The End of Serendipity: Will Artificial Intelligence Remove Chance and Choice in Everyday Life?

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Figure 1: He Loves Me? He Loves Me Not? A chance game. Will we keep pulling off petals to get an answer?

ABSTRACT

Software defines our everyday experiences! Communication in families as well as in the workplace is largely software mediated. The choices we make, from the news articles we read to the movies we watch and the people we date, are to a large extent software supported. Personalized news portals, navigation systems, social media platforms, shopping portals, music streaming services, and dating apps are only some examples of systems that affect what we experience, think, and do. Improvements in human computer interaction have led to a wide universal adoption of these systems in many areas. Artificial intelligence, learning about the users and their preferences, and striving for simplification in interaction, reduces the need to make active decisions and herby removes chance and choice. Will this lead to highly optimized systems – that apparently work great for the user, but at the same time end the element of randomness and serendipity in our lives? Simplified content creating, recommender systems and augmented reality are drivers for this. Can interactive human centered artificial intelligence help to keep the user in control or if this is just an illusion?

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **Ubiquitous and mobile computing theory, concepts and paradigms**; • **Computing methodologies** → **Artificial intelligence**; **Machine learning**.

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KEYWORDS

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1 INTRODUCTION

There are phrases that are still common "I met her accidentally and we get on well together", "it was pure chance that we were there at the same time", or "we sat next to each other on the train, and realized we work on the same thing". Until now, many of our major decisions in life, such as the job we work, the people we live with, or whether and with whom we start a family, largely depend on chance and the choices we make. This may be history!

In the pre-digital age, the choice was much smaller, since you were, in most cases, essentially limited to your community (local as well as societal). These limitations applied to mundane everyday tasks, such as what and where to buy an item, as well as to big life choices of what school to go to or whom to marry. As the choice was limited, no recommender systems were required. In many cases, chance played a major role as well as the social environment people were in. Decision support, if required, was provided by friends or even by playing a chance game, such as the daisy oracle, depicted in figure 1, where you alternate choices (e.g. yes, no, yes, no, etc.) while pulling off petals, till all are gone.

With digital technology our horizon widens, we have much more choice. We have access to virtually unlimited information and we can connect to people all around the world. However, this comes at a price! As choice becomes huge and the number of options is more than we can look at in a lifetime, we need algorithms that help us

to decide what we see and what stays hidden. These algorithms are common by now and have become the fabric of success (or a reason for failure) for online stores, media portals, social networks, and dating sites. Providing the users with a appropriate pre-selection is key.

2 UNLIMITED CONTENT, IMPOSSIBLE CHOICE

We have gotten used to being supported in our decisions since the early days of the WWW. In the 1990s, there were still web directories (e.g. Yahoo!) that made an effort to create human-curated, hierarchically organized categories of links to websites. It was apparent that this does not scale to the content on a WWW scale. Directories and also search engines only provide access to a fraction of the available content. In [5] the PageRank algorithm is described (which was at the foundation of Google) as "a method for rating Web pages objectively and mechanically, effectively measuring the human interest" highlighting the challenge.

Without algorithmic support for selecting the content that we focus on, most of the popular websites and social media applications would not work. Let's illustrate the scale of this challenge: The search query "Bolzano" on Google lists 37 million hits. We know that users typically look at the first 10 hits on a search page and even the order on within the first hits significantly impacts the users' choice [2]. There are no "right" 10 to select out of the 37 million. However - what is put on the first page will get the attention.

As content generation becomes easier, this challenge will grow! And it already has. Over the last 30 years, the skill required to bring a media item online and make it potentially accessible to billions of people has been reduced massively. The number of tweets per day has grown from 5000 tweets per day in 2007 to 500 million tweets per day in 2013 [1].

Nowadays, a 7-year old can create a movie clip and share it on social media with a worldwide audience. As more and more people become content producers, the asymmetry between the time an individual spends consuming media, and the amount of content available, grows. Already now over 500 hours of new content is uploaded to YouTube every minute [2]. With life-logging [1] and upcoming wearable devices that can continuously stream what the wearer sees and experiences, we expect another steep increase in available content.

Observation 1: The amount of available content is huge, the rate of content creation is high and still increasing, and the major part of content created and shared is of low quality.

Implications: We need algorithms to make a selection and user interfaces to guide our attention.

What are critical issues? A truly random selection of content will not work and lead to a frustrating experience as most of the content is of low quality and not relevant for the user. We need algorithms that are smarter and that make "better" choices, which will inevitably introduce bias. This also leads to the question of who will parameterize the algorithm and who has control over it?

[1] https://www.internetlivestats.com/twitter-statistics/
[2] https://blog.youtube/press/

3 A (SMALL) WORLD THAT SHARES MY VIEWS

If you take a random sample that is representative of a population you will get diverse opinions. Opinion polls before elections illustrate this. Even in the pre-digital world, the opinions in our family, our personal environment, even in the place we live, are typically much more homogeneous than across a population. However, in the physical world we are likely to encounter people with very different views, be it in the workplace, on a sports team, or while waiting for the bus or going shopping and overhearing conversations. Sometimes very different views make us uncomfortable, but at the same time, they help us become aware of a wider range of views. People who can afford it often choose the convenient, yet costly option, living in homogeneous communities (or even gated communities), engaging with like-minded parents in private schools, and taking the car instead of public transport.

