



Universiteit  
Leiden  
The Netherlands

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

Kallergi, A.

### Citation

Kallergi, A. (2012, December 18). *Connecting the dots : playful interaction with scientific image data in repositories*. Retrieved from <https://hdl.handle.net/1887/20303>

Version: Not Applicable (or Unknown)

License: [Leiden University Non-exclusive license](#)

Downloaded from: <https://hdl.handle.net/1887/20303>

**Note:** To cite this publication please use the final published version (if applicable).

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/20303> holds various files of this Leiden University dissertation.

**Author:** Kallergi, Amalia

**Title:** Connecting the dots : playful interactions with scientific image data in repositories

**Issue Date:** 2012-12-18

## **Appendix A**

# **Examples of Flickr groups per theme**

All screenshots captured in May 2011.

**Boxers and People Who Love Them**

Group Pool | Discussion | 548 Members | Map | Join This Group

**NowHowAboutThat.♥ (a group admin) says:**  
 24 Dec 08 - I would just like to make a shout out to my wonderful admins; **LaTasha** (TheEffingPrincess), and **Shelley** (boxermum7). **BOTH OF YOU ARE AMAZING!!**

"The bond with a true dog is as lasting as the ties of this earth will ever be."  
 -Konrad Lorenz

**Discussion** 34 posts | Only members can post. Join?

Title	Author	Replies	Latest Post
<a href="#">Vote for Lexie</a>	nheffell	0	3 months ago
<a href="#">new on the block</a>	kaisers mom	3	3 months ago
<a href="#">So whats the truth on white boxers?</a>	Nick Hoffman	4	4 months ago
<a href="#">Is she or isn't she????</a>	haley585	5	4 months ago
<a href="#">Boxer and Parent Picture Contest WITH A PRIZE!!!</a>	Forget Me Not Photography Bristol, VA	22	25 months ago
<a href="#">Akc boxers for sale</a>	Forget Me Not Photography Bristol, VA	9	25 months ago

Search this group's discussions   [More discussions](#)

**About Boxers and People Who Love Them**  
 boxers, boxers, boxers! who doesnt love this beautiful breed? I hope you decide to join this boxer-crazy group. Here at Boxers and People Who Love Them we like to know what your opinions are, and take your feedback seriously, Feel free to flickmail any of the admins.  
 Thank you,  
 Sarah  
 \*NowHowAboutThat.♥

**Additional Information**

- This is a **public** group.
- View the [group rules](#).
- Accepted media types:
  - Photos
  - Video
- Accepted content types:
  - Photos / Videos

(a) group homepage (partial view)

**Some Topics you may be interested in are:**

[Post Your Boxer's Birthday!!! :\)](#)

[Akc boxers for sale](#)

[\\*\\*\\*NEW GAME\\*\\*\\* Alphabet](#)

[questions?](#)

(b) detail

**Figure A.1:** Gaming as secondary activity. Groups of various topics may play threaded games in their message boards. Here the 'Boxers And People Who Love Them' group playing an instance of the ABC game (group URL: <http://www.flickr.com/groups/boxersandpeoplewholovethem/>).

**Flickr Games** Group Pool | Discussion | 350 Members | Map | Join This Group

Group Pool 441 items | Only members can add to the pool. Join?

Title	Author	Replies	Latest Post
FlickrFlashMob	irodman	259	16 months ago
Want to play a game?	lee★fly	121	19 months ago
Catch The Seagull!	Clive Lawford	0	21 months ago
I SPY Photos	USGoffers	0	26 months ago
Sing a Rainbow	Mr Jaded	272	40 months ago
Icon Puzzle	dr_joplop	6	40 months ago

**About Flickr Games**  
All kinds of games within Flickr.  
Flickr evolved from a game, and is an excellent environment for creative playing.  
Let's play together!

