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## Connecting the dots : playful interaction with scientific image data in repositories

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## **Chapter 5**

# **Playing with images 2: Storytelling as playful interaction**

**Based on:**

*A. Kallergi and F. J. Verbeek. Storytelling as playful exploration of biological image data: Reviewing a candidate interaction paradigm. In Proceedings of the IADIS International Conference Interfaces and Human Computer Interaction 2012, pages 35-42, 2012*

**Abstract:** This chapter examines the applicability of storytelling as a way to playfully interact with scientific image data. Arguing that scientific practice can benefit from a moment of openness and playfulness, we propose a story-based interaction with image data as a means to ignite playful and creative responses to scientific images. By means of a literature review, preliminary user studies and the implementation of a concrete storytelling artefact, we attempt to better understand the potential, relevant aspects and specific challenges of storytelling with scientific images. LABBOOK, our current implementation, is an instance of a storytelling artefact that is a digital collaborative storytelling game for biologists and their images. The game should be understood as a platform for storytelling and social exchange. By confronting the players with the challenges of story composition, LABBOOK has demonstrated a capacity of storytelling to probe an active look into the images involved.

## 5.1 Introduction

In this chapter, we examine the applicability of storytelling as a way to playfully interact with image data from the life sciences. The reader of this thesis should, by now, be familiar with our interest in interaction paradigms along the lines of playfulness, exploration and creativity. Storytelling with images is such a candidate interaction paradigm we investigate. Partially motivated by the finding of our Flickr study (cf. chapter 4), our interest in storytelling as a way to play with images marks a shift from rule-based forms of play. In chapter 3, we considered playing as gaming and exploited the formal rule structure of a game. In this chapter, on the other hand, we adopt a less rigid understanding of playing as creating and exploit the relevant qualities of stories and storytelling. Moreover, while chapter 3 focused on communicating existing connections between images, this chapter is mainly concerned with the articulation of new associations regarding scientific images.

Biology is a science typically oriented around visual clues. Much of contemporary biological research is based on the production, inspection and analysis of image data as produced by various experiment designs and various imaging systems. Obviously, image data are used in scientific discourse and publication as persuasion and communication means to support and better demonstrate a finding. Nevertheless, the life cycle of a scientific image is much richer and far more dynamic. For instance, images as preliminary or intermediate findings can be used to guide and refine research choices. Images as snapshots of ongoing research must be discussed and reflected upon for further decisions to be made; conversation and references to other images are two mechanisms that inform and transform one's response to image data. As repeatedly argued throughout this thesis, managing one's research by incorporating observations from image data may benefit from an open-minded and exploratory attitude of the researcher. In search of new ideas, challenging questions or simply insightful observations, it is often useful to re-consider and re-interpret one's own data under the light of other data or under the light of new associations, non-obvious and unexpected ones included.

This chapter investigates storytelling as a means to play with scientific images in ways that could potentially stimulate creative responses to image data. We are particularly motivated by the role of associations as a way to process and synthesize information and the role of imagination as a way to articulate potentially useful ideas, toy with possibilities and even create associations where there appears to be none. A story-based interaction with scientific images may be a valid

strategy to ignite similar processes: By creating opportunities for storytelling, we hope to create opportunities for a great deal of re-consideration, re-interpretation, imagination and filling-in of gaps to be at work. Potentially, storytelling and the processes we associate with it can be exercised in a shared or social context. The work presented in this chapter manifests our increasing attention to the social aspects of scientific creativity. While the cognitive processes relevant to scientific creativity are interesting, one should remain attentive to the fact that scientific creativity owes a lot to social exchange and collaboration. Our storytelling paradigm expands to address both storytelling with other images as a process of synthesis and storytelling together with other researchers as a process of conversation.

The structure of this chapter is as follows: Section 5.2 summarizes interdisciplinary ideas and practices regarding storytelling with images. Utilitarian usages of storytelling are many and accomplished and have motivated our interest in a story-based interaction with scientific images. A series of preliminary user studies towards a storytelling game for scientific images is described in section 5.3; these studies inform both our understanding of storytelling with scientific images and our design trajectory towards a concrete product. Section 5.4 presents LABBOOK, our current implementation of a collaborative storytelling game for biologists. Results from the evaluation of the current product are discussed in section 5.5, while section 5.6 presents our conclusions from our involvement in (designing for) storytelling with images from the life sciences.

## **5.2 Motivation**

This section discusses relevant aspects and qualities of stories and storytelling as drawn from literature and from various products and practices employing storytelling with images. Essentially, storytelling involves a process of articulation and of synthesis which we find particularly valuable. In addition, its considerable playful and social dimensions are of equal relevance.

### **5.2.1 Of stories and storytelling: A few definitions**

First of all, what is a story? Defined casually, a story is an account of events; these events can be “either true or false” (Polkinghorne, 1988, chapter II). Everyone’s got a story to tell, and it need not be one of a literary value. Stories and narratives can be treated as either synonym or distinct terms depending on whether a story is understood as distinct from its rendering (Abbott, 2007). We will use the term ‘story’ and ‘narrative’ interchangeably, with story being the account of a sequence

of events rather than only the sequence of events accounted. This definition is closer to an everyday understanding of the term ‘story’ but it still allows us to consult the extensive field of narratology, i.e. the study of narratives. However, here be dragons! The field of narratology is a fearsome one, perturbed by its own definition wars, including ones on the definition of narrative. An account of a sequence of events may not always demonstrate a satisfying degree of ‘narrativity’; a typical example given is the chronicle.

