone, but all applications generally have a built in exit function.

The user also needs to have some sort of options menu, and guidelines. This is a must for this application. Stacking LEGO

seems simple and intuitive, but all the operations and possibilities is something that can confuse a potential user.

Lastly the menu needs to have an easy access to the LEGO session itself. It shouldn't be complicated for the user to start a new LEGO session, meaning that this action should be as intuitive as it gets.

Insert sketch 1:

The main menu screen
The initial ideas for the main menu were generated following the 'x plus x' sketch generation principle outlined in the course. In the case of the sketching done for the main menu, a '5 plus 5' scheme was used. One common theme in the sketching of the main menu was separation of the design of the menu and the interaction with the menu, and the difficulties with making that separation. In quite a few of the earlier sketches, what was being sketched was more a way of interacting with the menu rather than the design of the menu itself.

It became apparent that the menu had to use the gestures given from Hololens, ie., the bloom gesture. Since a fixed main menu screen could lead to different problems, such as blocking precious field of view, and a menu screen fixed to the world could be forgotten and overlooked, a gesture-activated main menu was the prefered interaction.

The generator board
After discussing menus in the context of the Hololens, it became apparent that there was a need for a menu that could be placed and interacted with in the real world. Using the tracking capabilities of the Hololens, different designs of the so called 'generator board' came up. The main purpose of the generator board is to generate blocks that the user can then drag out of the predefined spawning space.

The idea came up that a menu with the same look and functionality of a tablet device could make interaction natural for the user. Having the ability to pick up, move and place the menu on a surface like a table or the floor seemed like a natural way of approaching the problem. The idea can be seen in a very early sketch in figure (HVILKEN FIGUR?):

DESIGN DECISIONS
During the sketching phase, several design choices were discussed. One of the very first decisions made was the overall look of the menu. The choice of big buttons, clear visual cues and short textual descriptions was present in almost all of the sketches in the early design phase, as seen in figure (HVILKEN FIGURE???):

Suitability of LEGO in AR
One of the aspects with the application was the suitability of LEGO in an AR setting. This question was asked rather late in the development process. What became apparent was that the virtual LEGO in an AR setting would not be able to provide the
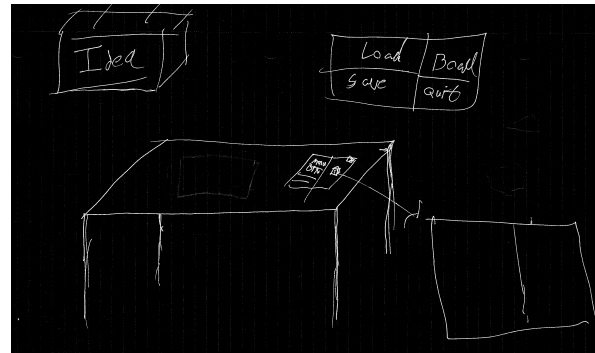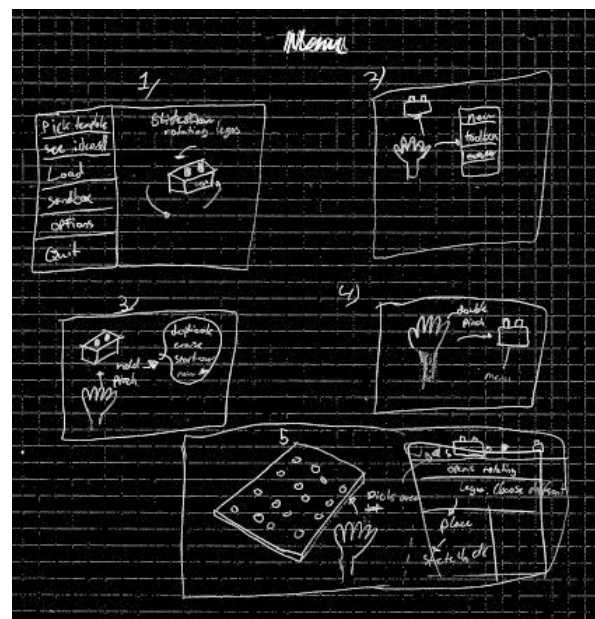

Figure 1. Skriv lidt lækert her.

