Adaptive Reality for Mitigating Digital Addition

Project A inspired by Lean Startup

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Introduction

When I decided to start the business of a HubSpot solution partner in 2020, I faced a serious obstacle and did not have any clue on how to implement the project of inbound marketing with Marketing Automation, because I had worked as a project manager who had only known and practiced the waterfall approach. It was a kind of awakening that I comprehended why my most of long projects were not completed in original time, scope, and cost.

Understanding Agile and Scrum born to avoid it, I have been taking a long journey of learning Agile, Scrum, and XP(Extreme Programming). Although I acquired PSM Level I, I could not find a project in which I can truly work as a Scrum master because Agile is not a common business practice in South Korea yet.

Promoting HubSpot, I realize that inbound marketing is new to South Korea and a part of Build-Measure-Learn feedback loop which is stated in Agile Marketing and originated from Lean Startup. Scrum framework 2021 also mentions “lean thinking” which drives me to learn about Lean Startup.

Lean Startup enlightens me about changing my target customers of HubSpot to startup companies, which I believe pivoting, because they are true early adaptors of new technology. In this process, I realize that the most important thing in startup is creating a new idea of solving customers’ problems, which is just a hypothesis, and validating the hypothesis with an experiment. This is so intriguing that I decide to do it by myself. I have designed a new idea of Adaptive Reality, MVP for mitigating the children’s digital addiction which is a prevalent problem in the world of a pandemic. I believe that this is a first attempt to implement augmented reality for the purpose of changing human behavior in a better way.
Product Designer: Cho, Dong Hyung

linkedin.com/in/dong-hyung-cho-64586a95
Agenda

1. Digital Addition Problems
2. Hypothesis
3. Technical Concept of Solution
4. Roadmap for Validated Learning
1 Problems of Digital Addiction

Symptoms and Adverse Effects of children’s addiction in the digital world
Problems of Digital Addition

Some children are too early exposed to smartphones and addicted to playing video games or falling into social media, refusing to release smartphones.

The common symptom of the addicted behavior is sedentary and solitary, the children spending most of their time with smartphones and isolating themselves from other physical human beings. The addicted behavior inevitably results in lack of physical activity and social interaction.

The lack of physical activity among young people has especially more devastating implication, because of the correlation between physical activity and cognitive development; less physical activity, less cognitive development. The lack of social interaction may also incur the feeling of isolation, leading to depression or anxiety.

In addition, the sleep deprivation caused by using a smartphone overnight has a serious side effect of impeding healthy cognitive and physical development.
Solution for Mitigating Digital Addiction

According to WHO, physical activity enhances thinking, learning, and judgment skills and reduces the symptoms of depression and anxiety. Indeed, physical activity ensures healthy growth and development in young people.

WHO recommends that “children and adolescents aged 5-17 years should do at least an average of 60 minutes per day of moderate-to-vigorous intensity, mostly aerobic, physical activity, across the week and should incorporate vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, at least 3 days a week.”

To mitigate the effects of the addiction, it is imperative for us to engage the children more in physical activity. However, any attempt to make the children stop using smartphones or to replace smartphones with other devices can easily fail, because it may aggravate more unexpected, negative emotional reaction or behavior.

A solution should include smartphones as well as increasing the physical activity. I design adaptive reality, the augmented reality in the confined and controlled space, that makes a child or a team of children engaged in physical activity – catching virtual objects on adaptable routes viewed only in smartphones, leading to the change of the sedentary and solitary behavior.
The solution must include a smartphone and, at the same time, increasing physical activity.
2 Hypothesis

What ASSUMPTIONS do we want to VALIDATE?
Hypothesis to Be Validated

- The addicted children, aged from 5 to 9 with smartphones, can increase their actual physical movements through making movements in augmented reality where the digital world is a part of the real world.
- If their physical movements reach the desirable level of physical activity, then their sedentary and solitary behavior will be reduced. In addition, because of the increase of physical activity causing fatigue, they may tend to have the normal sleep pattern, going to sleep before 23:00 and awaken around 8:00.

Assumptions

- The children addicted in the digital world relentlessly resent any attempt to stop using smartphones.
- The augmented reality, based on a controlled and safe environment, with smartphones is interesting enough for the children to voluntarily make movements in the digital world, which can be only accomplished by making physical movements in the real world.
3

Technical Concept of Solution

Technology used for building
Adaptive Reality
Standing at the gate of a medium sized, simple rectangular room mostly consisting of horizontal and vertical lines, a child uses a smartphone to see the room, with the mobile app specially developed for this experiment.

The child sees the 3D digital world in the smartphone which is a part of the real world, but the 3D digital world is augmented. The colors of the walls, floor, and ceiling in the 3D digital world are purposely different from those in the real world, although the outlines and structure of the two worlds are same.

A most distinct difference is that there is a virtual 3D flag appeared on the floor of the digital world. If the child moves and stops on the flag, the flag will be disappeared and remarked as caught in the smartphone, and then another flag distant from the current position will appear. The new flag instigates the child to move on.

The several flags, according to a designed, unique route, will be shown one after another until the child returns to the gate. This exercise in which the degree of difficulty will be changed according to the child’s previous performance may repeat several times until the child reaches the desirable level of physical activity.
The mobile app will constantly capture a 2D image and send it to the application server. It will also receive the augmented 3D image with a virtual flag and display on the smartphone with # of flags caught. When a child cannot find a flag on the screen, the arrow will appear and guide the child finding the flag.