In contrast to this, the virtual world offers means to find a world of like-minded people. If you don't like your neighbor's views it is a significant effort to break contact with them; in contrast to the virtual world, and in particular to social networks, where "unfriending" someone or "muting" their posts is just a click. In 2020, several people on my Facebook feed announced that they have unfriended all the connections that had posted or shared Trump-friendly messages. These decisions are understandable and reduce individual stress as people stop seeing content that makes them uncomfortable. It is easy to imagine that the same behavior happens across the whole political spectrum. Polarization is reality in social networks and there is no common strategy that works against polarization as discussed in [4].

As we can easily shape our own (little) world, we can create much nicer personal media landscapes. The things we see do not challenge us, they show that we are right and that our opinion is at the center of what "people" are thinking and talking about. Additionally, we can separate domains like religion, politics, education, economics, hobbies, and science into separate communities which makes it even more coherent in each of these circles. A simple calculation reveals that even the most extreme view can easily create its coherent community. Assume your views and values are only shared by 0,01% of the population. If you live in a town with 50.000 people, this means there are only 5 others that share your view, which makes your thinking everything but mainstream. However, in a German online forum, this view still has the potential to be shared by 8.000 people. Hence having a very active online community of a few hundred people who all share the same strange ideas is very likely. Reading, posting, and discussing can take up all attention. And, as hundreds of people see it the same way, we don't realize that this may be a very extreme view.

With people documenting what is happening at an unprecedented rate, and with police reports and court cases online searchable, we have plenty of factual accounts of things that happen. This vast amount of information allows you (or an algorithm) to tell a story that is based on verifiable information that can be fact-checked but is nevertheless misleading. Hence the bigger problem is the selection of real news rather than fake news.

Observation 2: The number of people that are active online is huge and creating a community of like-minded people has become

simple. Keeping people that don't fit your world and their uncomfortable opinions out of sight is trivial, as unfriending has no cost attached. Proving your point with facts has become easy as you can search for cases that support your story.

Implication: We consume more information that confirms our beliefs. We feel better informed as we have plenty of sources to pick from. We lose the bigger picture and find it comfortable.

What are critical issues? User interfaces and algorithms are optimized to engage the user and to create a positive and captivating user experience. There is no incentive to "bother" users with uncomfortable media and information items or to show the bigger picture. User interfaces and algorithms for community platforms and communication systems are critical to create social cohesion.

4 DON'T CHOOSE! THE ALGORITHMS HAVE AN OPTIMAL SOLUTION FOR YOU

Which car should you get and where should you buy it? Which is the best option to fly to London for your next business trip? Should you get the house in the suburb or the flat closer to the center? Should you go out with this person? Currently, we still spend lots of time finding good solutions and answers to these questions. Once algorithms learn what we like and dislike, understand our preferences and values, we can run simulations and use AI to find optimal solutions under uncertain conditions. Once these tools are available, making your choice without running a simulation and consulting an AI for decision support, may be considered very risky or even stupid.

Such decision support systems may still have the human in the loop. They preselect and let us choose between options that are similarly optimal with regard to our preferences (or the cost function used for optimization). Pruning the search space will make it easier to find what we like, but at the same time, it limits our personal choice massively. Apparently, a good system will be designed to not offer inefficient or suboptimal solutions to the user.

Observation 3: Simulation and optimization can reduce the number of options that we consider when making decisions. The pruned search space, however, relies on us making a reasonable choice in defining the cost function in the optimization and including everything that is relevant in the simulation.

Implications: We will voluntarily let algorithms reduce the space from which we chose in order to make life more convenient. There is a dilemma: We cannot realistically consider all options as this would take forever. Convenient and comfortable solutions come at the expense of loosing control and introducing bias.

What are critical issues? The reduction of the search space is often directly related to the user interface we design and to the modalities available. For example, shopping with a voice user interface will limit the choice more than having a big screen available, as reading out a list of 20 alternatives would be tedious. Hence we may give only 2 alternatives. Whereas showing 20 options on a big screen for the user to choose from is easy.

5 BUT IT FEELS ALL REAL, I AM IN CONTROL

When we use current systems, it does not feel like we are limited in choice. While shopping on Amazon or AliExpress we have more choices than we can possibly look at in the time we allocate for this task. For example, a search for the term "Laufschuhe" (German for running shoes) gets 40.000 results on the German Amazon site. Even if I filter the sizes that fit me and select other preferences, there are still more than a thousand possible choices. We can scroll endlessly. Nevertheless, by the sorting (algorithm) and presentation (UI), my choices become very limited. The power of controlling the algorithm and the user interface is becoming huge. The design hides that we have given up choice. It is designed in a way that the users still feel in control. The shopping experience in our example leads to a user who feels like they have chosen from a nearly infinite number of options, where in reality their choice was very limited and the online shop made the choice for them.