The focus of this work is on storytelling that includes and initiates from images. To be more accurate, it is about story-making rather than story-telling. For the remainder of this chapter, the term ‘storytelling’ will refer to the telling of a story that is actively generated by the storyteller, rather than the reciting of an existing story. Story-making need not be mediated by an artefact, but there exists a long tradition of ‘user-generated’ stories, i.e. stories unfolded or produced by the user’s interaction with a tool or platform. Numerous environments or strategies have been attributed a capacity to support or engage a reader or player into the production of narratives: Hypertext fiction, interactive storytelling and videogames, mainly adventure and role-playing games, are a few typical examples, all distinct in their mechanics and aesthetics and yet alike in their ascribed potential to transform ‘traditional’ narratives. From a cybertext theory (Aarseth, 1997) perspective, user-generated stories will involve ‘non-trivial effort’ and interaction with a mechanism/algorithm operating on a set of building tokens. We are aware of this tradition of interactive and playable stories and acknowledge the impact of technologies and interactivity on the way stories emerge. Technically, the use of small units of information to be assembled by the user in a meaningful storyline is a theme we adhere to. However, we are less interested in the trails of the user as an output (cf. hypertext) or the choices of the player on particular forking or decision points (cf. interactive storytelling).

### **5.2.2 Why stories?**

There is a substantial tradition on storytelling as a means to understanding. Firstly, stories have been long acknowledged as carriers of information and as a means to transmit know-how, beliefs and values across generations. Their cultural significance aside, stories are powerful communication tools. This applies to the domain of science as well: As most science communicators would confirm, stories about famous scientists, significant scientific discoveries and even complex scientific phenomena are powerful and engaging educational aids. Avraamidou and Osborne (2009) provide an extensive overview of the applicability of narratives

for science education and science communication. Clearly, stories help transmit a message and make a speaker easier understood. But can a story make a speaker easier understood to the speaker herself? In other words, can the composition of a story contribute to understanding? Several practices would support the case as stories have been frequently used to either elicit or organize information. Consider as an example the use of narratives in social science research: Stories have been repeatedly used as the means for human subjects to articulate about their experiences. What is more, narrative inquiry as a methodology engages with stories as both the subject and the means of the inquiry. That is to say, stories are either the collected material to be analysed or a medium for the researcher to make sense out of her own observations (Polkinghorne, 1988; Pinnegar and Daynes, 2007, chapter VII). In a similar fashion, storytelling has been applied for knowledge management in organizations, e.g. as a way to verbalize tacit knowledge about a task or about the organization (Hannabuss, 2000; Rhodes and Brown, 2005). Similar practices are to be found in the field of HCI, with storytelling being used as a tool for brainstorming or user-centred research. In all of the above cases, storytelling is employed to stimulate and facilitate the articulation of useful information and knowledge that would otherwise remain implicit.

Storytelling seems to be a natural and comfortable way for humans to cope with information and complexity. The idea of a narrative way of thinking which qualifies as a distinct mode of reasoning was pioneered by Bruner (1986) and Polkinghorne (1988). The exact nature of narrative knowing and narrative reasoning as well as the exact relation of narrative reasoning to paradigmatic (or logico-scientific) mode of reasoning are discussions we will refrain from. However, we find it fascinating that the way we process stories requires a particular way of connectivity between parts. Firstly, it requires some connectivity: Parts of a story become meaningful because they contribute to a plot. To quote Polkinghorne (1988, chapter II), “narrative ordering makes individual events comprehensible by identifying the whole to which they contribute”. Secondly, the connectivity involved is of peculiar nature. The causal relation between parts is by far not necessary, but it is still sufficient. As Worth (2005) summarizes, “narrative lines of reasoning do not generally prove anything, but they do show how something might have come to be the case”. In a way, what makes stories particularly attractive is exactly the need to devise or imagine explanations that impose coherence over discrete items.

For the sake of completeness, a word of mention is due to the types of texts or stories specifically produced by scientists. As already mentioned, narrative inquiry and science communication are straightforward examples of the use of



stories in scientific practice. At the same time, scientists produce a variety of written texts which may or may not be understood as stories. The various scientific writing ‘genres’, e.g. the research article or the conference presentation, are definitely worth analysing in terms of language and rhetoric devices employed. Such purely argumentative scientific texts have been in times examined under the lens of traditional narratives (Dubois, 1992; Sheehan and Rode, 1999; de Waard, 2010). Then again, debates over the narrativity of scientific texts are irrelevant to our purposes as we are motivated by the processes of verbalizing, composing and articulating, not by the nature of the output text. As regards the act and process of writing, it is useful to observe that scientific writing can be integral to scientific inquiry as opposed to ensuing it. Holmes (1987) studied manuscripts of prominent scientific figures to suggest that the act of writing may have played an active role in the conduction of research. Specifically, the need to formulate one’s research into a legible and coherent whole for an informed and critical audience may help the researcher identify gaps, synthesize ideas and conceive new experiments. Naturally, we wonder if verbal articulation for the sake of storytelling with research material can have a similar impact.

