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Summary

Scientific practice is an activity that is data-intensive and widely supported by computerized systems, data repositories included. It is also an activity that is highly creative and, as such, can benefit from a moment of openness, playfulness and exploration. This thesis contributes a broad but extensive investigation of playfulness as a desirable attribute of a scientist's interaction with scientific image data. We argue that playfulness is relevant for scientific creativity in general and for exploring scientific image data in repositories in particular. Given our thesis, the question we ask is the following: What could playfulness with scientific images amount to and how do we design for it? Via case studies and reviews, we flesh out particular elements of play for exploration and implement artefacts that exemplify instances of playful interaction with image research material in collections.

Chapter 1 provides a concise review on the core topics of this research, namely scientific creativity, the role of images in the life sciences, discovery and exploration in data collections and the meeting points of play and games with the domain of Human Computer Interaction (HCI). Based on this material, we propose (a) playfulness as an attribute to be stimulated in interfaces to scientific image repositories and (b) associations as the focus point of play for the sake of exploration and creative responses to image data.

Chapter 2 introduces the CSIDx database (Cyttron Scientific Image Database for eXchange), a multi-modal imaging database for images produced in the life sciences. In CSIDx, we aim for an integration of images across imaging modalities, i.e. across various microscopy techniques operating at different levels of detail. Semantic annotation of images is proposed as both the means to link modalities and a necessary requirement for image sharing and reuse. Our work on the CSIDx database emphasized the significance of linking images for a better understanding of the biological phenomenon under study. It also emphasized ontology-based metadata as a core aspect of the image collection. Information visualization aids were introduced to better communicate the nature and structure

of semantic, ontology-based metadata (cf. ontology viewer). Additional visualization aids were introduced to facilitate browsing and to better illustrate (attributes of) the collection as a whole (cf. search results visualization).

Chapter 3 presents Onto-Frogger, a video game developed for the CSIDx database. Onto-Frogger is a single-player, arcade style game for scientific images, their annotations and the connections established by these annotations. The game abstracts the CSIDx database to a graph of images that are interconnected because of their annotations. Onto-Frogger aims to familiarize the players with the idea that images in a (semantically enriched) collection are interconnected and to invite them to identify, predict and resolve various connections during gameplay. To achieve this, we propose a strong coupling between the graph and the game logic: Features of the graph are used to control the progress of the game, to decide upon its outcome and to score the player actions. As such the game becomes a form of 'executable' information visualization that materializes connections rather than visualizing them. Exposure to the game seems to contribute to the user's mental model of the data collection and data organization. In addition, converting an aspect of the system into something relevant for the player, e.g. score, allowed the player to react on an important aspect of the system, i.e. annotations.

Chapter 4 takes a step away from the CSIDx database to examine what lessons can be learned from existing practices in popular image collections and from existing games involving digital images. Chapter 4 reviews image-based gaming activity in the Flickr photo sharing system. We supply a first understanding of the various ways Flickr groups engage in play, a first categorization of the types of games played and some observations on the mechanics involved. Next to being a small step in classifying the rather unstructured environment of Flickr groups and games, our study contributes some suggestions on possible formats of gaming with images. Flickr games may not always comply to a strict definition of the term 'game', although they are clearly perceived as games by their initiators and participants. Considering activities without an explicit winning condition introduces new directions for play and playfulness with images. What is more, we observed that players often value ambiguity as a source of play. Employing ambiguity as a design principle is another exciting direction that gaming with images can head in.

Chapter 5 presents LABBOOK, a collaborative storytelling game for biologists and their images. Motivated by the findings of our Flickr study, we looked for ways to play with images that are less rule-bounded. More specifically, LABBOOK was motivated by an interest in the qualities of stories and storytelling. Stories and storytelling have been extensively used as a means to probe articulation, to invite

creative play and to impose coherence and structure. Stories provide a mechanism to synthesize parts into an intelligible whole and a faculty to articulate about experiences or ideas. LABBOOK aims to probe similar processes by inviting players to build a story with their research images. LABBOOK is also a platform for social exchange and interaction between researchers. By confronting the players with the challenges of story composition, the game has demonstrated a capacity of storytelling to probe an active look into the images involved.

In the course of this research, we devised and investigated possible ways to literally play with scientific images in manners that would potentially stimulate exploration and creativity as in identifying patterns, making associations, embracing ambiguity and participating in social exchange. Our case studies have resulted in a number of encouraging observations and user responses. All in all, we hope to have motivated fellow HCI researchers and HCI practitioners to research and/or to implement playful interactions with scientific image data in repositories.