**Additional Information**  
This is a public group.  
Accepted media types:  
• Photos  
• Video

(a) group homepage (partial view)

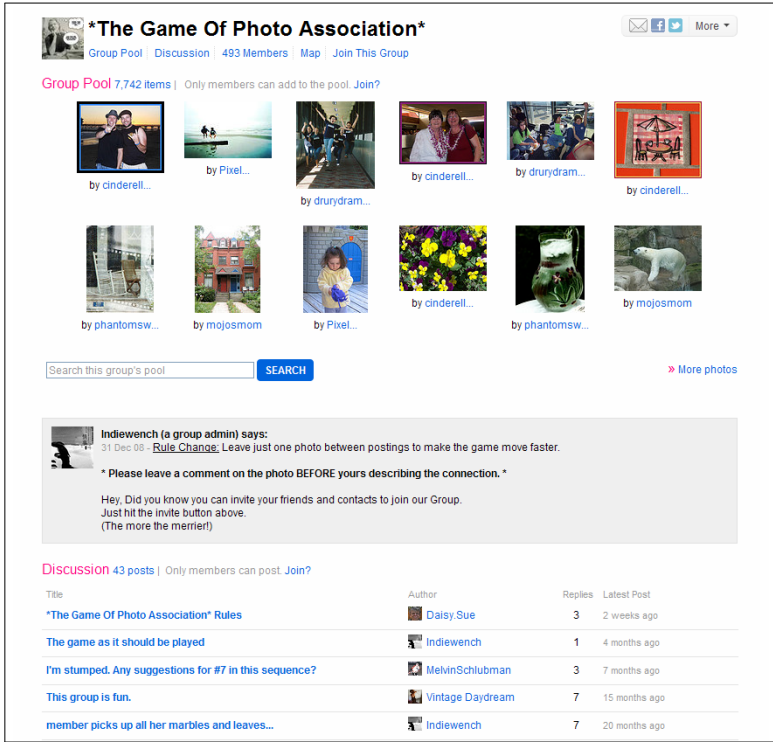
**About Flickr Games**

All kinds of games within Flickr.

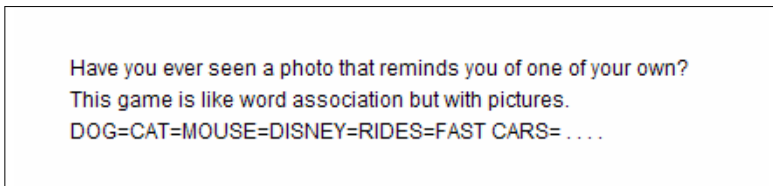
Flickr evolved from a game, and is an excellent environment for creative playing.  
Let's play together!

(b) detail

**Figure A.2:** Gaming as core activity. A number of groups are specifically created for the purpose of playing games among their members. Here the 'Flickr Games' group maintaining a collection of several known threaded games (group URL: <http://www.flickr.com/groups/flickrgames/>).

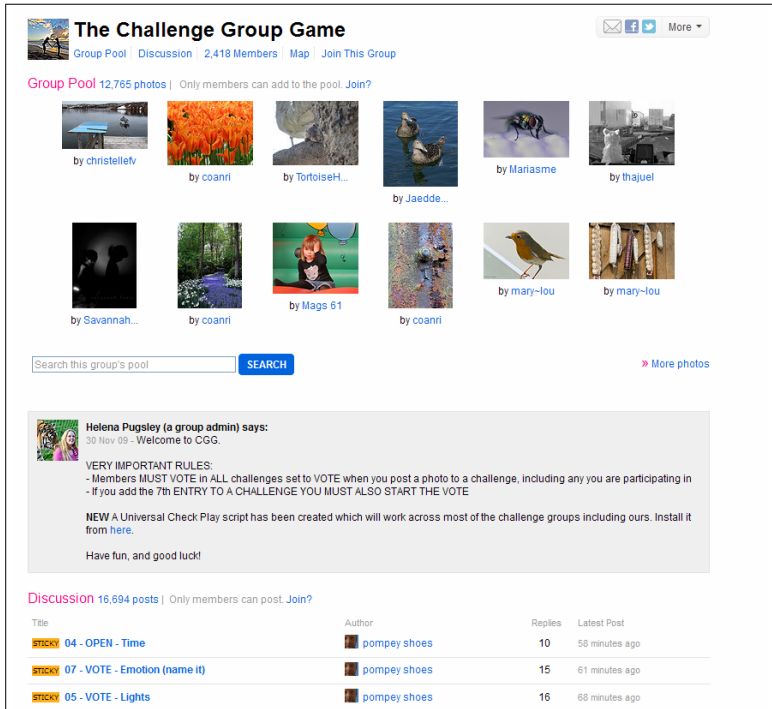


(a) group homepage (partial view)



