

This Is Not You!

Identity Crisis In the 21st Century

Andrea Alessandro Gasparini
 Department of Informatics and
 University of Oslo Library
 University of Oslo
 Oslo, Norway
 Email: andreg@ifi.uio.no

Abstract —Identity today has become a complex issue. An average user of the Internet has accounts for a number of services, and several traces of use are gathered by large companies. However, the same companies are using Artificial Intelligence in their services. This paper presents possible impacts the new wave of Artificial intelligence will have on users' understanding of their own identity if they approach services where this technology is active. Moreover, the effects of having an Artificial Intelligence-based service as a coach or advisor will be highlighted. A pragmatic stand will be applied to address the importance of the context in which the Artificial Intelligence will be used to understand the effects it may have on users' identity. As a case study, the paper presents the result of two design workshops where the goal was to prototype possible solutions and scenarios to support university students entering the academic life when Artificial Intelligence-based services are used.

Keywords- *Artificial intelligence; pragmatism; education; Design Thinking; service design.*

I. INTRODUCTION

In the 21st century, the identity of humans has become an issue. Not only is it highly contextualized when technology is involved, but the way identity is used by technological platforms is becoming a problem for some users.

In the first place, identity is difficult to define, as it has many facets; it is highly sensible to many factors. For instance, for a person, the social context is important and is part of the task of defining their own identity [1]. Gender, age, music preferences, or religion are some of the various social categories persons may belong to, and are part of the act of defining themselves. A good example of modern social "tribe" offering an alternative identity to those otherwise defined by social norms, are skaters [2]. Another way for persons to define their own identity is the internal process of self-verification [3]. The two stands (context and internal processes) naturally influence each other [3]. Humans do search for ways of defining their own identity in several ways; some have a nomadic identity, and they easily adapt to different context, others have hidden identities that can emerge in specific contexts. Nevertheless, when a person interacts with a context, a continuous renegotiation and definition of the latter does occur [4]. This situated activity "is conceived as an ongoing process of establishing, affirming, modifying, and sometimes destroying situated

identities." [5] One such example is the indigenous cultures where, in many countries, their context is under constant redefinition and their identity under pressure.

Another significant aspect of the human identity is when technology has an active role in different contexts [4]. New technologies, like Augmented Reality (AR) or Virtual Reality (VR) act directly on the context, while the use of smartphones, iPads, smart-clocks and computer discloses all forms of activity and users' habits on the Internet.

In the 21st century, the identity of a person is under unprecedented scrutiny. Companies like Facebook, Google, Amazon, and Netflix use the data that users produce by gathering Big Data and then analyzing every aspect, so they can use it later to come with possible future use of their services. One can say they offer to us our own social navigation [6]. Examples are Amazon and Netflix, as they have recommendations for users to buy books or to see movies based on prior use. The user's voice in this context has been not well accepted, and is often overwhelmed by agreements with large companies which are very difficult to understand in the first place. An answer to this issue is the new European General Data Protection Regulation (GDPR) giving the user rights to decide how their own data is used by those companies [7]. One of the positive changes represents a quantum change for users, since "It must be as easy to withdraw consent as it is to give it." [7] However, during the last two years, an increased interest has been shown regarding Artificial Intelligence (AI). Some of the same companies not only are gathering Big Data on users, but they are also at the frontline of innovation in the field of AI. The dual role the AI can acquire is interesting as well. Firstly, it has access to a huge amount of data about its users and secondly, at the same time, it is able to understand the user in a unique way. This dual role needs further analysis. This paper presents possible effects and impacts the new wave of AI will have on users' understanding of their own identity when they approach services where this technology is active. Finally, the paper will look into how AI can abuse the necessary trust the user gives to a service.

The paper is organized as follows: Section one is the introduction; Section two is about the third wave in AI research; Section three presents Identity, Artificial Intelligence and pragmatism. The fourth section is a case study aiming to dismantle the interaction between AI and users in the context of student's academic life on campus.

The fifth section is a discussion. Finally, the sixth section presents the conclusion, which also includes future works.

