Knowledge in Computational Design: Typography, Emoji and Flags

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Abstract

This paper describes a showcase of Computational Design projects from three different areas: Type design, Icon design and Flag Design. The nature of these tools is also different, going from a creativity support tool to a fully automatic system. We analyse these tools in terms of use of knowledge and user interaction.

Keywords

Computational Design, Typography, Emoji, Flags

1. Showcase Description

The ability to create new concepts by making connections between existing ones is, in part, related to our creative behavior [1]. Such ability is highly needed in design processes and has to be considered when implementing Computational Design systems.

The use of knowledge-based systems has great potential in computational design, especially for solving creative problems based on previous solutions. In this paper, we describe a showcase of three projects from three different domains: type design, icon design and flag design.

In this section, we describe the projects featured in the showcase, which consist of a creativity support tool (*TypeAdviser*), a co-creative system (*Emojinating*) and a fully automatic one (*Ever-changing flags*). All the projects use knowledge to help or guide the process of design in a computational system.

1.1. Type Design

A typeface is a set of characters that work as a family – even though they all look different, they share characteristics. The first project that we want to describe, *Typeadviser* [2], is the result from a master's thesis [3] and it aims at helping type designers in their creative process. It consists of a creativity-support tool that explores anatomic relations among characters of a typeface to provide help in the early stages of designing a typeface by using semi-automatic letter-part sharing and allowing the users to compare their design with existing typefaces. In

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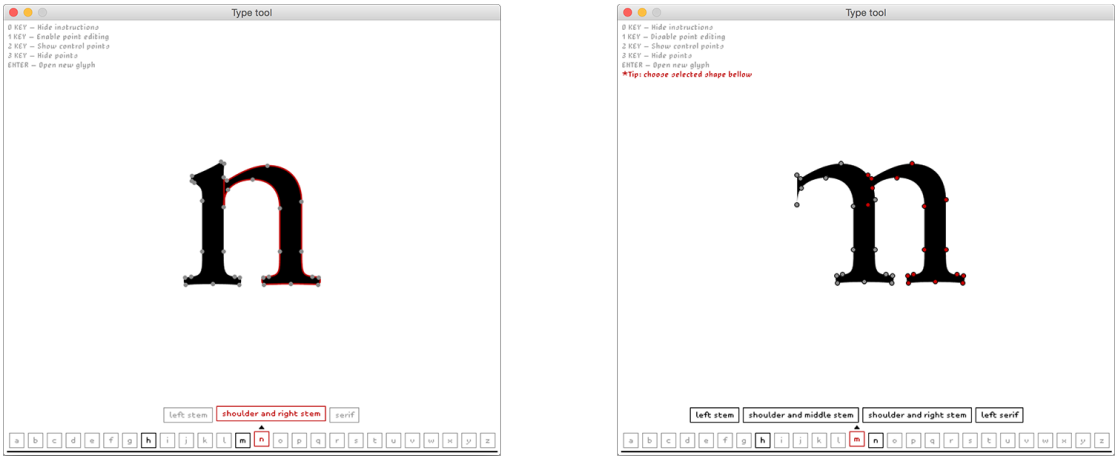

Figure 1: Interface of *TypeAdviser*

[3], we conducted a study to identify rules for the development of typefaces that could be used in a computational system to design a typeface based only on a few characters given by the user. Despite not being able to fully produce a typeface, the system gives support to the design task stimulates creativity and helps to reduce the time spent by the designers in the initial stage of the design process. The system is composed of two components: the *Part-sharing* (see Fig. 1), which is based on the consistency criterion, and the *Adviser*, which uses Self-Organizing Maps to suggest similar designs to the user.

The user inputs previously drawn vectorial glyphs and then identify their parts. The system then generates other letters, based on the predefined rules of part-sharing – this is controlled by the *Part-sharing* component, which was built using type design principles. The *Adviser* uses Self-Organizing Maps (SOMs) to suggest similar designs to the user. A SOM is used to produce a similarity map of different styles of character for each letter, grouping similar styles. With this approach, the user is able to draw a letter and then see possibilities for the other letters, based on the drawn one. There are two main uses for this: (i) to serve as inspiration by allowing the designer to see characters of similar typefaces; but also (ii) to help in distancing the typeface being designed from existing ones. Our system could be combined with approaches for computational generation of glyphs [4]. For a more detailed description, we refer the reader to [2].

