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

Kallergi, A.

Chapter 4

Play and exploration in image collections: A Flickr-based study

Based on:

A. Kallergi and F. J. Verbeek. The games Flickrites play: An investigation of Flickr-based gaming activity with special focus on opportunities for exploratory interaction. In Proceedings of the IADIS International Conference Game and Entertainment Technologies 2011, pages 35-42, 2011

Abstract: What kind of games do people play with digital images? To probe this question, we examine image-based gaming activity as exercised in the Flickr photo sharing system. Noticeably, a surprising number of user-moderated games are being played within the structure of Flickr groups. We provide an assessment of this activity and a first categorization of the exact types of games played: Recurrent themes are observed and discussed. Furthermore, we examine gaming activity in the scope of collection exploration, looking for opportunities that may stimulate or engage the player to explore an image collection. Being interested in playful interactions with images and in games as a platform for exploration, we question if the games played can support collection exploration. Potentially promising ideas as derived from the current Flickr gaming landscape are grouped, reported and discussed.

4.1 Introduction

An invitation to play is an invitation to explore. In the context of data collections, where a potential for discovery and a need to explore are substantial, exploration can benefit from a more playful and open-minded attitude of the (re)searcher. Technically, exploration relates more to undirected, open-ended information activities such as browsing and is often exercised as movement across information space. Precision is not always the key: Getting an impression of the collection as a whole, following related or connected items, landing at unexpected but useful items, establishing serendipitous connections between items can all trigger a feeling of discovery. In order to design interfaces that will challenge and engage the user to explore, we believe that ideas from play and games are worth exploiting. In chapter 3, we observed that gaming can support both the relevant tasks, i.e. navigation, and the relevant emotional state, i.e. positive affect, for exploration. Our research aligns with the increasing interest of the HCI community towards more playful interfaces: Currently, much attention is given to the potential of applying gaming elements in different contexts including application software. Consider as an illustration the classic work of Malone (1982) pollinating HCI with gaming elements, recent studies on funology (Blythe et al., 2004) and fun in the interface and the numerous examples of serious games (Susi et al., 2007; Alvarez and Michaud, 2008), games with a purpose (von Ahn, 2006) and game-like applications. We are particularly interested in the 'gamification' (Deterding et al., 2011) of interfaces to image collections and in 'gamification' as the means to promote collection exploration. In chapter 3, we engaged in implementing suitable gameplay for collection exploration. Nevertheless, we find it useful to examine what lessons can be learned from existing practices in popular image collections and from existing games involving digital images. We hope to be able to extrapolate our findings to further support playful interactions with image collections.

For the researcher interested in interactions with image collections, Flickr (http://www.flickr.com/) is one of the obvious choices to study. Its popularity and success are phenomenal. Flickr is one of the major photo hosting and sharing systems and one of the top visited websites worldwide, with a large community of users and a vast collection of images. Official statistics are not available but Flickr is rumoured to consist of over 30 million registered accounts (Flickr: The Help Forum, 2009); the 5-billionth photo was reported on September 2010 (Zack, 2010). More importantly, Flickr has been a fruitful and influential platform for social web practices, such as tagging, social networking and social browsing. Daily, a substantial number of users are uploading, annotating, browsing and

commenting photos in Flickr, while a great deal of social interaction is taking place via features such as favourites, comments and groups.

Play and playfulness have a noticeable role in the overall interaction with Flickr. According to Velasco-Martin (2009), "one of Flickr's main strengths, beyond being highly usable, is that it is fun, since they were somehow capable of conserving its playfulness, which is key for its user participation". Similarly, in "Flickr is a MMORPG" (cited by Fake, 2004), the commentator enumerates the striking similarities between a typical game and Flickr: "Flickr is inherently, down-to-its-bones about play. If you look at a list of the elements of a successful game, they are all present in Flickr: a sense of space to explore, a range of challenges, a range of abilities which can succeed [sic], the need for preparation and skill, a variable feedback system". Taking a slightly different approach, Mäyrä (2008) analyses Flickr as a game of paidia, i.e. as an activity of less competitive but playful and game-like behaviours to support online photo sharing.

