A color map to compare reactions tools in interactive systems

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A color map to compare reactions tools in interactive systems

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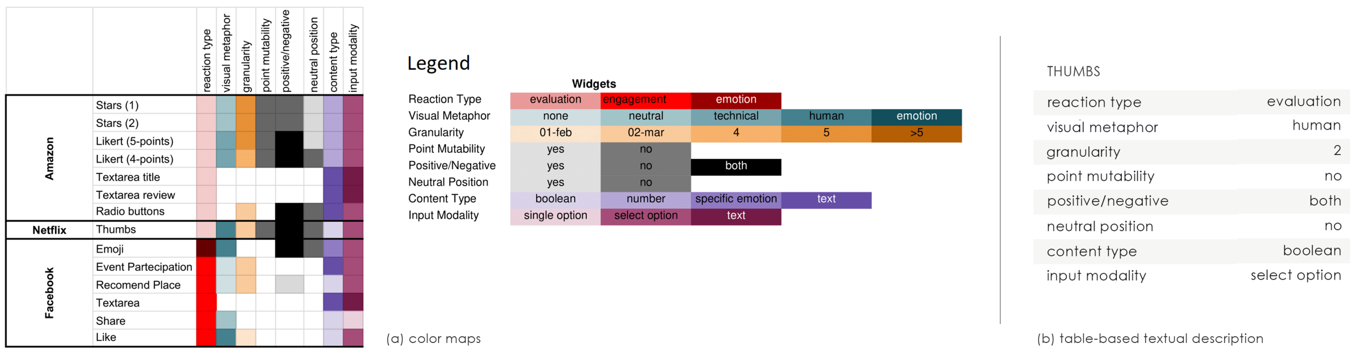

Figure 1: (a) color maps: Amazon vs. Netflix vs. Facebook - (b) table-based textual description: thumbs reaction tool

ABSTRACT

In this paper we study whether visualizations based on color maps can encourage the intuitive interpretation of detailed descriptions, as the ones proposed in the formal model UPRISE, designed to analyze interactive system components, such as reaction tools, which allow users to provide reactions. We carried out a between-subjects experiment where 56 participants had to group 6 systems according to similarity using either color maps or textual descriptions. Results showed that color maps seem to favour inter-user agreement in comparison and grouping tasks.

CCS CONCEPTS

• **Human-centered computing → User interface design**;

KEYWORDS

interactive systems, color maps visualization, user reactions

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1 INTRODUCTION AND BACKGROUND

Nowadays, almost all websites allow users to react to their contents, offering different graphical interface controls (from now on: reaction tools) to express ratings, emotions, or write textual comments. User reactions are very important: as they can provide information on users' interests and preferences, they can be used to deliver intelligent behaviour, such as recommendations [4]. For these reasons, the modalities for eliciting and collecting user reactions, from reaction tools to system feedback, should be carefully designed. However, no or little attention is devoted to this goal, both in current design practices and in academic literature. Thus, to fill this gap we proposed the UPRISE (**U**ser **P**rovided **R**eactions in **I**nteractive **I**ntelligent **S**yst**E**ms) model [2], which aims at formally describing all the components of systems allowing users to provide reactions.

According to UPRISE, reaction tools are described in terms of their properties, e.g.: (1) *Reaction type*, the kind of reaction the user is providing (e.g., a rating or an emotion); (2) *Visual metaphor*, the visual presentation form; (3) *Granularity*, the number of available positions; (4) *Neutral position*, the presence of an intermediate point. A complete list of reaction tools features can be found in Fig. 1 (b).

Following Beaudouin-Lafon [1], the UPRISE model can be used as a comparative tool among interactive systems. In particular, it allows to highlight similarities and differences in the interface and overall structure of such systems. However, we observed that comparing complex systems in terms of a number of different properties can be cumbersome, resulting in a limited possibility to grasp common patterns and generate useful insights.