### **5.2.3 Related work**

In Kallergi and Verbeek (2012), we review a number of products and practices relevant for the domain of HCI that involve storytelling with images. The review discusses a number of applications, from card games to smartphone applications, and a number of practices, from design and brainstorming methodologies to interface metaphors in personal photoware. Generally speaking, storytelling with images was found to be discussed and employed as:

- creative play
- a means to probe articulation, of both new and existing knowledge
- a means to impose structure

When used as an organization metaphor in interfaces, storytelling is generally employed to either facilitate image sharing or to facilitate image retrieval. All things considered, storytelling allows participants to make explicit, to make coherent, to play, to share, to organize. Such well-established functions of storytelling can be of relevance for a playful and exploratory interaction with scientific image data. Note that storytelling with images spans across a variety of applications, from analogue games to video games to story editors, and a variety of story construction methods, with or without a narrative theory backdrop and with or without gener-

ative capacities. These features mark a valid design space of potential artefacts for storytelling with scientific images.

Closely related to our interest in a story-based interaction with scientific data is the work of Kuchinsky et al. (2002). The authors propose a biological storytelling metaphor as a means to organize various data about biological entities (genes, proteins etc.). We endorse the authors' propositions on the relevance of storytelling for scientific reasoning and practice. Their notion of synthesis as a necessary part of hypothesis formulation greatly corresponds to our notion of a synthesis via the establishment of associations. However, their work does not consider the particularities of image data and of image-based storytelling, which are the focal point of our research.

### **5.3 Preliminary user studies**

We have been particularly motivated by the qualities of storytelling and the potential we perceive for igniting creative responses to image data. Yet, despite the widespread applications of storytelling with images, storytelling with scientific images is a novel and somehow unconventional practice for researchers in the life sciences. How would our target users respond to the practice of storytelling with research images and what features should a storytelling artefact for research images support? To tackle these issues, we conducted two preliminary users studies as further documented in this section. We consider these studies to be both a means to an end, i.e. a well-received product, and a research methodology that enables us to shed some light on the topic of storytelling with scientific images.

#### **5.3.1 Probing stories: Storytelling with image blocks**

##### **Why we did it**

In a preliminary and rather exploratory study, we invited users to share and create stories around their research image material. Our intention was to simply observe the type of talk around and about images and to test a few aids that could potentially facilitate story construction. If storytelling with research images is an unfamiliar practice for researchers, what kind of tools, metaphors and visual or lexical clues can we supply to probe storytelling? As a start, noticing that the comics idiom has been previously applied for sharing or authoring personal photos, we introduced a comic strip metaphor. Our hypothesis was that the comics aesthetic may set the tone for more playful expressions and that a limited

structure such as the comic strip may facilitate users to express their stories in episodes.

### **How we did it**

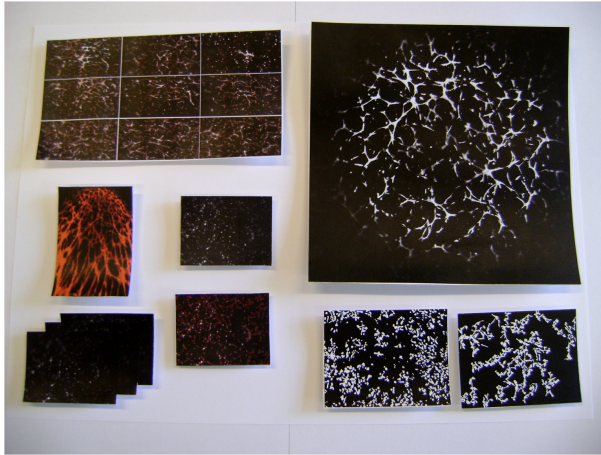
Three researchers (3 bio-informaticians/ 2 male, 1 female) working with images from the life sciences were invited for individual interviews. Each interviewee was provided with a set of image blocks and utility blocks. Image blocks (cf. Figure 5.1) were derived from the participant's latest conference presentation. Utility blocks (cf. Figure 5.2) consisted of speech balloons, captions and character blocks. The subjects were asked to produce two distinct images sequences, namely a synthesis of their images into a story and a three panel comic strip. All sessions were video-recorded (137 minutes of footage).

### **Highlights**

When asked to tell a story with their images, all subjects reconstructed a 'scaled-down' version of their presentations. The result is a diagrammatic representation of the research addressed in each presentation. When asked to produce a 3-panel strip, responses varied. One subject produced an exceptionally complete and valid comic strip: The strip includes time progression, conflict and resolution elements, two characters and dialogue. The other two subjects, both involved in image processing, used the 3 panels as 3 distinct processing steps, adding connecting lines between the panels to represent input or output. Simply put, these subjects turned the comic strip into a diagram instead of a narrative sequence. However, when asked to re-describe the same sequence starting with the phrase 'Once upon a time', both subjects unmistakably switched to a storytelling tone. It should be mentioned that both researchers were surprised at first and actually laughed at the introduction of the sentence. Yet, they both continued the phrase by immediately introducing a character. One subject introduced a hero/protagonist, namely a researcher who produces and analyses images. The other subject 'personified' the biological phenomenon under study ("Once upon a time, there was focal adhesion living together with a cell").