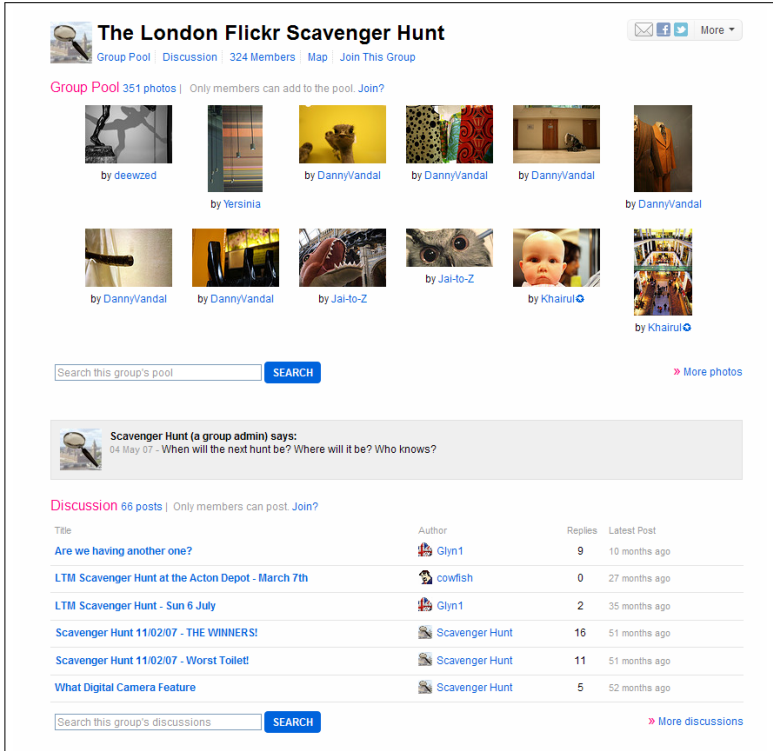
(b) detail

**Figure A.3:** Gaming as core activity. Groups dedicated to gaming may maintain several threaded games (cf. Figure A.2) or be dedicated to one type of game. Here the 'The Game Of Photo Association' group playing a single instance of a Photo association game in the pool of the group (group URL: <http://www.flickr.com/groups/gameofphotoassociation/>).

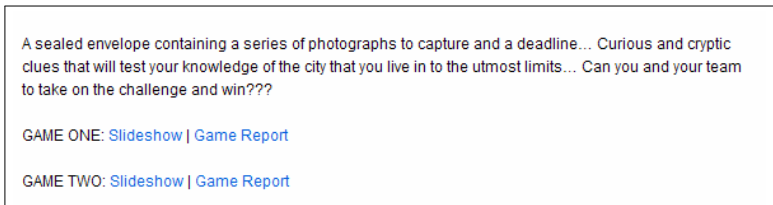


(a) group homepage (partial view)

**Figure A.4:** Gaming as contest. A number of groups are specifically created for the purpose of conducting image challenges and contests. Here the 'The Challenge Group Game' group (group URL: [http://www.flickr.com/groups/the\\_challenge\\_group/](http://www.flickr.com/groups/the_challenge_group/)).



(a) group homepage (partial view)