If the core of Flickr's interaction is infested by such implied play, the platform is also associated with a number of explicit play activities that use the Flickr collection and system. In one hand, the Flickr API has allowed a considerable amount of programming activity for external applications that use the Flickr collection. Many of these applications are simple, image related games. External games are hosted and maintained by their developers and reside outside of the Flickr system. On the other hand, the platform itself, and specifically the format of groups (cf. Figure 4.1), is extensively utilized for playing simple image games. This study will exclusively discuss gaming activity exercised within Flickr groups. Our interest in group gaming activity is two-fold: Firstly, groups are noteworthy community spaces and are often associated with entertainment (Stvilia and Jörgensen, 2007). Secondly, group games are initialized and moderated by Flickr users themselves. This allows for freedom and flexibility in setting up or adjusting the games, which we hope to provide us with a better insight into the needs and preferences of the players. Nevertheless, it is exciting to observe how members in a self-organizing system provide playful means to interact with the system.

The rest of this paper is structured as follows: An examination of the types of gaming activity exercised across Flickr groups and a first look into the exact types of games played is given in section 4.2. Reoccurring themes and distinguishing game concepts are identified and discussed. In section 4.3, we examine one particular 'genre', i.e. associative games, to contemplate on the potential of gaming as exploration. Conclusions and points of discussion are given in section 4.4.

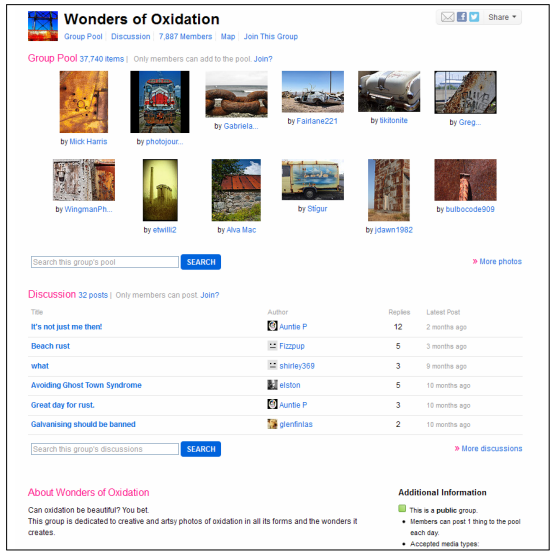

Figure 4.1: Entry page of a typical Flickr group (partial view). Here the 'Wonders Of Oxidation' group, a group dedicated to photos of oxidations (group URL: http://www.flickr.com/groups/52239914863@N01/). Depending on the rules of the group, group members may contribute content to the image set of the group (group pool) and may participate in discussions held in the message board. Screen captured: 05-08-2012.

4.2 The games Flickrites play

During the period September - November 2010, we reviewed a potentially relevant subset of Flickr groups and the gaming activity they employ. While manual and, consequently, only indicative, this examination verifies the extent of gaming activity taking place in the Flickr universe and provides us with a first yet informative look into the characteristics of this activity. The data examined in this section are available at http://bio-imaging.liacs.nl/galleries/iadis2011/.

4.2.1 Collecting and examining groups

Potentially relevant Flickr groups were retrieved by querying the Flickr interface for the terms 'flickr games', 'photo games' and 'games' with added restrictions (cf. Table 4.1). The ambiguity of the concept 'game' and the limitations of the Flickr search severely impaired the precision of our queries, the results of which required further manual filtering. Out of the overwhelming number of results, a maximum of 500 results per query were retrieved. Duplicate retrieved results, groups with insufficient number of members (<= 1), non public groups and non English speaking groups were programmatically removed. Subsequently, groups with obviously irrelevant topics based on their title or description were manu-

Table 4.1: Queries submitted via the Flickr API interface. A maximum of 500 results per query were retrieved for further inspection. Results were refined using both programmatically accessible attributes (e.g. number of members) and textual information of varying level of detail. The group titles, the group descriptions and, eventually, the discussion threads were examined in the given order.

Query	Date	Hits	Retrieved
flickr games	16-09-10	2506	500
"flickr games"	16-09-10	20	20
"photo games"	16-09-10	54	54
games -video -videogame -playstation -xbox -nintendo -sport -olympic -cards -board -toys -rpg	15-09-10	7037	500

ally removed. Examples of irrelevant topics encountered are sport events, toys, videogame screenshots, videogame conventions, game reserves and many more. After several manual filtering iterations, the original result set was reduced to 166 relevant groups for further analysis. Relevance of a group or activity was often assessed with respect to the intent of its initiator, i.e. explicit reference to a game and its rules. All 166 groups make claims to some sort of gaming activity within their setting; however, their understanding of the concept of 'play' is varied.