### **What we have learned**

We believe that the challenge in (designing for) storytelling with scientific images would be the switch to a narrative tone or mindset. Note that all subjects eventually narrated a story around their images when properly prompted to. In our experience, cliché phrases and archetypical characters were of considerable help



**Figure 5.1:** Image blocks (partial view) as derived from the subject's conference presentation.



**Figure 5.2:** Utility blocks, including speech balloons (speech, thought and scream balloons), captions and character blocks.

while the comic metaphor was not as helpful as expected. Interestingly, subjects were aware of their difficulty to treat their images outside of their regular framework. One subject remarked that researchers are always too much ‘into’ their images and further suggested introducing a few irrelevant images in the set in order to ‘break’ this fixation. Another subject commented on having presented the corresponding research topic ‘dozens of times’ and further suggested conducting sessions with researchers in earlier stages of their research. With these observations in mind, we concluded that our storytelling artefact should provide substantial support towards setting the right tone or mindset for storytelling.

### **Glimpse on the potential of storytelling with scientific images**

What can this exploratory study suggest about the potential value of storytelling with image data from the life sciences? As expected, stories can work well as means of communication. Two of the subjects associated a storytelling mindset to explaining their research to (non-technical) listeners. As this study was based on existing presentation material, it is likely that our subjects perceived storytelling as an alternative delivery channel of an already worked-out story rather than as a productive synthesis of their material. An unexpected but easily explained result was the capacity of stories to capture the researchers’ personal experiences and the social dynamics of scientific practice. In particular, two of the subjects included collaboration with other scientists in their stories and further articulated about the challenges of collaboration.

### **5.3.2 Playtesting stories: Storytelling with a card game**

#### **Why we did it**

For our next step, we encapsulated the act of storytelling into a game. The primary aim of our game would be to ‘loosen up’ the storyteller, a requirement identified in subsection 5.3.1. Narrative aids such as cliché phrases and characters should steer the player towards a more narrative tone, while gaming elements should poke a more playful attitude. In addition, we decided on a multiplayer game mode as a means to probe both storytelling and social interaction. Motivated also by other storytelling methodologies that utilize cards, we formulated the act of storytelling into a card game. However, we refrained for designing a finalized game concept and, instead, invited our players to collectively devise game rules.

### **How we did it**

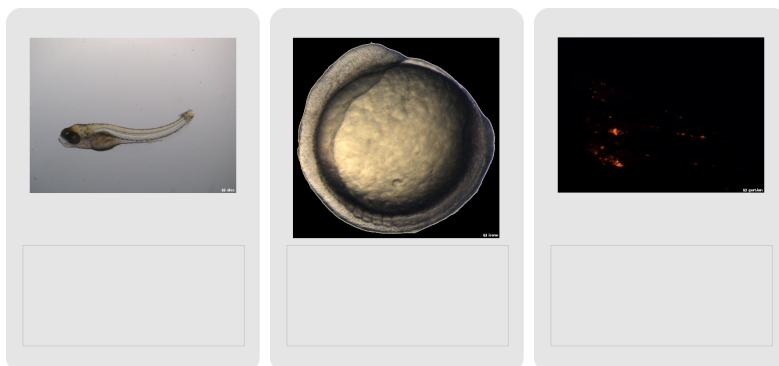
Three researchers (2 bio-informaticians, 1 biologist/ 2 male, 1 female) were invited for a group session. Prior to the session, subjects were asked to submit a number of images (minimum 5 per person) from their current research. We created a deck of cards that included image cards out of the participants' images (cf. Figure 5.3a) and various utility cards (cf. Figure 5.3b) such as help cards with characters, genre cards with common literary genres, start cards with opening lines and end cards with closing lines. The entire set of cards used in the session can be found in appendix B. After a short introduction, the players were provided with the deck of cards and a rudimentary set of rules (deal a hand, play a card, try to finish your cards first). Their task was to comment upon the rules, resolve ambiguities, identify flaws and propose modifications. The session was audio-recorded (74 minutes of audio). Players were also asked to fill in a questionnaire about both the initial and modified gameplay.

### **Highlights**

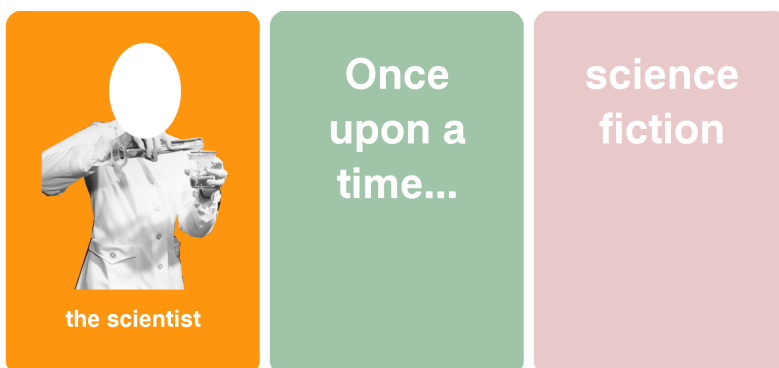
It was immediately apparent that the initial game rules were obviously under-developed. Specifically, the first player to start was also the first one to win. Our players got occupied with this flaw and devised an accumulating number of restrictions that would limit a player from playing her card. However, it was particularly interesting to see that the players reported no difficulties in playing their cards; on the contrary, they found it particularly easy to add their card to the ongoing story. The players themselves attributed this ease to the similarity of their images. For the record, the players did not manage to propose a set of rules that would resolve the identified issue. However, many of their suggestions were incorporated in the next incarnation of our game concept.