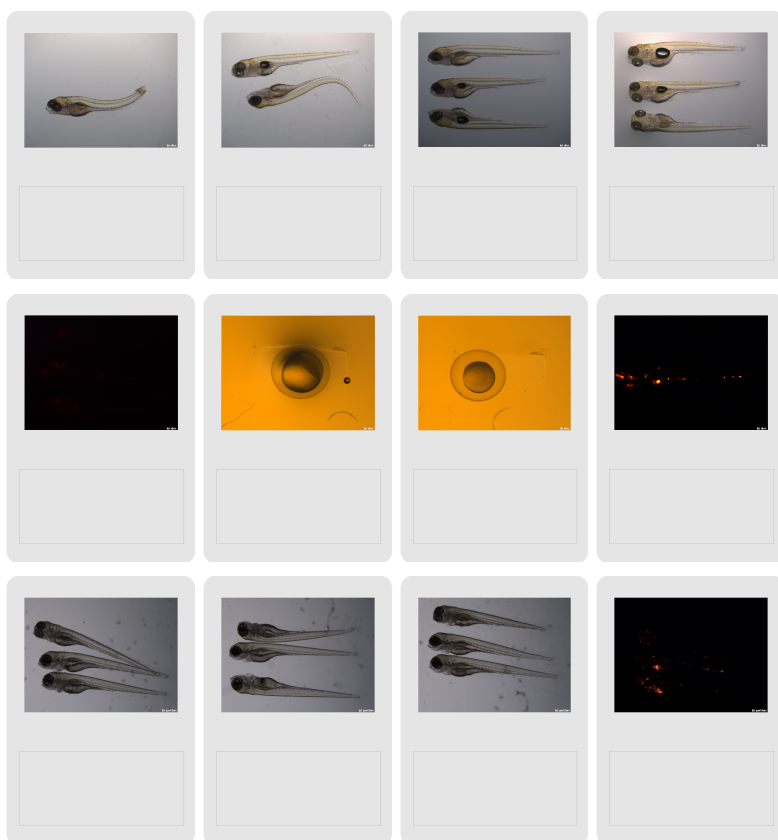
(b) detail

**Figure A.5:** External gaming activity. Groups may engage in games or playful activities that are photo-oriented but performed outside the Flickr system. Here the 'London Flickr Scavenger Hunt' (group URL: [http://www.flickr.com/groups/london\\_flickr\\_scavenger\\_hunt](http://www.flickr.com/groups/london_flickr_scavenger_hunt)).