CAD software is used for storing the scanned 3D and the augmented 3D data. The data about the routes of flags on the 2D floor is also stored.

The application server includes a 3D scanner, CAD for designing the augmented 3D and the routes of flags, the deep learning matching 2D to 3D including matching the scanned 3D with the augmented 3D, and software displaying a virtual flag in the augmented 3D according to the selected route and user’s pervious performance.
3D Scanning
By 3D laser scanner, the room is scanned. The scanned 3D data, representing the real world, is stored in CAD software.

Capturing 2D Images
The mobile app in the smartphone, using its camera, takes a picture constantly and send it to the application server.

Matching 2D to 3D
The 2D image sent by the smartphone is matched with the scanned 3D stored in 3D database. The deep learning algorithm will be developed for matching 2D to 3D with Python and C++.

Calling the Augmented 3D
As soon as the user’s position is identified after matching 2D to 3D, the augmented 3D is called.

Matching the Augmented 3D
The augmented 3D called is matched to the scanned 3D with the user’s position.

Selecting a Route and Flag
One route is selected according to the degree of difficulty determined by user’s previous performance, and a flag on the route, which is aligned with the user's position, is presented.

Displaying Augmented 3D with a Flag
The augmented 3D image, including a virtual flag, is presented. If the displayed flag is last in the route, then the user’s performance, time, is measured and stored. Based on the measure, the degree of difficulty will be determined, and another route, less or more difficult, will be selected. Then the user will be asked to start again.
Relevant Technology

- **3D Laser Scanner** for scanning the room
- **CAD** software storing 3D data and designing the augmented 3D and the routes of flags
- Capturing 2D by smartphone camera
- **Deep Learning** matching 2D to 3D (TBT*)
- Software displaying a virtual flag according to the designed route in augmented 3D and the user’s previous performance (TBD**)
- Software displaying the augmented 3D, including a flag, in a smartphone (TBD**)

*TBT: To Be Trained with Python in the workstation based on GPU
**TBD: To Be Developed*
What is Adaptive Reality?

Adaptive reality® is the limited version of augmented reality (AR) reflecting the confined and controlled physical space where a user's movement in the digital world is based on the physical movement in the real world. Its purpose is to increase the user's physical activity so that the user's sedentary and solitary behavior will be changed.
Roadmap for Validated Learning

Learning Roadmap inspired by Agile, Scrum, XP, Lean Startup, and Design Thinking
Learning Roadmap

According to the validated learning, the roadmap can be significantly adjusted.

- **Validate Hypothesis of 1st MVP**
  Construct the simple augmented reality with fixed objects such as 3D flags for increasing an individual's physical activity, experiment it with samples of 30 or more addicted children, and conduct hypothesis testing.

- **Validate Hypothesis of 2nd MVP**
  Construct the complex augmented reality with moving objects such as 3D running rabbits for increasing a team's physical activity and social interaction, experiment it with samples of 30 or more addicted children, and conduct hypothesis testing.

- **Expand Adaptive Reality**
  According to the validated learning, the augment reality will be refined to accommodate more complex environment.

- **Apply Adaptive Reality to Commercial Use**
  Develop a commercial application of Adaptive Reality.

**Commercial Use of Adaptive Reality**
Possible example: 3D ad or guide in the streets of Adaptive Reality, a virtual figure guiding a customer in a shop, etc.
Required Resource for Accomplishing 1st Learning Roadmap

- Form a new scrum team, at least five members for effective design thinking, that consists of one playing the roles of a product manager as well as scrum master and four developers: two for the machine learning server, one for the mobile app, and one for 3D database server (mainly CAD). The diversity of the team in terms of demographics and psychographics must be carefully considered.

- Execute the project based on Scrum artifacts and events. The validated learning from Lean Startup through the Build-Measure-Learn feedback loop is a foundation of this project.

- The team adheres to the Scrum values such as Commitment, Courage, Focus, Openness, and Respect as well as Agile Manifesto values and principles and will need proper time for teamwork because it will go through the stages of forming, storming, norming, and performing. It may take two or three months just to reach the norming stage. To exert constant work cadence, the team will need four or more months.

- The developers specially adhere to the values, principals, and practices of Extreme Programming (XP).

- There must be a common workplace for the team members to work together. Face-to-face communication is essential, unless the circumstance dictates work from home. There should be at least three rooms: an working office, a meeting room, and an experiment room. The size of an experiment room is medium, big enough for children to navigate physically.

- There must be two workstations with GPUs: one for CAD and the other for deep learning. All of team members' laptops must be capable of handling CAD or machine learning. A 3D laser scanner, CAD software, and NoSQL database will be needed.

- The initial estimate of accomplishing the first learning roadmap is one year. Based on the outcome of the first validated learning, the second learning roadmap and the size of the team will be specified.
Scrum Team,

capable of gaining validated learning, is a most critical success factor of this project, inspired by Agile Manifesto, Scrum Framework, Extreme Programming, Lean Startup, and Design Thinking.
“A startup is a human institution designed to create a new product or service under conditions of extreme uncertainty.” by Eric Ries in The Lean Startup