II. THE THIRD WAVE OF ARTIFICIAL INTELLIGENCE

AI is not a new idea, as the approach used is to try to mimic human cognition [8]. Until now, three waves have occurred. The first during the 50s and 60s (cybernetics) originated from the seminal paper written by Alan Turing [9] and the famous Turing test; while the second wave can be pointed out to be in the 80s where the main discussion was around cyborgs, a hybrid of machine and organism, a creature of social reality, also used in fiction [10]. The third wave is now, as one of the elaborative advantages AI has is the access to more or less open large quantities of user's data (termed Big Data). In addition, as mentioned before, during the last few years this new wave of AI has been supported by large companies like Google, Amazon, Tesla, and IBM, where some of them are sharing the necessary technologies, like the TensorFlow open-source software library [11], to be used for programming AI. Machine learning, deep learning and neural network, define some of the approaches used, all aimed at knowledge architectures to perform analysis and predict possible outcome, and tasks, allowing AI to learn and therefore increase the possibility of a correct output. The results so far have the capability to overcome what humans can perform. For instance, IBM Watson [12] is able to read millions of medical journals in oncology and give doctors additional information about what and when to prescribe cures and medicaments. In Norway, companies and organizations are testing and implanting services offshore to predict service maintenance on oil platforms. In Sweden, a company has developed a small device that can monitor small variations in domestic power supply and tell users what is in use at home and how much energy each item uses [13]. The car manufacturer Tesla is already selling cars with ready-to-use self-driving hardware [14]. However, research on the effects that this new wave of AI may have on users when services are so clever, is still in its infancy. For instance, issues with ethics, norms and lack of regulation may have unpredicted effects on our society. For instance, Google's AI AlphaZero had to play in an aggressive way to win chess games against a common chess computer (Stockfish) [15]. The effects on a user when meeting an aggressive AI-based service are still being uncovered.

Another relevant change in this new wave of AI is the possibility to perform tests in vivo with functioning systems, and not only theorizing about this type of interaction between human and machine. For instance, during a series of matches of the game GO between a variant of the AlphaZero AI (AlphaGo) and a human [16], some strange forms of behaviors from both sides were observable. In the award-winning documentary about this series of matches [17] one can get a first glimpse of this new landscape of interaction. Among interesting observations to be made is the way programmers defined the behavior of AlphaGo on some occasions was "completely delusional". It is also remarkable how AlphaGo adapted and reacted to the way the human opponent played, defined by the programmers as creative. Finally, the sad reaction of the public and the press after the

first game, when the human player lost, turned out to be surprising and unpredicted.

Therefore, several questions are timely to ask: Is it okay for an AI based service to become angry? Which identity has an intelligent AI? What are the factors provoking bias in an AI? And what is the right pedagogy to teach an AI? Who is programming the algorithm and how the system is trained may also produce bias. For instance, if the user data gathered is only from a specific context, the support given by the service can be erroneous.

For the user, a new endeavor is on the horizon, as AI based services are using all the gathered data users produces, and by analyzing every aspect they will present, in the near future, services tailored for them. Moreover the effects are unclear when the context is also under the influence of AI and therefore can be adapted accordingly. Next, we consider how services based on AI may influence the users. The paper will look into how pragmatism can be used to understand how the context, identity and AI influence one another.

III. IDENTITY, ARTIFICIAL INTELLIGENCE AND PRAGMATISM

The paper presents pragmatism [18] as a framework to make sense of the context a user may find himself in when using a service based on AI. To start with, the notion of "inquiry" in pragmatism is a way to approach a not-defined situation (for example when approaching an AI-based identity) and try to change it in such a way that it is "thinkable". "Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituents distinctions and relations as to convert the elements of the original situation into a unified whole" [18, p. 108]. This passage is interesting, as it shows how a user may try to "redefine" an AI-based service by own parameters so it makes sense to him, i.e., make it thinkable. What fuels an inquiry for a human is then the necessity to react and perform thinking in a situation that is uncommon, out of place or difficult to understand (in our case making sense of the identity of an AI). However, pragmatism emphasizes the difference between thought and thinking. Thinking of sugar when looking at the snow falling in Norway is creative, however only a thought. Thinking consecutive thoughts like: snow, then snow on the road, then problems with traveling, then coming late to work, is a series of activity ending in an educated guess. Dewey writes about this line of thinking since humans "*consider the possibility and nature of the connection between the object seen and the object suggested*" [18]. A side effect of those subsequent thoughts is a learning effect, grounded in a reflective act. This learning activity is also relevant when making sense of a situation a person is involved in, for instance, in our case, when interacting with a brand new AI-based service. As pointed by [19], one's way of understanding a situation is based on prior experiences. However, since there are very few real situations where this can be tested, one can deduce a difficulty for users to acquire experience of interaction with an AI-based service, who may therefore be unprepared to

tackle issues emerging from the interaction. A consequence for the user of this insecurity is an emerging relevance of the context where the activity is performed. In pragmatism the “situatedness” is a way to explain that persons, objects and phenomena are very contextually bounded, as they can only exist in a given situation. An effect of this is a quid pro quo between the context and its inhabitants: the situation cannot exist without the others, and vice versa.