Hence, in order to ease comparison, we tried to devise intuitive visualizations which can encourage the exploration and intuitive interpretation of data, similarly to Chernoff's faces [3]. More specifically, we mapped the possible values of all the properties describing UPRISE elements ([2]) by different colors and visually represented interactive systems in matrix form, based on the following rules: *i)* matrices correspond to UPRISE elements (e.g. reaction tools, ...); *ii)* columns correspond to properties; *iii)* rows correspond to element instances (e.g., the "Thumbs" reaction tool); *iv)* sets of rows correspond to systems; *v)* cell colors correspond to values, see the Legend in Fig. 1(a). We refer to such visualizations as *color maps*, also know in data visualization literature as colormaps [5].
Fig. 1(a) presents a visual comparison between three social interactive systems, Amazon, Netflix and Facebook, focusing only on their reaction tools for the sake of simplicity. Observing Fig. 1(a), one can see, for example, that Facebook and Amazon both use a more extensive range of reaction tools than Netflix. However, Amazon and Netflix are more similar as for the type of reactions they allow, since they both value evaluations, while Facebook almost exclusively concentrates on engagement and emotion. Due to this peculiarity in the reaction type, Facebook also stands out as far as the reaction tool point mutability is concerned: in fact, this property is "not applicable" for all the reaction tool used in Facebook, showing that reaction tool used to express emotions and engagement do not normally fall into the category of scales consisting in a series of (similar or different) points. Similar considerations can be extended to the "granularity", "positive/negative" and "neutral position" dimensions. Finally, while Amazon uses reaction tools with a neutral or technical visual metaphor (or for which this concept is not applicable), both Facebook and Netflix have examples on the "human" side. Thanks to our description in terms of the UPRISE model, we can conclude that Amazon and Facebook are more complex systems in comparison with Netflix. Similarly to Amazon, Netflix also collects evaluations, but it favours simpler reaction tools, which are on the whole more similar to those used by Facebook. However, we believe that we would not have been able to gain such insights as easily if we could not have used the here proposed color maps. Therefore, we would like to have an empirical feedback coming from users in order to see if color maps can actually favour system analytical comparison compared to a textual description (organized within a table) of the same properties (see Fig. 1(b) for an example description of the "Thumbs" reaction tools).

2 THE EXPERIMENT

We conducted our experiment online, due to COVID-19 restrictions.
Hypothesis. We hypothesized that users in the experimental group make more effective comparisons and groupings than users in the control group and find the color map grouping tasks easier.
Design. We used a between-subjects design: the control group see the UPRISE reaction tools's description of 6 anonymous systems in textual form (see Fig. 1(b)), while the experimental group see the same description in the form of color maps (see Fig. 1(a)).
Participants We recruited 56 participants (86.7% in the age range 18-25, 6.7% in the 26-35 age range, and 6.7% in the 36-24 age range), 43 females and 13 males, among the students attending an advanced HCI course. All participants were students in Computer Science and Innovation and Communication Technologies.
Apparatus and Materials. We created two Google Forms containing the material to be presented as well as open and closed questions for pre- and post-test.
Procedure. We greeted participants in a welcome page introducing the experiment, and we collected some socio-demographic information. Afterwards, the experiment started by showing the description of the reaction tools used by 6 anonymous systems, grouped by page. In the last page we showed all the descriptions and asked the subjects to group the systems based on their similarities. Finally, we asked the subjects which criteria they followed for grouping, how easy the task was, and if they had some observations.
Results. Regarding the system grouping, the two groups obtained very similar results, in fact results largely correlate $r(56) = .88$, $p = .0505$. However the experimental group reached a larger consensus in grouping, namely subjects found the same groupings found in the control group, but more subjects agreed on the grouping. The experimental group found an average of 43 groupings (SD=4.19) vs. 35 groupings (SD=3.50) found in the control group, and the difference is statistically significant as determined by one-way ANOVA ($F(1,12) = 15.08$, $p = .003$). Thus, color maps seem to favour inter-user agreement.
Regarding how easy the grouping tasks were, we directly asked the users by means of a 7-points Likert scale (1=very difficult, 7=very easy). Experimental group gave an average score of 3.16 (SD=1.2), while the control group gave a lower average score of 2.96 (SD=0.9), however this difference does not result to be significant, as determined by one-way ANOVA ($F(1,56) = .501$, $p = .481$), thus on average users have not found it easier to interact with color maps.
Open-ended questions were analysed by first identifying possible categories for the issues they mentioned (open coding) and then counting the number of instances for each category. Eighteen participants per condition (64%) provided information on the criteria they followed to group systems. The following categories were identified: *tool type/functionality* (experimental group: 22% vs. control group: 5,6%), *number of tools* (0% vs. 5,6%), *visual appearance* (72% vs. 5,6%), *specific tool features* (0% vs. 44%), *generic answer* (22% vs, 22%). Interestingly, almost all participants in the experimental group mentioned the visual aspects of the color maps, in particular colors (77%), blank spaces (23%) or the number of rows (23%). In contrast, none of them performed a more detailed analysis based on specific reaction tool features (e.g., reaction type or visual metaphor), which was the preferred method for the control group. This seems to confirm our idea that color maps can support the intuitive interpretation of system descriptions.

Finally, we have a last open-ended question asking for other considerations. In total, only 8 (5+3) users answered. In general, 37,5% of users (3/5) complained about the readability (in particular, for the smallness of the fonts), 25% of users (2/5) admitted that they did not understand very much, for the unfamiliarity of the topic. Even if generated by few answers, these aspects can be seen as limitations of our experimental design that might have affected the results.

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