### **What we have learned**

We have been particularly motivated by the fluency and ease of our participants during story construction. That said, we admit we have no sufficient data to tell which factors contributed to this fluency. It could be the personality of the players, the card game format, the new narrative elements in the utility cards, the playfulness embodied in the cards themselves, the presence and input of other players or the cookies on the table. Generally speaking, the character and genre cards were well-received with the latter being assigned a progressively more prominent role in the game. What is more, we observed that players repeatedly



(a) Examples of image cards. The provided deck included image cards out of research images submitted by the players prior to the play session. In the session, players were asked to annotate the cards and incorporate the annotations in the game as they deemed appropriate.



(b) Examples of utility cards. The provided deck included help cards with characters, genre cards with common literary genres, start cards with opening lines and end cards with closing lines.

**Figure 5.3:** Examples of cards used in play session. The complete set of cards can be found in appendix B.

motivated and complemented each other. Other players can, in fact, be a valuable catalyst in probing storytelling.

We have been attentive to what we believe to be a tension between a competitive game mode and a storytelling mechanic. A resolution such as finishing your hand first was hard to implement in a fair manner and so was a clear criterion for accepting or rejecting a move. Players soon fell back on a scoring mechanism and a winning condition based on accumulation of points after several rounds. Nonetheless, accumulating restrictions in playing the next card had a negative impact on the pace of the story with players being noticeably slowed down in composing their moves. We suspect that storytelling is better experienced as a loose playful activity, and it may actually not require a winning or scoring condition. To some extent, this observation corresponds with our findings in chapter 4: Flickr image-based games, such as the ones based on building chains of images by associations, repeatedly lack a winning or scoring condition.

### **Glimpse on the potential of storytelling with scientific images**

The stories produced were strikingly rich in their imaginative power. Our players would easily introduce zebrafish with super powers and zebrafish jumping free out of their wells. There were also ready to turn fluorescence signals into galaxies and zebrafish embryos into planets; in the words of one of our players, they ‘fantasized’ about their images. A very promising observation was found in the capacity of our players to appropriate visual details for the sake of story composition. This attention to visual details goes beyond obvious elements (e.g. dark eyes) to minute or irrelevant details in the image (e.g. imaging artifacts). Associations across images were also observed: A bright-field image of fish followed by a fluorescence image of fish was explained as the zebrafish obtaining infrared vision while differences in the orientation of the imaged fish were highlighted (“the fish turned around...”). The players seemed to enjoy the stories they produced while positive attitudes towards the opportunity to be exposed to other researchers’ images were off-the-record expressed.

## **5.4 LABBOOK, the collaborative storytelling game**

This section introduces LABBOOK, our current implementation of a digital, collaborative storytelling game for images in the life sciences. The game should be understood as a platform that creates opportunities for storytelling in a shared and social context. LABBOOK confronts the players with the challenge of story



composition and invites them to imagine associations, re-consider their own and one another's images and participate in social exchange. The game employs digital images as dictated by practical needs and a reasonable approach to data management.

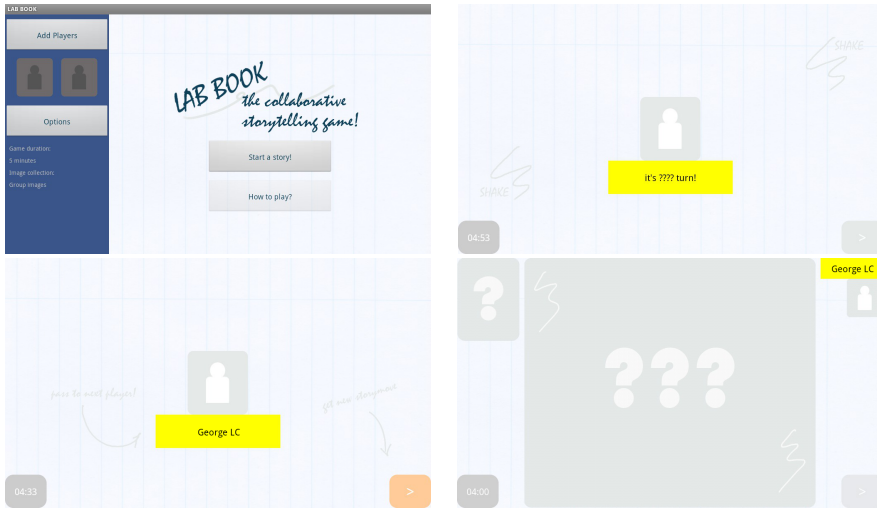
### 5.4.1 Concept design

Despite lacking well-defined rules, the paper-based card game described in section 5.3.2 seemed to perfectly facilitate the mood and attitude we were after. Naturally, we question: Can we mitigate our card game to the digital domain without sacrificing its playfulness and its affordance? Which are the distinctive aspects of the experience that we should strive to maintain and which modes of play would permit us to do so? We decided that the game should remain multiplayer, it should maintain narrative aids in the form of utility cards and that, while being digital, it should provide some elements of physical interaction.

