

Breaking the fourth wall: Embodied Interfaces for a Better Algorithmic Experience with Recommender Algorithms

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ABSTRACT

Recommender algorithms deal with most of our contemporary culture consumption. Algorithmic Experience (AX) emerges in HCI to guide users' experience with algorithms. To the best of our knowledge, previous work on recommender systems does not consider tangible interfaces to support positive AX and better algorithmic awareness. The ongoing research proposes to expand the design space for the current AX debate by designing an embodied interface suited for movie recommender algorithms.

CONTEXT AND MOTIVATION

Culture has been transformed by algorithms. They enact a function of cultural gatekeeping, sorting, ranking, managing, distributing and even producing existing music, movies or tv shows, video streaming and other kinds of cultural expressions, becoming relevant cultural objects [9].

Unfortunately, there is a general low algorithmic awareness among users [8]. Furthermore, algorithms produce negative user experiences such as threats of invisibility, anxiety and inequalities [4], bias in personalization processes [5], and user categorizations based on mere profit [20].

Different academic researchers have tried to solve these issues. Examples include invitations for human-centered algorithmic systems [3,18] or paradigm proposals towards algorithmic experience (AX) [1,19]. Similarly, recommender systems efforts address transparency, trust, and interaction issues [12,16]. Interestingly, no "embodied or tangible" design addresses yet the black-box nature of algorithms, promotes users' awareness or improves the experience with algorithmic systems [12,16].

Therefore, this research examines the design, interaction, pros and cons of embodied interfaces to improve AX. To delimit the scope, movie recommender algorithms have been chosen due to four main reasons strictly related with qualities

that only tangible interfaces could provide. First, the "abstract" and complex notion of "algorithm" for most users could be overcome by tangible interfaces that could represent a more concrete idea of what the algorithm does, how to control it and increase its awareness among users. Second, the existent varied and broadly accepted tangible opportunities to represent the algorithmic outcomes in this application domain such as archetypes for movie categories, figures or toys related with commonly known shows, and common interaction signs such as "thumbs up/down" to interact with the recommender system. Third, the opportunities that tangible interfaces offer could open collective and shareable experiences in such a social cultural practice. Fourth, the everyday use of movie recommender algorithms rises sensible social issues and design opportunities, such as more control and transparency over recommendations and promotion of small or not mainstream content creators. TEI possesses here an unexplored and novel occasion to expand the design space in the current academic algorithms debate and bring new embodied interactions.

OBJECTIVES AND RESEARCH QUESTIONS

To guide this research, a main research question and three research sub-questions were proposed: How can tangible interaction improve the algorithmic experience of movie recommender algorithms?

RSQ1: Which tangible interface is more suitable to address the interaction with movie recommender algorithms?

RSQ2: How can we design the interaction of an embodied interface to improve AX in movie recommender algorithms?

RSQ3: To what extent can embodied interactions improve the AX of movie recommender algorithms?

BACKGROUND

Different academic efforts have described the relevance of algorithms in the cultural context and in audience definition. For instance, Striphas proposes *algorithmic culture* as "the enfolding of human thought, conduct, organization and expression into the logic of big data and large-scale computation" [21:396]. Additionally, Gomez-Urbe and Hunt describes Netflix's intentions to promote audiences that are too small to exist [10:6] and increase the overall engagement with the platform [10:7]. Similarly, Hallinan and Striphas

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explore how Netflix's recommender was improved during a contest called the Netflix Prize [11].

Unfortunately, there are also negative experiences with algorithms. Eslami et al. have studied users low awareness of algorithm curation existence [8], which translates into surprise and anger. Additionally, discriminatory practices, anxiety and panic had been reported by Bishop [4] in YouTube. Also, Bozdag described the layers in which algorithmic personalization could be human biased [5].

Therefore, the interaction with algorithms has been also explored. For example, Diakopolous presents a transparency standard for algorithms [7]. Oh et al. picture a novel chapter in HCI based on *algorithmic experience* "as a new stream of research on user experience" [19:2531] to consider long term relationships with algorithms. Similarly, Alvarado and Waern propose Algorithmic Experience (AX) as "...the ways in which users experience systems and interfaces that are heavily influenced by algorithmic behavior." [1:7] and suggest design areas for social media [1:6].

Other works center in the interaction with recommender systems. Jugovac and Jannach survey research about interaction with recommender systems [16], while their "black boxed" nature is analyzed by He, Parra and Verbert in their survey about interactive recommender systems [12]. Regarding recommender systems evaluation, Knijnenburg et al. present a user-centered framework to test recommender systems interaction [17], while Tintarev and Masthoff evaluate seven different aims for recommender explanations [24]. Similarly, Bakalov et al. evaluate user models and personalization effects for recommender algorithms [2], while Cramer et al evaluate an art recommender system [6].