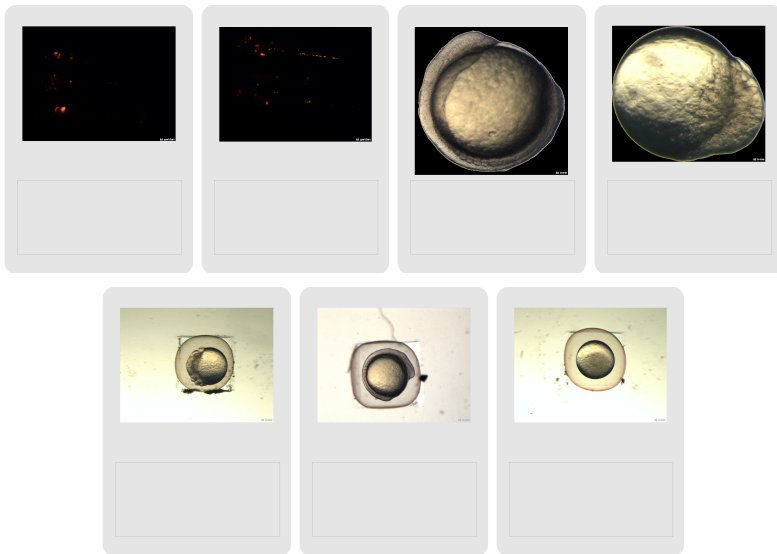


## **Appendix B**

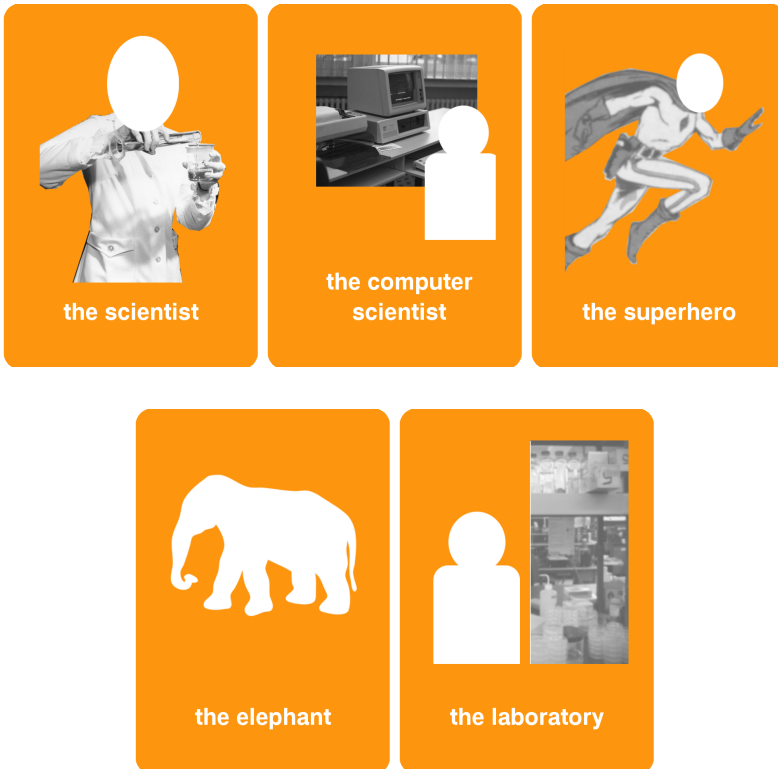
### **Playtesting stories: Cards**



**Figure B.1:** Image cards as derived from research images provided by the participants.



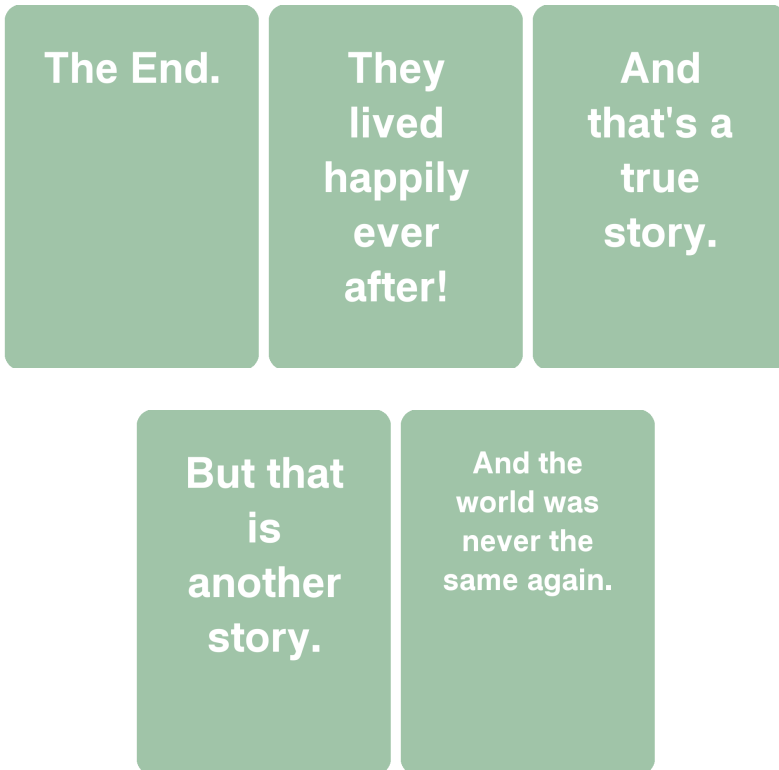
**Figure B.1:** Image cards as derived from research images provided by the participants (cnt.).



**Figure B.2:** Utility cards with characters.



**Figure B.3:** Utility cards with opening lines.



**Figure B.4:** Utility cards with closing lines.



**Figure B.5:** Utility cards with common literary genres.





# Bibliography

- E. J. Aarseth. *Cybertext: Perspectives on ergodic literature*. Johns Hopkins University Press, 1997.
- H. P. Abbott. Story, plot, and narration. In *The Cambridge companion to narrative*, pages 39–51. Cambridge University Press, 2007.
- J. Alvarez and L. Michaud. Serious games. advergaming, edugaming, training and more. Technical report, IDATE, 2008. URL [http://www.ludoscience.com/files/ressources/EtudeIDATE08\\_UK.pdf](http://www.ludoscience.com/files/ressources/EtudeIDATE08_UK.pdf). Accessed 11 March 2011.
- E. F. Anderson, L. McLoughlin, F. Liarokapis, C. Peters, P. Petridis, and S. de Freitas. Serious games in cultural heritage. In *The 10th International Symposium on Virtual Reality, Archaeology and Cultural Heritage VAST-State of the Art Reports*, 2009.
- P. André, M. C. Schraefel, J. Teevan, and S. T. Dumais. Discovery is never by chance: Designing for (un)serendipity. In *Proceedings of the 7th ACM Conference on Creativity and Cognition, C&C '09*, pages 305–314. ACM, 2009.
- L. Avraamidou and J. Osborne. The role of narrative in communicating science. *International Journal of Science Education*, 31(12):1683–1707, 2009.
- R. Baeza-Yates, B. Ribeiro-Neto, et al. *Modern information retrieval*, volume 82. Addison-Wesley New York, 1999.
- P. Barr, J. Noble, and R. Biddle. Video game values: Human-computer interaction and games. *Interacting with Computers*, 19(2):180–195, 2007.
- G. D. Battista, P. Eades, R. Tamassia, and I. G. Tollis. Algorithms for drawing graphs: An annotated bibliography. *Computational Geometry- Theory and Application*, 4(5):235–282, October 1994.