With computing support becoming ubiquitous, and with user interfaces that blend the virtual and physical (e.g. augmented reality) world, the impact on our reality moves beyond specific applications or websites. The separation of the traditional world, where we make non-assisted choices, and new mechanisms will blur. The navigation system will impact where we go in the physical world. The route it suggests is optimized, but again it limits our choice! Intelligent systems become more and more part of the fabric of everyday life, very much as Weiser [9] predicted. Eventually we go towards a reality where choice is taken from us and where we move towards life on Autoplay. And as we lose agency an control when using autoplay on YouTube [3], we may experience the same in the real world.

Observation 4: With algorithmic decisions embedded in everyday systems, with user interfaces that integrate with our perception, and with computing technologies becoming ubiquitous, implicitly delegating choices to artificial intelligence becomes normal.

Implications: We are used to taking what we experience as real. As more and more of our perception is designed (be it an app or AR) our reality can be easily manipulated. The user interface and the interaction design will create reality and hence has great potential for manipulation.

What are critical issues? There is a dilemma of convenience and ease of use versus direct control. User interfaces are central here. They can be designed to allow control and to give real choice. But they can also be designed to guide or mislead the user and hence only pretend that there are choices available. For example, if you show the user four items in an online shop, you can manipulate their choice by having one that is out of their budget, one that has low ratings, and one that is not available until next week. The user still believes she has a choice, but by designing the presentation, the system already manipulated the decision.

6 A DYSTOPIAN VISION: CREATING YOUR FUTURE

These observations are the basis for a dystopian vision, which shows the risk of reducing choice and change in decision making.

Where to drive? The navigation system can make us perceive an environment differently. It can pick routes that bring us close to certain locations (and stores) and keep us away from other parts of the town. Depending on the route, we may never see a homeless person, even though they are there. Who makes the decision

on what you should be exposed to when you drive? It is easy to manipulate where you shop and how safe you feel.

Where to eat? Search sites (e.g. Yelp) can easily nudge you to visit certain restaurants and avoid others. They can also increase the chance of people meeting in a restaurant, while also having the power to make sure they will never meet when going for dinner. Hence, further separating groups in society seems really easy to implement.

Whom to marry? Who will you have a relationship with? Who will choose the person you start a family with? In the digital age, your choice of potential partners for life is huge, even if you limit it to a geographical area. Dating sites use algorithms to reduce the choice from several thousand to 10 or maybe 50. The user interface and the interaction design (in particular, how potential partners are presented, when you receive notifications, and the communication channels provided) will further impact the user choice. Access to the algorithm and interface can become the basis for a new human breading experiment.

Creating decision support systems, pre-selecting options, and presenting choices are essentially shaping the future for individuals and society. Who should we trust to make the choices for us? Who should be able to limit our choices? Are there alternatives to the current trend?

7 DON'T AUTOPLAY YOUR LIFE.

If you put YouTube on Autoplay you can comfortably watch all evening long, without making any decisions but at the cost of lost control [3]! YouTube will guess what you like and after some time you will probably like it.

Designing the interaction and implementing the user interface inevitably creates realities for people. Real is what we see. Real is the options we have. Real is what we can do. This reality is not given by nature anymore. It is designed by people! By people who create algorithms and who develop intelligent interactive systems.

Researchers in Human-Computer Interaction and UX professionals are at the core of these developments. The interface literally offers the choices we have and it limits our options. If a movie is not visible on the recommendation page, we will not watch it! As this goes much beyond entertainment, into the very fundamentals of our lives (e.g. what education we get, what interests we develop, what we spend time and attention on, or what people we partner with) the responsibility for not manipulating individuals as well as society is massive.

Systems with more autonomy, ranging from smart buildings to autonomous cars and automated investment plans, will create an even more fundamental question: should the human be in the loop? More precisely, at which points should the human be in the loop? Should we provide means for users to interact in real time with automated systems and should they have the ability to easily intervene [7]?

Hiding controversial and less comfortable content, and simplifying selective community building, makes our lives more convenient and comfortable, but harms public and societal discourse. By nudging people into difficult conversations, we can help ensure that our society does not separate across insuperable barriers. Systems we design should moderate constructive discourse, instead of preventing it.

From a human computer interaction perspective there a many challenges, that are still unsolved, including:

- How to have users in control without overloading them with choice and decisions?
- What is serendipity and chance in an intelligent system? Is this beyond a random element?
- How can we make it transparent to the user, that they have a choice, but at the same time make them aware that they choose from a preselected subset?
- How can we allow meaningful human interventions in automated processes, decisions support and pre-selection processes?
- How can we have the comfort of automated systems without being constantly manipulated?
- How can we create a truly interactive human centered artificial intelligence?
- How to stimulate creation of interactive and healthy communities that capture a wide range of political and societal views?

We should not create a world that is on Autoplay, where decisions are taken from the user. We should engage the user! How we design the interaction and the user interface is the key to keeping choice and chance for users and hopefully not ending serendipity with the next generation of intelligent systems. The discussion on human center AI has started, e.g. [8] and [6], but we do not know the solutions yet.

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