In this context, tangible interface design has elaborated various examples towards a materialization of interaction with digital information such as algorithms. For example, Sundström et al proposed *inspirational bits* to represent digital design materials [22], while Vallgård and Redström suggested *computational composites*: mixtures between digital computations and other materials to give diverse properties to digital tools [25]. Ishii's *tangible bits* couple digital information with everyday physical objects and surfaces [19], providing a physical form to digital information. Similarly, *radical atoms* [15] propose "...interactions with dynamic physical materials that are computationally transformable and reconfigurable" [15:45].

PRELIMINARY RESULTS

A first study has been published as a full paper at CHI [1] and used a semiotic inspection and sensitizing workshops to analyze the user experience with Facebook's newsfeed [1:3–5]. Both methods collected different negative experiences expressed by the users in relation with the curating algorithms in their newsfeed and produced different design solutions to improve the experience with the system. The results proposed the concept of *algorithmic experience* (AX) as a way to define explicitly the interaction with and

experience of algorithms [1:1] and suggested a framework for AX pictured in Figure 1. It is composed of five different design areas to improve AX in social media: profiling transparency and management, algorithmic awareness and control, and selective algorithmic memory [1:6].

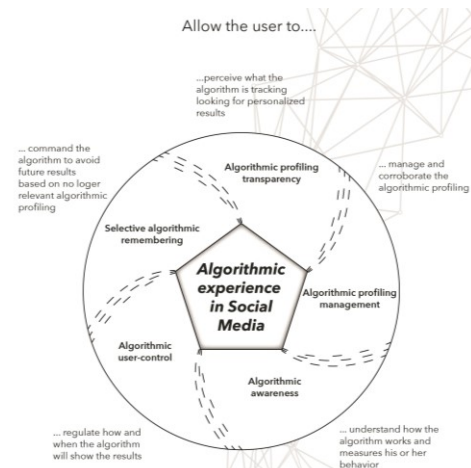


Figure 1 Design areas for AX in social media [1:6]

A second study took the AX framework and applied five sensitizing design workshops to explore the AX of Netflix's recommender algorithm. Additionally, the method opened the opportunity for the users to propose their "algorithm material representation" answering the question: "How does Netflix see you?" with different materials and creative tools such as LEGOS™, Play-Doh™, pilots, pens, markers, construction paper, and others. Figure 2 shows the exercise results validating that users possess different tangible and material ways to represent their algorithmic profiling and recommendations. As can be seen in the figure, these forms could be grouped in two main categories: abstract and archetypal representations. Abstract representations are defined by graphs and structured forms, while archetypes are reflected in clowns, castle-like TVs, characterized people sitting in front of the system and using props, and others.



Figure 2 Users' material representations

Furthermore, the study provided other results related with AX for recommender algorithms, extending the original framework with two new design areas: algorithmic social

practices and algorithmic usefulness. It also produced suggestions for possible tangible representations for algorithms for AX improvement. A paper describing these results has been written and will be submitted to DIS 2019.

RESEARCH DESIGN AND METHODOLOGY

PhD research will follow a research through design methodology and a mixed approach as shown in Table 1.

Research sub-question	Data collection	RtD action/result	Analysis methods
RSQ1	Literature review about embodied and tangible interfaces	Select a group of tangible interfaces (TI) for the selected domain	Guided by Radical Atoms [15], similar theories and properties for abstract and archetypical possibilities
	Think aloud and observation	Design a final TI based on the previous group to address the next RSQs	
RSQ2	Co design explorations	Design an appropriate TI interaction language for the selected domain	Guided by AX framework for recommender algorithms [1]
RSQ3	Sensitized workshops and interviews	Provide an analysis of TI's potential and limitations	
	Surveys and questionnaires	to improve AX for the selected domain	

Table 1 Data collection and analysis methods

TIMELINE

Since the ongoing research is just starting its second year, it still possesses 3 years left according to the initial founding agreement. January 2021 is the date in which all the research questions should be addressed, and the final thesis defended.

1. From January 2019 to July 2019: It is intended to implement a movie recommender prototype based on academically proven movie recommendation algorithms and datasets. Possibly, a paper will be elaborated to evaluate AX improvement in recommender algorithms.

2. From July 2019 to January 2020: RSQ1, a literature review about tangible/embodied interfaces will be done to determine the most suitable implementation for the intended research. Additionally, a think-aloud/observational study will be performed to discover user's behaviors towards movie recommender algorithms during movie watching in their use context.

3. From January 2020 to July 2020: RSQ2, co-design exploration, and an iterative prototype development method together with users will be done for the tangible interface interaction and operational design.

4. From July 2020 to January 2021: RSQ3, sensitized workshop together with interviews, surveys and questionnaires will be done to evaluate the effects on AX.

CONTRIBUTIONS

This research could provide many outcomes for the TEI community. For instance, it could offer a first proposal for positive Algorithmic Experience (AX) using Tangible Interfaces (TI). Similarly, it will provide an approximation to address the black-box nature of algorithms using TI with movie recommender algorithms as an application domain. Finally, it could open a novel design space to develop a "killer app" for TI in different algorithm-related contexts.

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