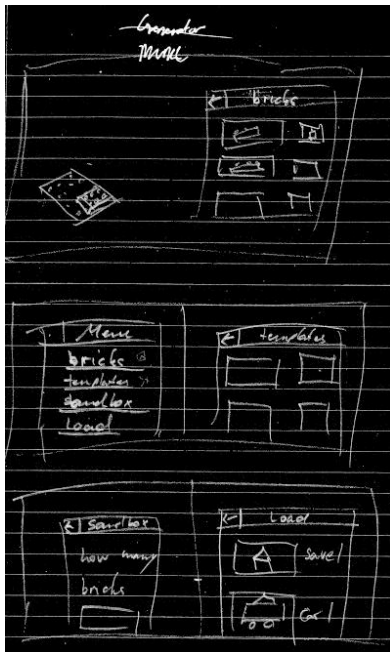
Figure 2. Skriv lidt lækert her.

Figure 3. Skriv lidt lækert her.

same "finicky" feel that LEGO has, sitting at a table, obsessing over small details in an advanced (?) setup. This is because of the computing limitiations of the Hololens and the technology architecture. The minimal rendering distance of the Hololens is, right now, much larger than the distance one would be from af real-life LEGO project, ie., arms length. This limitation demands a much larger brick size than real-life LEGO and this in turn limits the overall complexity of a virutal LEGO project.

HOLOTOOLKIT
The main package (?) used for developing for the Hololens in this project was the HoloToolkit-Unity. This package comes with some premade functionality to ease the interaction with the Hololens and is an open source toolkit made by Microsoft to speed up any development for their new platform (quote dem måske?).

Spatial mapping
The toolkit contains seven feature areas, of those spatial mapping and input were of most interest to us. We used the spatial mapping part of the toolkit to be able to "digitize" the world and make our application able to track surfaces so as to place our generator board on real world surfacs instead of having it float in mid air. This connection between the real-world and digital playground created in our application was essential, both to the experience but also to be able to call our application alternate reality. (SKRIV MERE TEKNISK NÅR VI VED HVAD FUCK DER FOREGÅR).

Input
The input part of the toolkit allows us to track the gaze and the users interaction with the objects in the application, be it buttons, bricks or the generator board. This tracking is done by shooting a ray from the users gaze (the middle of the screen on the Hololens in our case) and checking whether any colliders, object hitboxes, were hit. This raycasting, as its called, is intuitive since it uses the line of sight from the user to any object in the gameworld, so whatever you can see, you can interact with.

More specifically, the orientation and position of the Hololens with regards to the objects in the gameworld is maintained by a GazeManager from the HoloToolkit and the cursor is then placed on the vector originating from the users gaze by a CursorManager.

FUTURE WORK

LEGO size and compexity
To combat the issue with the size of actual LEGO and the complexity available in this scale a virtual magnifying glass could be envisioned. Using a special gesture, a certain area of the LEGO bricks could be brought into view using a secondary "screen", a menu that could show a zoomed in version of the actual view the user has. (Er det lort?)

Brick shortage
We have a severe shortage of bricks available in our prototype. Anyone who considers an AR LEGO application will soon have to think of which blockset or types they would include. The amount of distinctive LEGO bricks is staggeringly high, and this sort of work would probably benefit greatly from working together with LEGO as to get dimensions and oddities right. This work would also make such an application much more attractive, as one of the strongest selling points of LEGO is the variety but ensured compatibility.

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- Write in a straightforward style.

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- Explain all acronyms the first time they are used in your text—e.g., "Digital Signal Processing (DSP)".

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CONCLUSION

ACKNOWLEDGMENTS

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