The description texts of the examined groups in combination with their message boards suggest certain reoccurring themes. Specifically, it appears that most of the groups relate to any of the following themes:

1. Gaming as secondary activity: Groups of various topics may play games as threads in their message boards. These groups engage with unrelated to gaming topics (e.g. photos of boxer dogs or flowers) or communities (e.g. a group of Canberra based photographers) but provide or permit some entertaining diversion in the form of threaded games.
2. Gaming as core activity: A number of groups are specifically created for the purpose of playing 'casual' games among their members. Several variations in the organization of these dedicated to gaming groups are possible. For example, dedicated groups can maintain collections of several known threaded games; such collection groups are often suggested as central hubs to play games otherwise scattered around Flickr. Other groups maintain multiple instances/threads of the same type of game in their message board. Finally, many dedicated groups are single instances of one game, played in the pool (image repository) of the group, rather than in the message board.
3. Gaming as contest: A number of groups are specifically created for the purpose of conducting image challenges and contests. Such activities are usually periodic, accompanied by strict posting rules and voting procedures and resolved with the announcement of a winning photo. A less formal variation of this theme is found in groups that require their members to

award, rate, comment or favour images of other group members. While different in their organization, these groups also structure their play around rating the quality of one another's images.

4. External gaming activity: Groups may engage in games or playful activities that are photo-oriented but performed outside the Flickr system. Consider, for example, scavenger hunts that require players to shoot a list of given subjects in limited amount of time. In such cases, the group usually serves as a reference point for instruction and coordination and as a container for the submitted image entries.

Examples of groups that are representative of the above themes can be found in appendix A.

Groups dedicated to 'casual' games (theme 2), challenge/rate groups (theme 3) and container groups (theme 4) are all primarily engaged with playing with images and could be all filed as dedicated to gaming. Yet, we find useful to distinguish these varied understandings of play. External gaming activity, although potentially creative, will not be further discussed; focus is on games that utilize the existing Flickr database. Challenges and contests are labelled distinctively from 'casual' games due to their particular focus on judging and voting. Gaming as secondary activity (theme 1), however, is a discrete theme and can be easily intertwined. For instance, there exist challenge groups that also play 'casual' threaded games. For the purposes of this study, an exclusive classification of the groups is less important than observing the various functions and forms of playing as suggested by the users.

4.2.2 Collecting and examining games

We further look into the types of 'casual' games played as either core or secondary activity. First, we look into the threaded games played (cf. Figure 4.2) and, then, extrapolate our findings to groups dedicated to one type of game only. To collect games, we used all 10 groups with core gaming activity that maintain game collections and 2x10 random groups with secondary gaming activity; these group are expected to play threaded games only. The message boards of the groups were queried via the Flickr interface for the term 'game'. Again, the notion of game in the retrieved threads is not clear-cut. Similarly to the various forms of play in groups, we encountered various activities such as challenges/contests or themed showcases among the results. In consistence with our earlier distinction, pure contests and themed threads as well as overt requests for comments were not considered for further inspection. Moreover, we found numerous purely word-

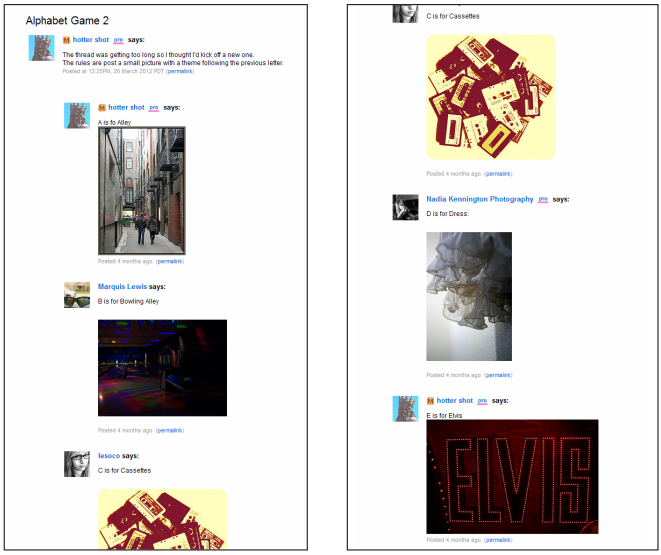

Figure 4.2: Threaded game played in the message board of the group (partial view). Here an instance of the ABC game played by the 'Flickr For Fun' group (group URL: http://www.flickr.com/groups/flickrnewpictures/). In threaded games, players typically post their moves as replies to an ongoing thread with played images included as thumbnails. Screen captured: 05-08-2012.

based games, which are worth mentioning but are irrelevant to our study as they incorporate no images in their gameplay. Word games were excluded but image variants of those exact word games were retrieved.