1.2. Icon Design

The visual representation of concepts or ideas through the use of graphic shapes has always been explored in the history of humanity and has a key role in how we share information among each other. This is the base idea behind our work on computational generation of visual representations of concepts. We follow an approach that explores visual blending of existing symbols to represent new concepts. Our contributions in this domain started with a low scale system, in which three concepts (*pig, angel and cactus*) and corresponding visual representations were used to produce combinations [5]. In a follow up project, we increased

Figure 2: Examples of blends produced by *Emojinating*

Figure 3: Flags generated by *Ever-changing Flags* on November 15^{th} 2019

the scale by implementing a system that allows the user to introduce text to be represented [6] – *Emojinating*. The system retrieves existing emoji that match the input text using semantic information associated with them and also by exploiting ConceptNet [7] to extend introduced concepts. The retrieved emoji are visually blended to produce representations for the input text (see Fig. 2). The user is able to guide the production of solutions and the system is able to change its own knowledge to constantly adapt to the user [8, 9]. Our approach is aligned with other projects that address visual representation of concepts using emoji, e.g. [10]. For a more detailed description about our system, we refer the reader to [6, 8, 9].

1.3. Flag Design

The last project that we want to present addresses flag design. Flags have an important role when it comes to constructing and maintaining a sense of identity of a nation [11]. The symbols that are included in a flag reflect changes that occurred in the entity that they represent and their design is affected by a process of slow evolution, which you can see by looking at previous versions. We go one step further and use the constant-changing nature of our society and the easy access to global information to propose that, in addition to identity, a flag can also represent "mood". By "mood" we refer to a temporary, yet meaningful, state. *Ever-changing Flags* [12] uses knowledge from three different sources: (i) meanings of existing flags, (ii) a dataset of colour names, and (iii) semantic information associated with emoji. These knowledge sources are used to produce changes to country flags based topic (see Fig. 3), while still maintaining the resemblance to the initial flag. The system is based on the idea of "ever-changing flag", i.e. a flag that is in constant change and reflects the "mood" of the country that it represents. This constant updating is implemented by using Google News RSS feed to retrieve trending topics, which are then used to motivate the changes in the flag. This sense of reactivity to the environment is also explored by other authors, e.g. [13]. For a more detailed description, we refer the reader to [12].

2. General Overview

We briefly described three projects (*TypeAdviser*, *Emojinating* and *Ever-changing Flags*) from three different domains (*Type Design*, *Icon Design* and *Flag Design*). All these projects have one thing in common – they all use domain knowledge to guide and/or aid in a process of design. However, the way that they integrate and make use of this knowledge is not the same.

One issue with implementing systems for computational design is that they address tasks that can be seen as open-ended – there might be no optimal solution since they often depend on user preferences. For reason, the relation between user and system is of extreme importance when developing such a system. This relation has an obvious impact on the way a system is designed, especially concerning the use of prior knowledge. By analysing the described projects, it is easy to identify several ways of using knowledge. *TypeAdviser* uses knowledge to reduce the time spent in designing a typeface but also to present the user characters of similar style, thus making it easier to either come closer to or avoid resemblances to existing typefaces. On the other hand, while *TypeAviser* uses knowledge to merely aid the process of design, *Emojinating* highly relies on domain knowledge. The capability of reaching solution that represents a user-introduced concept depends on the existence of such knowledge. Moreover, *TypeAviser* can only be seen as a creativity support tool. In contrast, *Emojinating* has a more cooperative relation with the user, creating a co-creative dynamic between the two. In addition to this, *Emojinating* is able to adapt itself to the user by changing its knowledge – e.g. by a keeping a record of what sort of solutions match the user preferences.

The third project (*Ever-changing Flags*) can be placed in the opposite end of the spectrum to *TypeAdviser* – it requires very little of the user. The system uses the domain knowledge as a guide to produce its own solutions – e.g. using elements (or part of them) that have a certain meaning to assign a similar meaning to a flag. In doing so, the only thing required of the user is the selection of which country the system should produce a flag for.

Another interesting aspect is the possible applications of these systems. One example is the use of *Emojinating* engine for purposes of information visualization [14]. Another example concerns one of the goals for the project *Ever-changing Flags*. In addition to being used in a web-app, there is also the possibility of integrating in an installation. Such setup increases the impact on the participant and addresses questions of perception – do the participants still identify themselves with altered versions of the flag of their country? All these aspects gain importance in our research work, which not only involves implementing systems but also thinking about their impact on society [15].

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