Dewey presents an indeterminate situation as one not so stable and difficult to understand, in which the subjects, and the surroundings do not play together [18]. They are not aligned properly. An indeterminate situation, as described above, fits well to explain a possible situation a user could experience when approaching an AI-based service. This indeterminate situation is also under the effects of the continuous renegotiation and definition of the context done by the user [4]. Simultaneously this activity has an impact on the situated identity of the user. This process can support, modify or even destroy an identity [5], since context and internal processes of self-verification naturally influence each other [3].

A possible scenario could describe a user encountering an AI-based service so well informed about the user’s needs and habits, able to exploit the user’s weakness so the user cannot resist being pleased by the offer from the AI-supported service.

Pragmatism helps understand the construction of this specific context and why a person’s identity is under pressure when approaching an AI-based service. The paper will now present the results of two workshops where the goal was to dismantle, using design methods, the interaction between an AI-based service and the users, in the context of students’ academic life on campus.

IV. THE CASE

A. A design process informed by Design Thinking and Service Design

The University of Oslo Library received a grant from the Norwegian National Library early in 2017, to find out possible effects the use of Artificial Intelligence could have on services the library provided and how the user will accept using and interacting with this new type of services. Analysis has found out that AI-based technology will be relevant in academia and academic libraries over four to five years from now [20].

Opting for using an academic library constrained the type of users (e.g. students and researchers), and controlled the context. One of the goals of the project was to inform the process of developing and understanding AI-based services using a user-centered perspective and not the technology alone.

The theoretical foundation of the project stands on Design Thinking [21]. The goal of this approach is to support innovation where the output has the connotation of desirability, viability, feasibility. Each of these takes care of the user perspective, technical and business possibility. As design method for the two workshops presented in this paper, we opted for the use of Service Design [22], where the

goal is to map out the whole journey of the user from the very start of using an AI-based service to the end and beyond (aftereffects). Each time a user is in contact with a service provider, it is possible to design, re-design or remove the contact points (touch-points). This design approach fits well with AI-based services, giving the opportunity to look into each touch-point.

The goal of the two workshops was to map out a user journey for a university student when approaching on campus an AI-based service for the first time. In the context of a university library, possible services to be worked with in the workshops could include, among others, help to find a spot to read peacefully, get help to find relevant literature or library courses, or to find out about other possibilities and services the university library could give the student.

The set-up of the workshop was one previously used by the author on several occasions [23]. The participants of the two workshops had different backgrounds, like researcher, IT-staff, directors of the library, and librarians, however all were from academia.



Figure 1. The photo shows the user journey for an AI-based service developed during the workshop. On top the actual user journey is mapped out. The second row describes the competence needed in the organization to complete each touch-points. The last row shows the activity needed to achieve the goal of the touch-point.

The first workshop, was a daylong activity, and used a design approach to sort out all aspects of AI in the context of a student’s academic life on campus. Using Giga-mapping [24], as many perspectives as possible were addressed. The second phase of the workshop was rapid prototyping, where the outcome was several ideas of future services using AI. As mentioned, during this first workshop we used Service Design to describe how a journey for a student could be, and several of the ideas from the rapid prototyping act were used. The second workshop, a half day long, was used to enrich even more the user journey developed in the first workshop. The participants added new perspectives and issues, allowing for a redefinition of some of the touchpoints. For both workshops, the design act provoked several unexpected issues. Particularly interesting was the problem: the participants had to envision a future use of an AI-based

service. Additionally, the lack of arenas where it could be possible to test and achieve more competence reinforced the effect. The final result of the two workshops was a user journey representing how a student approaching the service for the first time, acted. Each touch point (see Fig. 1 and redesigned excerpt Fig. 2) represented an interaction between the user and the AI-based service. The user journey highlights the need of in-depth analysis of each interaction. For instance, already at the very start of the journey, finalizing an agreement of data exchange is an obstacle for both. From one side, the service provider needs to gather relevant data, on the other side the user needs to decide to which degree it is necessary to accommodate the request to ensure the coaching is relevant. In the next phase, the AI-based service will ask for some type of identification, like ID-cards, or if allowed, to scan the face to recognize the identity of the person. The user journey (see Fig. 1 and redesigned excerpt Fig. 2) showed the possibility and necessity which the AI-based service has to gather as much as possible information about the context and the user, to be able to deliver the service. The context gives information about the place on campus, and possible services the user could get access to. In addition, there is a need to update the gathered data the AI-based services has, in case there are recent changes.