In putting forth our requirements for the next game concept, use case scenarios were of particular help. Clearly, the major aim of our game is to stimulate collaborative storytelling. But how and under which circumstances do we envision our game to be played? Considering the workflow and actual routines of a practising scientist, how do we create opportunities for storytelling that are not artificial and do not introduce hassle for the researchers? Providing realistic answers to these questions is crucial for the adoption of our product. With these in mind, we provide the following use case scenarios:

1. The coffee table scenario: Colleagues of the same research group use the game as a pastime activity during coffee breaks. They play a couple of rounds with one another's images while at the coffee room of the institute. The game may be laying around at the shared facilities or be owned by one of the group members.
2. The ice breaker scenario: Collaborators in an interdisciplinary project use the game as an introductory activity during a project meeting. They play a couple of rounds with one another's images to get acquainted to the work or research interests of each collaborating party.

Note that both of the above mentioned scenarios expect the players to be co-located.



**Figure 5.4:** Screenshots of LABBOOK, the game. Players play in random order and the new next player is drawn by shaking the tablet. Stories unfold storymove by storymove and the new storymove is drawn by shaking the tablet.

### 5.4.2 The game

LABBOOK (cf. Figure 5.4) is a collaborative storytelling game for biologists and their images. It is played by a group of players on a tablet computer shared among the players. The aim of the game is to collectively construct a story around a collection of research images and within a set time limit. Stories unfold image by image with the players taking turns in the same story: The player whose turn is due draws the next image/storymove that she attaches with her narration to the ongoing story. One storymove (cf. Figure 5.5) is a combination of a random image from the image set and a random utility card. The progression of the story is linear: A new move connects to the previous move and new moves are drawn by shaking the tablet. The sequence of the players is arbitrary: Players play in random order instead of in turns and the new next player is drawn by shaking the tablet. The story ends when the time is up with a random closing line. The player's narration is automatically audio-recorded and can be played back at the end of the game. There is no (extrinsic) reward other than enjoying the process, the company and the generated story.

#### Controls and design choices

At the core of our game is collaborative storytelling with scientific images. Thus, the fundamental elements of our game are the players and their images. However,



**Figure 5.5:** One storymove is a combination of a random image from the image set and a random utility card. The player whose turn is due (highlighted at the top right corner) attaches the storymove to the ongoing story using hints from both the image and the utility card. Utility cards provide various suggestions including characters, places, literary genres or annotation terms from the image collection.

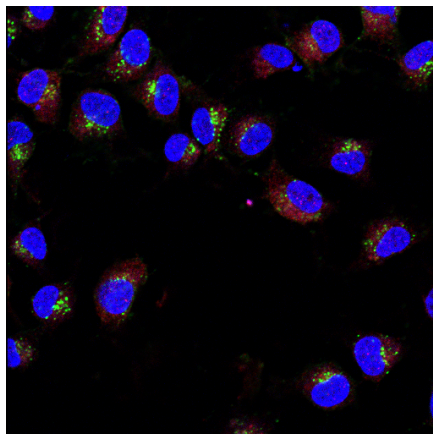
another essential component is the platform the game is played on. The tablet computer entered our design as a solution to our requirements for a shared, collaborative and fluent story development: It provides us with a shared space and a shared story timeline similar to the ones supported by a card game. Then again, having a tablet at our disposal introduced new opportunities for game design. Mitigating the game to the digital domain offers functionalities that were not available to us beforehand while the hardware itself, i.e. a portable tablet with a touchscreen, microphone, speakers and accelerometer, supports additional interactions to be further exploited. To begin with, the tablet's interface allowed us to introduced a shake control which we hope to aspire a feeling of chance and to highlight the randomness involved in each storymove. Secondly, the size and mobility of the display, as opposed to a tabletop, could potentially increase physical interaction with or around the display; we attempt to capitalize on such an opportunity by introducing the random play order. Drawing one move at a time instead of being dealt a hand and the combination of one utility and one image card into a single storymove were suggestions brainstormed by our test players (cf. section 5.3.2). LABBOOK is developed in Android 2.3.3 and deployed on a Blackberry Playbook 7" tablet.

## 5.5 Results

### 5.5.1 User evaluation

LABBOOK was evaluated by four novice users (4 life science students/ 2 male, 2 female). The major aim of this evaluation was to test our game design choices for playability. The players were asked to play the game first in pairs (2 groups) and then in a group of four (1 group). The game was played with a set of 15 images out of two research projects previously presented to the players (cf. Figure 5.6). That is to say, the users had prior exposure to the images and a thorough introduction to the research topics involved but were not the ones producing or researching the images involved. The sessions were audio-recorded (51 minutes of audio). Players were encouraged to play the game in their native language, i.e. Dutch. Play sessions were followed by interviews and players were also asked to fill in a questionnaire at the end of each 2-player session.

As reported by the players, the game rules and in-game interface were straightforward. Players had no difficulties in figuring out what to do next (cf. Table 5.1) and they quickly resolve the shake control and random player turn. Interestingly, one player concluded that the game is very easy to play because “there are actually no rules”. While LABBOOK has indeed no rules on how to make a move or on how to win, it has of course a structure and logic in its progression; this logic was immediately internalized by the players. Regarding some of our game design choices, the random turns rule was once reported as contributing most to the enjoyment of the game. When playing in pairs, a very long sequence of moves by the same player was frustrating to the player involved but amusing to the other. Nevertheless, a long sequence of moves should not be much of an issue when more players are involved. Responses about the shake control were indirectly related to the random turns rule: Generally speaking, the shake control was found to be playful but too many shakes in a row by the same player were reported to “disturb the storytelling a lot”. Mobility of the tablet was not an issue but the tablet’s role as a shared surface is disputable. During the 2-player session, players would frequently interfere/participate in each other’s move. This behaviour was not observed during the 4-player session. In fact, one player commented on the missed opportunity to look at the image being narrated during the 4-player session. The issue of visual access definitely requires our further attention: Potential solutions may span from introducing simple interface hints to adopting alternative technologies.