According to our retrieved set, a number of popular threaded games tend to reoccur across groups. Table 4.2 provides a list of the most frequently played threaded games, presented under their generic names. In most cases, the exact same game appears under different names, e.g. the ABC game was found as the 'Alphabet game', the 'I am going on a picnic and I am bringing...' game, etc. In some cases, slight variations in the rules occur (e.g. count to 10 or to an ever increasing number) but the core of the game remains the same. A frequent variation, particularly in groups with secondary gaming activity, is to play known games with a subset of images relevant to the interests of the group, e.g. the 'NJ-New Jersey' group plays known games with New Jersey related images only. All these easily identifiable variants were filed under their generic names.

A closer inspection of the collected threaded games reveals a rather limited range of game concepts. For example, in both the ABC and the 'Last letter' game, the subject of the next image should start with a given letter. The two games differ in the way the next letter is produced, but, in both cases, the response is illustrative of a triggered subject. We attempt to capture such similarities in the core

Table 4.2: Top-10 most frequent threaded games filed under their generic names. Given frequency reflects the occurrences of the same game concept across multiple groups, not the number of game instances within the same group (can be more than 1). Collections: Groups dedicated to gaming that maintain collections of threaded games. Secondary: Groups that play threaded games as secondary activity.

Generic name	Rules	Collections	Secondary (1)	Secondary (2)
ABC	Post an image whose subject starts with letter L, L increases alphabetically	7	6	6
I spy	Post an image that depicts a subject spied in the previous image	6	6	5
Person above you	Post your favorite image from the previous person's photostream	3	6	6
Photo association	Post an image that relates to the previous image	5	1	3
I request a...	Post an image that depicts the requested subject	4	1	1
Rainbow	Post an image with color C, C follows the rainbow	4	1	2
Count	Post an image that shows X items, X increases	3	1	3
Last letter	Post an image whose subject starts with letter L, L is the last letter of the previous subject	2	0	0
Spell shot	Post an image whose subject starts with letter L, L moves along the letters of a given word	1	1	1
Name my photo	Give a name/title to an image	1	1	2

rules of the games by deriving a number of representative game concepts/genres. Our focus is on the function of images in the game: What is the player expected to do with respect to (an) image(s)? What is the contribution of a posted image in the progression of the game? Our proposed concepts are described in Table 4.3.

Table 4.3: Proposed game genres/concepts, in alphabetical order. The verbs proposed are representative of the activity required by the player during the game and with respect to images.

Category	Description	Examples
associate	Post an image response to the previous image post: Construct a chain of responses	Photo association , I spy
create	Produce images, mosaics, etc.	Flickr-Wikipedia game
guess	Guess the subject of a given picture	Guess what? Guess where?
illustrate	Illustrate a (requested) subject, subjects produced by current or previous player	Count, Alphabet, Last Letter, I request a..., Opposites
reflect	Reflect on a posted image or on a photostream (note: simple feedback threads were excluded)	Person above you, Name my picture

The proposed concepts were used to label all retrieved game threads (cf. Table 4.4). Also, we label the groups dedicated to one type of game (cf. subsection 4.2.1). Once again, our approach when applying genres is a deliberately image-centred one. For example, games labelled as associative require that the next move in the game is an image response to an image stimulus from the previous move. However, there exist word association games that ask the player to respond to a text stimulus with a text response accompanied by an image. Technically, the function of images in these games is illustrative. Still, it is difficult to assess the impact of the accompanying image on the response of the player: It is likely that, in the presence of an image, a player does not solely respond to a text even if supposed to.