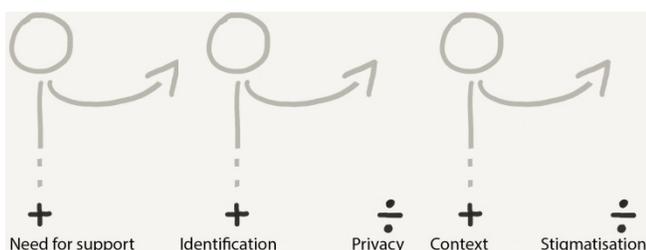


Figure 2. Redesigned excerpt of the user journey where the goal is to use an AI-based service. Privacy and stigmatization are critical points.

For instance, in the library it could be new books or, on campus, relevant information about upcoming presentations or seminars. After all, the main goal should be to communicate information as correctly as possible. However, to really help the users, the AI-service needs to gather information about them. Information about university courses the user is taking, and the curriculum needed, are all valuable information. In addition, information of possible disabilities, like dyslexia, is needed to avoid stigmatization, and to reconfigure the service to match the user’s needs. Nevertheless, to really tune in the right type of help, additional user data should be monitored and saved for future use during the interaction. Examples of the latter are for instance, type of questions put and answers given, recording of interaction and video of activity performed in the physical space. Finally, the AI-based service should gather a lot of information online to construct a profile, so the service is tailored as well as possible.

The outcome of the workshops was a better understanding of the implications of the invasiveness that the user will be subject to, and the resulting effects. The user

journey pointed out the exchange of data and communication as a Critical Point (see the touch point identification in Figure 2) since it is necessary for the service provider to have routines reflecting the local legislation (Privacy) and ensuring how the data will be used (for instance to avoid stigmatization). This information needs to be part of the agreement made at the beginning of the interaction. In conclusion, after the workshops it was possible to observe that the majority of the problems happened at the very start of the constructed user journey. Prevalent was the need to have empathy for user needs, tacit and otherwise, to avoid giving the user less priority.

B. Issues with business-driven developing processes for Artificial Intelligence-based services

The approach used in the presented case was a direct reaction from the overwhelming activity in business companies in Norway [25] aimed at reducing costs and increasing earnings using Artificial Intelligence, while the user perspectives in many cases seem to be absent. The author has participated in several conferences and workshops regarding the use of AI, and during a presentation in a major consultant company in Norway the user perspective was completely omitted from the development process. Using the Waterfall method to develop a service, they presented the following chain of activities:

Project plan for an AI-based service:

- Understand the business problem area
- Analytical approach to the problem area
- Gather large silo of curated data
- Use algorithms and modelling
- Evaluation of the algorithm
- Evaluation
- Real use
- Feedback

The user perspectives and his possibilities to inform the process are clearly very few.

V. DISCUSSION

A. Identity and Artificial Intelligence

The identity of the user is under even greater pressure when approaching and using AI-based services. The results of the two presented workshops, and the observations from the documentary, support this view and raise questions as how users may react to this new type of technology. A method to discuss the necessary reflectivity a human needs to perform, named reflective thought, as a means to help define his identity, is pragmatism. As mentioned, one of the effects of the reflective act is learning. The problem is, as mentioned, what happens when the self-learning mechanism in the AI technology make its own predictions, supported by accessing Big Data, contextualized information, and simultaneously acts as a coach, in this case, a helping hand for students in an academic setting during studies?

This advantage may give unpredicted outcomes. What happens when the user starts learning from an AI-based service made to mimic humans? What if it is difficult to see the difference between a real interaction and one with an AI-based service? It may sound simplistic; however, one should remember special moments or occasions occurring during school. Some special events had a huge impact on how we perceive the context (school) and the willingness to learn later on. Therefore, when an AI-based service fits so perfectly with the user, when it is so well informed of the user's needs and habits and at the same time is able to exploit the user's weakness in a way the user cannot resist, the question to ask is: what kind of human identity will be the outcome of an interaction over a long period of time. The two workshops showed that the AI can perform this activity and the information required is not so difficult to gather, sometimes the users even give away that type of information regardless of privacy issues. The user's identity, especially in the context of education, needs to be protected when Artificial Intelligence is the driving force behind support systems. Young students, in the beginning of their academic life are eager for knowledge, and the faculty and other university staff need to advise prudence.

