Final reflection

Master of Science Architecture, Urbanism & Building Sciences

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Graduation process

Position in the studio

The graduation topic is positioned within the studio New Techniques and is a combination of Building Product Innovation and Design Informatics. The topic explores a new assembly technique by applying robots in an assembly process. The robotic process provides input for updating the geometry of the elements to make them more suitable for robotic assembly.

Research approach

The literature research in combination with the case study of TheNewMakers provided the information required to design a robotic process hypothesis. Based on this hypothesis a physical experiment with a section of the wall component as well as a computer simulation with the whole wall component were conducted. The physical experiment was executed in collaboration with HBO mechatronic students.

Table 1: SWOT analysis of the research method.

	Helpful	***Harmful***
Internal	Strengths - Providing a robotic process on which TNM can continue to build and research upon. - Improve the wall component of TNM.	Weaknesses - Relatively small budget. - Relatively short time span.
External	Opportunities - Collaboration with HBO mechatronic students with their valuable knowledge. - Collaboration with HTCDelft. They open up their facilities for use during the research.	Threats - Collaboration with HBO students. There is a plan B if they are not able to provide the results on time. - Collaboration HTCDelft. If their facilities are not available anymore.

Research and design related

The research influences the design of the components of TheNewMakers. The assembly procedure of a specific wall component has been improved as well as the geometry of the separate elements.

Issues or dilemmas

Until P2 it was a real struggle for me to get the research framework clear. When I finished P3 it was the first time I felt confident about the framework. Although it was no easy process, thanks to several iterations I gained experience and knowledge in setting up an academic research. This confidence and knowledge helped me to act more as research leader and I guided the HBO students and the experiment. I learned my qualities lie more at the execution of a research and not in defining the framework.

An initial issue was my lack of knowledge regarding my chosen topic of robotics. I only had a basic understanding of robotics and it is a whole different world compared to the built environment. I felt as if I was in an ocean of new information, but with the guidance of my mentors and collaboration with the HBO students I was able to get a grasp on the topic and conduct the research.

Since a company has a different perspective compared to a university, I thought collaborating with a company, like TheNewMakers, might lead to issues. This was not the case, on the contrary, working with TheNewMakers helped to improve my focus and created a link between my research and a real world application. TNM provided a realistic case study with clear boundary conditions.

Time planning was sometimes a bit of an issue. Especially to make three schedules match, the schedule of: TheNewMakers whom have much more other projects to take care of, the HBO mechatronic students with their own deadlines and other courses, and my personal graduation planning. However, my presentation moments helped to define certain deadlines for myself. Especially the deadline of P3 as well as P4 helped to guide my planning and entwine it with the schedules of TNM and the HBO students.

Societal impact

Results applicability

The research results are very well applicable in practise. According to the Lean robotics methodology a robotic process consists of three phases: design, integrate and operate (Bouchard, 2017). The proposed robotic process resulting from this research lies close to the end of the design phase. Some aspects need to be worked out in more detail before the next step, meaning the integration phase, can be taken.

Innovation

The wall component of TheNewMakers is innovated and pushed towards the future by optimising it for robotic assembly. The optimisation was focussed on minimising the assembly time and CNC milling time. Besides the physical innovation, the starting point for a digital innovation is presented. The robotic simulation provides that functions using a written Python algorithm can be further developed to a more generalised algorithm that is able to handle size variations of the wall component as well as other components of TNM.

Sustainability

TheNewMakers is developing a sustainable building method. This research helps TNM to improve their components and speed up their production process, which enables them to implement more sustainable solutions in the built environment.

People

Some people working at TheNewMakers will have improved working conditions since they have less repetitive work to do when the proposed robotic process will be implemented. Thanks to freeing up some of their time they are able to allocate more of their hours to other tasks. Especially tasks where people are able to express their creativity and social skills, which are things a robot is not able to do as well as humans.

Planet

The planet will benefit when TheNewMakers is able to deliver more of their sustainable products to clients. If TNM would not be able to satisfy these clients, they could have chosen for other solutions from other companies that might be less sustainable.

Profit

TheNewMakers is likely to make a profit by applying the proposed robotic process. Employees who are currently spending time on repetitive and low-value-added work, can shift their focus to working creatively and create more value in the company (Bouchard, 2017).

Socio-cultural and ethical impact

This research contributes to applying robots in our world. When robots are applied in many aspects of society it will influence our lives significantly on so many levels. This influence can turn out positive or negative for humans. A lot of debate is going on regarding the issue if we should apply robots in such great numbers in our lives.

There are numerous researches and articles that state the public opinion is rather negative about robotics. Like a survey reviewing the opinion of over 4000 people in the United States, which showed that 72% of them are “very or somewhat worried about a future where robots and computers are capable of performing many human jobs” (Solon, 2017). It could be that this public opinion fuelled the following finding: I noticed that many researchers who are looking into applying robotics and automating tasks mention that they do not want to replace human workers. As a matter of example I will shortly explain one. A research developed a new robot that can be trained to feed dinner to someone with a disability. The robot was created because in the United States in 2010 about 12,3 million people needed such help. For the person who is being fed it is hard to socially accept the inability to eat without the assistance of another human. For the caregiver it is a time consuming task (Bhattacharjee, Lee, Song, & Srinivasa, 2019). It is clear this robot is unable to replace a caregiver, since it can only feed someone. Nevertheless, the corresponding author Siddhartha Srinivasa felt the need to state the obvious: “the point is not to replace caregivers: We want to empower them. With a robot to help, the caregiver can set up the plate, and then do something else while the person eats" (McQuate, 2019). This shows how researchers that are positive about robotics try to take away some of the concerns people have regarding robotics.

Wider social context

Although, only briefly touched upon in this research, an even more significant worry would be artificial intelligence. Robots on itself are just another tool, like a hammer. The algorithm controlling a robot is the one to be concerned about. Some global prominent thinkers have shared their thoughts regarding artificial intelligence. Stephen Hawking stated “Humans, limited by slow biological evolution, couldn’t compete and would be superseded by A.I.”, which is comparable to Elon Musk who called it our “biggest existential threat”, and Bill Gates said he is “in the camp that is concerned about super intelligence”. These answers were given during interviews in 2014 and 2015 (Torresen, 2018). In philosophy and AI, research is being conducted towards the AI control problem. The control problem refers to controlling a super intelligent AI and prevent it from replacing humans as the dominate species (Bostrom, 2014).

References

Bhattacharjee, T., Lee, G., Song, H., & Srinivasa, S. S. (2019). Towards Robotic Feeding: Role of Haptics in Fork-Based Food Manipulation. IEEE Robotics and Automation Letters, 4(2), 1485-1492. doi:10.1109/LRA.2019.2894592

Bostrom, N. (2014). Superintelligence: paths, dangers, strategies.

Bouchard, S. (2017). Lean Robotics: a guide to making robots work in your factory.

McQuate, S. (2019, March 11). How to train your robot (to feed you dinner). UW News. Retrieved from https://www.washington.edu/news/2019/03/11/how-to-train-your-robot-to-feed-you-dinner

Solon, O. (2017, October 4). More than 70% of US fears robots taking over our lives, survey finds. Retrieved from https://www.theguardian.com/technology/2017/oct/04/robots-artificial-intelligence-machines-us-survey

Torresen, J. (2018). A Review of Future and Ethical Perspectives of Robotics and AI. Frontiers in Robotics and AI, 4(75). doi:10.3389/frobt.2017.00075