On a side note and after having examined all collected threaded and single games, we comment on a few technical aspects of Flickr-based image games. Generally speaking, Flickr games are either endless or artificially terminated by means of time or number of posts. Players take turns in arbitrary order but limitations apply on the number of posts per player or the number of posts in between a player's next move. Overall, threaded games are simple, linear and easily identifiable. Single games, on the other hand, seem to demonstrate more variety in their concepts and in their rules. For the sake of comparison, Table 4.5 shows the 10 most frequently played games across single game groups. While the most frequent threaded games (cf. Table 4.2) are predominantly of the 'illustrate' genre

(associate= 2, illustrate= 6, reflect= 2), single games seem to demonstrate more variation in player activity (associate= 3, create= 4, guess= 2, illustrate= 1).

Table 4.4: Games identified per concept. Collections: Groups dedicated to gaming that maintain collections of threaded games. Secondary: Groups that play threaded games as secondary activity. Single games: Groups dedicated to gaming that play one type of game only.

Category	Collections	Secondary (1)	Secondary (2)	Single Games
associate	14	7	8	19
create	1	2	1	12
guess	1	3	2	20
illustrate	29	12	13	8
reflect	8	8	9	1
not categorized	6	2	1	2
total	59 games	34 games	34 games	62 groups

Table 4.5: Top-10 most frequent single games filed under their generic names. Single games: Groups dedicated to gaming that play one type of game only.

Generic name	Rules	Verb	Single Games
Photo Association	Post an image that relates to the previous image	associate	12
Guess where?	Guess the depicted location	guess	10
Guess what?	Guess the depicted subject	guess	6
ABC	Post an image whose subject starts with letter L, L increases alphabetically	illustrate	4
Flickr-Wikipedia game	Create a fake album cover using Wikipedia and Flickr	create	4
Mosaic game	Create a mosaic using Flickr search on given questions	create	2
Photoshop tennis	Edit an image sequentially	create	2
Visual storytelling	Create a story with images	create	2
I spy	Post an image that depicts a subject spied in the previous image	associate	2
Similar shots	Post an image identical to a previous one	associate	2

4.3 Exploratory behaviour in Flickr group games: Associative games

In this section, we focus on the games identified as associative. Note that the underlying mechanism of associative games can be highly relevant to collection

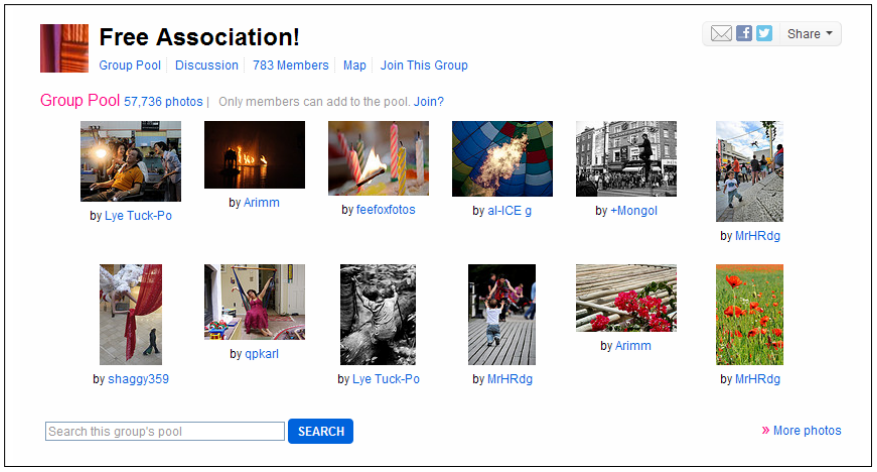

Figure 4.3: A pool-based associative game. Here partial view of the pool of the 'Free Association!' group (group URL: http://www.flickr.com/groups/free_association/). In pool-based games, players post their next move as a new entry in the group pool. Screen captured: 05-08-2012.

exploration: Establishing associations is often related to discovery and knowledge production. Moreover, associative games produce chains of images that are comparable to paths in information space and may be worth exploiting for collection exploration. Towards a closer examination of associative games, we study the game rules and message boards of the groups dedicated to one type of game labelled as associative. Groups dedicated to one type of game often use the entire pool as a game in progress (cf. Figure 4.3). During this investigation, we use collection exploration as a yardstick to organize our observations into three topics of interest, namely chain construction, chain navigation and chain interpretation. Note that this examination is mainly an effort to harvest potentially promising ideas rather than an exhaustive study.