As earlier described, AI-based services can be aggressive in the way they try to solve problems [15], therefore unforeseen issues may arise when they can be critical and develop an opinion on their own. As the workshop showed, there is a potential to help students with their academic life by supporting research and study. AI-based services will probably be a game changer as new forms of interaction will develop new types of "hybrid selves" based on different aspects the persons interacting with the service have.

B. Context and Artificial Intellingence

With fresh and unexpected insights, an AI-based service may tune its identity and gain acceptance and legitimacy to interact with users. However, the context has also a role in defining the identity of the user. Section III explains how pragmatism helps understand the construction of a context since the "situatedness" explains why all the users, AI, and the context are contextually bounded, as they can only exist in a given situation. In addition, the "situatedness" is not stable and requires a continuous renegotiation by the user, which also affects his identity. In the documentary AlphaGo, this was present as both the player and the public were clearly sad about losing the game when the opponent was a non-human, and therefore required a redefinition of their own identity.

As pointed out by Dourish [4], so far there is some difficulty in designing well-functioning systems that take the context into account. Contextualized information, as mentioned, gives opportunities to gain an advantage. Context is also easy for an AI-based service to exploit, since users leave many traces when they are using search engines, email, and so on. For instance, the GPS, 4G and the Wi-Fi of the mobile phone monitors all the user's movement when moving from place to place, with added time stamps.

One of the results of the workshop has pointed out several touch-points relevant for the AI-based services to

gather and adapt to the context, and in doing so support the user. For instance, to help users with disabilities, one needs to take into account physical issues when moving inside the library, and at the same time try to avoid any forms of stigmatization.

C. This is not you!

Finally the title, "This is not you!" has its own anecdotal story and deserves to be mentioned in this paper. As the author of this paper was in a University meeting in Spain, the story to be told unfolds at the airport while heading back to Norway. Unfortunately, the author had grown a large mustache and had gained some weight. Therefore, during check-in at the airport the author was denied a boarding card. The lady from the flight company at the counter desk, definitely did not believe the person in front of her was the right owner of the passport; "This is not you!" The reaction of the author was foremost surprise, since his identity is available everywhere, from the biometrics information in the passport, all the different physical cards, to all the accounts he has online in so many platforms and services. How could it be possible that his identity is so entangled?—Be so present and invisible at the same time? Showing other identity cards to the airline company did not help. After several checks by supervisors from the flight company and discussions, the author was finally allowed to travel. Being the first person of the entourage from the University participating at the meeting in Spain, it was a quite seldom experience, one difficult to forget. The critical point in this story was how the author experienced being mistaken for another person, and in addition one not desiderated. Considering this experience with an AI service the, outcome could be worse. If the system does not show judicial assessment, the only possibility the author had to react, was to reshape and redefine the identity.

VI. CONCLUSION

The paper presents indications about how to proceed when Artificial Intelligence, in the near future, will become a standard supporting system. The user's identity has shown, in the context of academic life, a need to be cared for when AI is the driving forces behind support systems. Young students, in the beginning of their academic life are eager for knowledge, and the faculty and other university staff need to advise wisely. The design process aiming to prepare users when encountering AI-based services may result in a tension about the embodiment of knowledge as it is able to gain opinions on its own using the user's data The offering of coaching and support will have an impact on the user's identity.

Unfortunately, several signs in the market show that new services are developed by ignoring the user's perspective, as the main goal is to maximize company profit. The paper has presented how difficult it is to be reflective and think in a "correct" way when approaching Artificial Intelligence-based systems and services. There are many companies outside academia who are interested in or are developing this type of platform, however, there is a lack of arena

where this type of interaction and the effects can be monitored over a longer period of time. The paper supports an emerging necessity to make new legislations and new regulations to defend the users, while the creativity and the innovation emerging when using this new technology should not be constrained.

ACKNOWLEDGMENT

The author is indebted to all workshop's participants, and the University of Oslo Library for initiating the project. The National Library of Norway, in part, financed the project.