(a) EGFR-induced breast cancer cells visualized with a confocal laser microscope. Three channels are captured: A red channel (Cy3) containing P-ERK expression staining, a green channel (Alexa-488) containing EGFR expression staining and a blue channel (Hoechst #33258) containing a nuclear staining. Image courtesy of Division of Toxicology, Leiden Amsterdam Centre for Drug Research (LACDR).



(b) Bright field image containing a zebrafish larva imaged with a Leica DC500 microscope. Image courtesy of Department of Molecular Cell Biology, Institute of Biology Leiden (IBL).

**Figure 5.6:** Examples of research images used in user evaluation.

When it comes to story construction, we were pleased to observe that the aids incorporated in LABBOOK were overall appreciated. Utility cards were well-noticed with players frequently starting their sentences with the utility card text. One player particularly valued the opening line mentioning that it removes the burden “to create a good beginning”. Most noticeably, after the 4-player session, all players highly appreciated the input of other players as a source of inspiration (cf. Table 5.1). All in all, LABBOOK seems to successfully integrate playful elements, narrative aids and the multiplayer mode. Then again, our players were of the opinion that it is the image set that governs story construction. All players asked for more diverse images in the game; they were fatigued by the reoccurring images feeling unable to come up with new ideas. This fatigue was reported not only after multiple sessions but already within a single session: The reappearance of the same type of images in the same story was found to hinder story construction. Interestingly, similar images have been found to be both an aid (easy to connect in a coherent way) and a hindrance (lack of new ideas). Some middle ground should of course be attainable. For instance, one of our players suggested the possibility to select a theme in the beginning of the game, a suggestion that may allow us to balance variation and coherence. Variation in the image set is a parameter we need to further consider and so are the total number of images included and the variation between storymoves. Note that image annotations could be exploited to calibrate variation: By means of annotations, we can potentially guarantee either sufficient similarity or sufficient variation within the image set and/or between two storymoves. Eventually, images will be supplied by the players themselves but we can always manipulate the search space of available storymoves.

### **5.5.2 Impact**

The stories produced with LABBOOK further confirm our earlier observations on the capacity of storytelling to engage players with visual details in the images. Once again, players appropriate visual details for the sake of story composition; as a matter of fact, they are very attentive to the image content. Green, red and pink specks in the image, the orientation of the fish and the positioning of the cells are repeatedly captured in the players’ narration. The players’ capacity of finding and utilizing patterns in the images is impressive. For example, players very often group cells together and propose that (groups of) cells move away or towards each other (cf. Table 5.2). Players were also able to make associations between subsequent images. For example, they often include in their narration

## 5. STORYTELLING AS PLAYFUL INTERACTION

**Table 5.1:** Relevant quotes extracted from play sessions and questionnaires (player id indicated as A# for the first pair and B# for the second pair)

topic	quotes
support: interface	“sometimes when you are in a game or something you think what do I need to do now? this explains itself” [B1], “there shouldn’t be much more in the screen because you are thinking about what you are going to say and shouldn’t be distracted by more things” [B2]
support: other players	“ I think it’s nicer to play with 4 people instead of 2 [...] more ideas, different people know more things, so you can just adapt to someone else’s story when you don’t know what to say” [B1], “more different, more inspiration, we have different points of view, although it got less because we got it a couple of times” [A2]
support: image set	“There has to be a bigger variation in the pictures, I think that’s also something that really matters, because right now they are all the same, so we can’t talk for hours about it any more...” [A2], “[B2] It is nice if there are different pictures ... [B1] you make a story and then the same pictures come back so you can’t continue with your story [B2] but it is a good thing that sometime the same pictures come back...” [B1, B2]
impact: potential use	“it’s more like a game for people who want to be creative, because you need to be creative to keep coming up with something new” [B1], “maybe it’s a good exercise when you are afraid to talk spontaneous in a group, and you just pass on the tablet and everybody says something, it gives you a subject to talk about” [B2]

the increase or decrease in the number of cells or fish depicted; multiplication, death and joining/being joined by other members of the same type were some reoccurring themes. Another frequently used strategy was zooming in or out in content when images of fish were followed by images of cells and vice versa (cf. Table 5.2). Appropriating visual details within a single image and employing the differences between two images are practices repeatedly observed among tests and groups. Hence, we believe we can safely suggest that players do resort to a more active look into images when confronted with the challenges of story composition.