Chain construction: To begin with, let us examine the practices involved in the construction of a chain of images. Images played in a chain are predominantly taken from the player's own photostream. This may be dictated by the use of the pool, although threaded associative games tend to be played similarly. It may also be a reasonable choice against copyright infringement. However, the possibility to encourage players to search or browse for images for the purposes of the game seems to be a missed one. Along a chain, the nature or type of the connection varies according to the focus of the group: Some groups value visual associations (color, shape, composition) while others value links based on the depicted subjects. The mood of a picture, or the emotions it triggers to the player may also com-

prise acceptable links. Non visual elements such as date, place and camera settings may or may not be accepted and so are other conceptual or intellectual links such as word jokes. Overall, players seem to contempt long chains of a very broad subject and a couple of groups explicitly aim for subtle or hard to identify links (cf. 'Tenuous Links' group, group URL: http://www.flickr.com/groups/association/). Note that in the case of subtle links based on depicted content, minute subject details are captured and practically 'zoomed out' in the next transition. Lively discussions on what comprises a successful link are frequent. Players also discuss their strategies for playing the game. Interestingly, players report having taken a picture particularly for the purposes of the game or for future use in the game (cf. Table 4.6). Finally, it should be noted that the majority of image chains are linear: Links are established between two images only, i.e. between the new move and the last image in the pool. Yet, an intriguing exception was found in the 'Matrix Game' group (group URL: http://www.flickr.com/groups/matrixgame/) which requires players to link their move to more than one image in the pool. Such experiments may allow for interesting topologies to emerge.

Chain navigation: Given an image chain, how does one browse or navigate the chain? As explained, dedicated associative games very often turn the entire pool into a chain in progress. This format may pose challenges for the players, who report difficulties in catching up with the last image, but provides more flexibility in accessing the chain. Members of pool-based games seem to be disapproving of long threads with thumbnails as used in threaded games. Pool-based chains are a noticeable example of using gaming as the mechanism to create accessible and interesting subsets of images. This mechanism is apparent in other types of gaming groups too, in particular contest groups that populate their pool with winning images only. However, in the case of associative games, the position of the image and, consequently, its context as provided by its neighbouring images are essential. As such, pool-based chains successfully demonstrate gaming as both a content and a context building mechanism. Moreover, using the pool for the needs of the game can lead to unexpected practical benefits such as the opportunity to use existing widgets for visualization and navigation: The default film strip navigation aid provided by Flickr is a representative example. Another, rather surprising, side effect is reported by Tenuous Links (2008): The default pagination and grid view of the pool resulted in serendipitous associations on the vertical dimension of the game.

Chain interpretation: The use of explanations between moves is a frequent point of discussion among players. Several methods have been proposed to explain a connection between moves, such as adding a comment, tag, note or description text in the corresponding image. Generally speaking, players are reluctant to add permanent elements to their images and seem to prefer comments for explanations. More revealing, however, are the discussions whether an explanation should be provided at all. Opinions on this topic are divided and may depend of the focus of the group, e.g. visual, conceptual or subtle links. Explanations can assist in the case of difficult links and may provide a prevention mechanism against random posting (not connected images are deleted in most of the groups). Yet, in some cases, players seem to value the challenge of reconstructing an association and they perceive explanations as limiting to the imagination (cf. Table 4.6). Surprisingly, players report that they appreciate coming up with their own association, even if it is not the intended one. In our view, this may be a first step towards turning these chains into meaningful narratives.

4.4 Conclusion

This study attempts to crystallize aspects of gaming activity in Flickr groups. The work is indented as an exploratory study along the lines of 'gamification' for collection exploration; automation was, therefore, not a priority. While our study is certainly subject to human bias, we trust that it provides a useful scouting of the Flickr ecosystem: A good understanding of the types of gaming activity and games encountered as well as of the vocabulary involved can be beneficial towards more automated investigations. A more robust system for group or game classification should be visible but a better way to gather a representative sample of groups from the Flickr database remains an issue. The ambiguity of the term 'game' not only impairs the retrieval of relevant results but also hinders the filtering process. In our case, it is plausible that groups excluded as irrelevant upon their description text do play threaded games as secondary activity as well.

Stvilia and Jörgensen (2007) discuss Flickr groups as community spaces providing opportunities for learning, for feedback and for entertainment via games and tournaments. Furthermore, the authors relate games to 'active' viewing of images and note that games can be used for "building context and telling a story of a place or a person". Such an observation is particularly relevant to our research on appropriating games for playful and exploratory interactions with images. During our study, we tried to better understand the processes and conditions for such an effect to occur. In other words, we questioned how or when image games may

Table 4.6: Relevant quotes extracted from description texts and discussions held in the message boards of single game, associative groups. Data accessed: 19-11-2010.