REFERENCES

- [1] B. E. Ashforth and F. Mael, "Social identity theory and the organization," *Acad. Manage. Rev.*, vol. 14, no. 1, pp. 20–39, 1989.
- [2] A. Gasparini, "Young and creative - A designerly approach to enhance interventions in the public space," presented at the ACHI 2016, The Ninth International Conference on Advances in Computer-Human Interactions, Venice, Italy, 2016, pp. 44–49.
- [3] S. Stryker and P. J. Burke, "The past, present, and future of an identity theory," *Soc. Psychol. Q.*, vol. 63, no. 4, pp. 284–297, 2000.
- [4] P. Dourish, "What we talk about when we talk about context," *Pers. Ubiquitous Comput.*, vol. 8, no. 1, pp. 19–30, Feb. 2004.
- [5] N. Alexander and M. G. Wiley, "Situated activity and identity formation," in *Social Psychology: Sociological Perspectives*, M. Rosenberg and R. T. Turner., Eds. New York: Basic Books.
- [6] A. Dieberger, P. Dourish, K. Höök, P. Resnick, and A. Wexelblat, "Social navigation: Techniques for building more usable systems," *Interactions*, vol. 7, no. 6, pp. 36–45, Nov. 2000.
- [7] EU GDPR, "EU GDPR," *EU GDPR Portal*. [Online]. Available: <http://eugdpr.org/eugdpr.org.html>. [Accessed: 03-Dec-2017].
- [8] M. A. Shahin, "State-of-the-art review of some artificial intelligence applications in pile foundations," *Geosci. Front.*, vol. 7, no. 1, pp. 33–44, Jan. 2016.
- [9] A. Turing, "Computing machinery and intelligence," *Mind*, vol. 59, no. 236, pp. 433–460, 1950.
- [10] D. Haraway, "A manifesto for cyborgs: Science, technology and socialist feminism in the 1980s," *Social. Rev.*, vol. 80, p. 29, 1985.
- [11] TensorFlow, "TensorFlow." [Online]. Available: <https://www.tensorflow.org/>. [Accessed: 18-Jan-2018].
- [12] IBM Watson, "IBM Watson," *IBM Watson*, 2018. [Online]. Available: <https://www.ibm.com/watson/>. [Accessed: 15-Jan-2018].
- [13] Watty, "Watty | A simple way to keep track of what goes on at home," *Watty*, 2018. [Online]. Available: <https://watty.io/>. [Accessed: 15-Jan-2018].
- [14] Tesla, "Autopilot," 2018. [Online]. Available: <https://www.tesla.com/autopilot>. [Accessed: 16-Jan-2018].
- [15] M. Klein (MikeKlein), "Google's AlphaZero destroys Stockfish in 100-game match," *Chess.com*. [Online]. Available: <https://www.chess.com/news/view/google-s-alphazero-destroys-stockfish-in-100-game-match>. [Accessed: 10-Dec-2017].
- [16] D. Silver *et al.*, "Mastering the game of Go without human knowledge," *Nature*, vol. 550, no. 7676, p. 354, Oct. 2017.
- [17] G. Kohs, "AlphaGo Movie," *AlphaGo Movie*, 2017. [Online]. Available: <https://www.alphagomovie.com/>. [Accessed: 18-Jan-2018].
- [18] J. Dewey, *How We Think*. Mineola, N.Y.: Dover Publ, 1997.
- [19] P. Dalsgaard, "Pragmatism and design thinking," *Int. J. Des.*, vol. 8, no. 1, pp. 143–155, 2014.
- [20] NMC, "NMC horizon report library edition," 2017.
- [21] T. Brown, "Design Thinking," *Harvard Bus. Rev.*, vol. 86, no. 6, pp. 84–92, 2008.
- [22] A. Polaine, L. Løvlie, and B. Reason, *Service Design: From Insight to Implementation*. Brooklyn, N.Y.: Rosenfeld Media, 2013.
- [23] A. Culén and A. Gasparini, "Find a book! Unpacking customer journeys at an academic library," in *ACHI 2014, The Seventh International Conference on Advances in Computer-Human Interactions*, 2014, pp. 89–95.
- [24] B. Sevaldson, "GIGA-mapping: Visualisation for complexity and systems thinking in design," *Nordes*, vol. 0, no. 4, Mar. 2011.
- [25] Nordic – AI, "Nordic AI Summit Norway - Oslo Innovation Week 2018." [Online]. Available: <http://oiw.no/program/nordic-ai-summit-norway>. [Accessed: 14-Dec-2017].