**Table 5.2:** Story fragments extracted from audio recordings translated from Dutch (story id indicated as A for the first pair, B for the second pair and AB\_# for the joined group)

topic	fragment
patterns: grouping, movement	“the cells were afraid of each other and flew to the other side” [AB_1] “they all went off to different directions” [AB_2] “then they all decided to go line dancing” [A]
transitions: zoom in/ out	“the computer analyst saw in the zebrafish [...] that a cluster emerged” [A] “the tragedy was that the fish had only two cells” [B] “and the cells were actually one big zebrafish...” [AB_1]

A new aspect observed during the LABBOOK game sessions was the employment of prior biological knowledge in order to compose a move. As expected, the players often referred to the knowledge they had acquired on the projects represented in the image set. It should be repeated here that our players were prior and independently of the game sessions exposed to the research of two of our colleagues who contributed the images. Naturally, the players often reflected on the newly introduced research topics and workflows and were able to identify and utilize for their narration the correct content of the image. What was, though, surprising was that the players made use of prior knowledge also in the *absence* of image or help content. More specifically, one player talked about “jellyfish being worried because they lacked vesicles and clusters”; this was indeed the case in the cells depicted. We argue that it would be highly unlikely to compose such a move without relying to one’s prior biological knowledge. To put it differently, a non-biologist would be able to abstract green spots into a story element but would be highly unlikely to devise a story element out of their absence. A different example of resorting to one’s prior knowledge for story construction was found in a transition between an image of cells to an image of fewer cells. The player introduced apoptosis, i.e. cell death, in the narration although neither of the projects was related to the phenomenon. The inclusion of a technical term that was nowhere present in the content of the game attracted our attention; when asked, the player reported having had to study for a cell biology exam. Coping with (the ambiguity of) a pending storymove seems to be a challenge that demands creative solutions. As such, it requires the player not only to focus on the visual clues available but also to dig into her own baggage of prior knowledge and interests.

How did the players respond to storytelling with research images from the life sciences? All players ‘moderately’ enjoyed the game and both pairs voluntarily proposed to play the game with all four participants. With respect to the aims of the game, LABBOOK was clearly valued as a creative exercise and as a platform for conversation (cf. Table 5.1). All in all, players seemed to enjoy the game and experience. There was, however, some scepticism about the quality of the produced stories. One of the groups commented on their story being illogical, an aspect they attributed to the obscurity of combinations and to a lack of continuity. The perception of the players is of course respectable but it should be mentioned that many of the stories demonstrate a surprising degree of continuity with introduced characters active across a number of moves. Nonetheless, continuity could be better supported by means of the game’s interface. For instance, we can consider a stage of active cards or a navigation aid to revisit the story so far. On the other hand, we have been conscious of the fact that our game does



not offer support for a narratively robust story construction. While we do not necessarily exclude this option, we have been mostly interested in the processes active during story-making rather than on the narrativity of the output stories. Another scepticism expressed regarded the relevance of biological content. The players commented that the game can be played with any type of images and were uncertain whether biological background or prior knowledge about the images assists story construction. The stories produced would suggest otherwise but we are wondering on the opportunities to better exploit the particularities of images from the life sciences.

### **5.6 Conclusion**

This chapter introduced the notion of a story-based interaction with scientific images. By means of a literature review, preliminary user studies and the design and implementation of a concrete storytelling game, we have attempted to better understand the potential, relevant aspects and specific challenges of storytelling with scientific image data. During this process, we have identified requirements for better facilitating storytelling which we embody in the implementation of our collaborative storytelling game. Providing substantial support towards setting the right mindset for storytelling and considering less competitive modes of play are two of the design principles we wish to highlight. Last but not least, we have collected particularly encouraging story samples and user responses that further motivate the use of stories as a way to interact with research images. An active look into images and a shared conversation space appear to be two of the major contributions of a story-based interaction with images.

In its current implementation, LABBOOK is a well- functioning and well- received platform for collaborative storytelling with images. The game's interface is straightforward, the game rules are clear and unproblematic and story construction is stimulated by narrative, playful and social elements. Certainly, there is a lot to be done for LABBOOK to be released as a complete product. First of all, we need to implement functionality for players to load their images and access previously played stories. Secondly, we need to make better use of the tablet computer as a shared surface: Visual access to the storymove under narration is an important issue especially when images unknown to the players are involved. Eventually, we can always consider more elaborate ways to regulate either the initial image set or the transitions between storymoves. Potentially, we can also consider incorporating computational support for story composition or employing formal narrative elements as aids to story construction.

While we have examined the stories produced by our players attentively, our appreciation of them has been only subjective. At present, we lack a metric to evaluate the produced stories on either their quality or their usefulness. Such a metric may or may not measure the story's narrative quality and may or may not consider its scientific content. Nonetheless, a metric will be needed if we are to compare different prototypes or different games on the stories they facilitate. On the other hand, our examination of the produced stories focused on (attributes of) the story-making process, particularly the strategies, creative solutions and inspirations of our players. Moreover, we have been attentive for straightforward references to the image content as well as straightforward references to transitions between images. Regardless of the value of the stories themselves, such references allow us to raise a case for the value of story-making as a trigger for an active look into and in between images.

Finally, it should be noted that LABBOOK was designed as a platform that creates opportunities for storytelling in a shared and social context. The game mode implemented, i.e. a multiplayer game for players that are co-located, is a means to stimulate both storytelling and social interaction. The game has been valued as a creative exercise and as a platform for conversation and we are confident that it can accommodate the use case scenarios proposed. Regardless of the value of the output stories and regardless of the value of the story-making process, the opportunity for a shared conversation space and the playful exposure to one another's images and to one another may be just enough.