Topic of interest	Quotation
Deliberately shooting a move	"Crossed a line yesterday by taking a photo just for Snap!" (source: http://www.flickr.com/groups/snap_game/discuss/36652/) "I haven't taken a picture for a specific link, but I do take pictures of things that I wouldn't ordinarily photograph because it might make a good link someday" "I haven't taken a picture for a specific link, but I have posted pictures to Flickr for a specific Tenuous Link." (source: http://www.flickr.com/groups/association/discuss/72157603673979260/)
Threads vs pools	"I definitely want to keep the links in the pool - I think it's easier to see the latest photos at a glance this way, rather than scrolling down a thread", "I am against the putting photos in threads. Takes too much bandwidth" (source: http://www.flickr.com/groups/association/discuss/72157594512516387)
Comments vs permanent elements	"I agree that comments are a better form. There's more space to elucidate the association, and the comments can add to your tally for explore. Some people have hundreds of tags, so the comments would then be, at least, at the bottom and easy to find.", "I'd prefer comments, too. I'm kind of picky about my tags" (source: http://www.flickr.com/groups/gameofphotoassociation/discuss/72057594097646962/) "I always delete notes that are added to my photos, I find them distracting." (source: http://www.flickr.com/groups/free_association/discuss/72157613635786863/)
Explanation vs no explanation	"Sometimes people have questioned what someone else's association is, and the discussion revealed all kinds of possible associations: different ones to different eyes", "I want to put my own interpretation on the association. I would rather not be told" (source: http://www.flickr.com/groups/free_association/discuss/72157613635786863/) "I think if you had to explain the link there would be no fun in this game, either when you post a picture or when you ask yourself what link another poster had in mind" (source: http://www.flickr.com/groups/snap_game/discuss/72057594069503455/)

support building context and, particularly, how game rules and game mechanics may affect this process. A significant observation we made is that pool-based associative games provide the means to populate a pool while indeed deliberately creating a neighbouring context for each image. In fact, the example provided by Stvilia and Jörgensen (2007) to illustrate their remark on context and storytelling turns out to be what we would call a pool-based associative game. In associative games, context building is facilitated by both the rules (associate images in a linear fashion) and the chosen format and available visualization (group pool). Further research is required in order to better understand the storytelling aspects of Flickr games. In particular, the function of text as a gaming element should be more carefully examined.

If games are to support a more exploratory interaction with an image collection, associative games are a considerable genre to implement. Associative games provide a mechanism to construct potentially meaningful chains of images with meaning being captured in the connections across images instead of the content or metadata of a single image. Such 'interrelations' are user-generated and may have a high degree of serendipity: Players respond to stimuli (i.e. previous image) in a creative way and reconsider their own collections in relation to the pending image. Eventually, these trails of player activity should be accessible to traverse by both players and future viewers. To that end, efficient visualizations and usable navigation aids are of particular importance. Finally, it is worth noticing that chains produced via associative games differ from thematically defined galleries as they require the viewer to decode the connection between two moves. This may call for a more active look into the images in question and can potentially result in even more associations being made. A surprising observation we made is that players often value ambiguity and enjoy the challenge to reconstruct an association. Such engagement with devising or reconstructing associations is extremely relevant in the context of collection exploration, particularly while traversing interconnected information points.

Online, community-driven games such as the ones identified in the Flickr ecosystem could be applicable to other types of image collections, i.e. scientific image databases, providing that the necessary infrastructure and an active online community of users are in place. More importantly, this study allows us to contemplate on alternative formats of gaming with images. We note that 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. Furthermore, we observe that ambiguity is received

positively and can actually serve as a source of play. Employing ambiguity as a design principle is another exciting direction that playing with images can head in. Note that the playful potential of ambiguity has been highlighted by Gaver (2002); Gaver et al. (2003), whose concept of 'ludic interfaces' (Gaver, 2002) emphasizes open-ended, interpretative and non-task oriented ways to engage with technology. The suggested role of ambiguity in 'ludic interfaces' corresponds with our observations on ambiguity as a source of play; in a sense, ambiguity can be playful for it introduces opportunities for new usages and interpretations.