- D. Bawden. Information systems and the stimulation of creativity. *Journal of Information Science*, 12(5):203, 1986.
- R. N. Beck. Overview of imaging science. *Proceedings of the National Academy of Sciences of the United States of America*, 90(21):9746–9750, 1993.
- Y. Bei, M. Belmamoune, and F. J. Verbeek. Ontology and image semantics in multimodal imaging: Submission and retrieval. In *Proceedings of SPIE*, volume 6061, page 60610C, 2006.
- Y. Bei, J. Dmitrieva, M. Belmamoune, and F. J. Verbeek. Ontology driven image search engine. In *Proceedings of SPIE*, volume 6506, page 65060G, 2007.
- M. Blythe and M. Hassenzahl. The semantics of fun: Differentiating enjoyable experiences. In *Funology: From usability to enjoyment*, chapter 8, pages 91–100. Springer, 2004.
- M. A. Blythe, K. Overbeeke, A. F. Monk, and P. C. Wright. *Funology: From usability to enjoyment*, volume 3 of *Human-computer interaction series*. Springer, 2004.
- M. A. Boden. *The creative mind: Myths and mechanisms*. Psychology Press, 2004.
- N. Bonnet. Some trends in microscope image processing. *Micron*, 35(8):635–653, 2004.
- J. Bovey. Using games to do exploratory experiments in graph comprehension. In *Proceedings of the 9th International Conference on Information Visualisation, IV 2005*, pages 335–338. IEEE Computer Society, 2005.
- J. Bovey and P. Rodgers. A method for testing graph visualizations using games. *Visualization and Data Analysis 2007*, 6495, 2007.
- J. Bruner. *Actual minds, possible worlds*. Harvard University Press, 1986.
- R. Caillois. *Man, play and games*. University of Illinois Press, 2001.
- J. M. Carroll. Beyond fun. *ACM interactions*, 11(5):38–40, 2004.
- J. M. Carroll and J. M. Thomas. Fun. *ACM SIGCHI Bulletin*, 19(3):21–24, 1988.
- A. Chamberlain, A. Crabtree, T. Rodden, M. Jones, and Y. Rogers. Research in the wild: Understanding ‘in the wild’ approaches to design and development. In *Proceedings of the Designing Interactive Systems Conference, DIS ’12*, pages 795–796, New York, NY, USA, 2012. ACM.

- S. J. Chang and R. E. Rice. Browsing: A multidimensional framework. *Annual Review of Information Science and Technology (ARIST)*, 28:231–76, 1993.
- D. Chao. Doom as an interface for process management. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '01, pages 152–157, New York, NY, USA, 2001. ACM.
- D. Charsky. From edutainment to serious games: A change in the use of game characteristics. *Games and Culture*, 5(2):177–198, 2010.
- L. Cherny, C. Clanton, and E. Ostrom. Entertainment is a human factor: a CHI '97 workshop on game design and HCI. *SIGCHI Bulletin*, 29(4), 1997.
- K. S. Chiang. Biology databases for the new life sciences. *Emerging issues in the electronic environment: Challenges for librarians and researchers in the sciences*, 25:139, 2004.
- M. Christoffel and B. Schmitt. Accessing libraries as easy as a game. *Visual Interfaces to Digital Libraries*, pages 25–38, 2002.
- P. M. Conn, editor. *Imaging in biological research, part A*, volume 385 of *Methods in Enzymology*. Academic Press, 2004a.
- P. M. Conn, editor. *Imaging in biological research, part B*, volume 386 of *Methods in Enzymology*. Academic Press, 2004b.
- S. Cooper, F. Khatib, A. Treuille, J. Barbero, J. Lee, M. Beenen, A. Leaver-Fay, D. Baker, Z. Popovic, et al. Predicting protein structures with a multiplayer online game. *Nature*, 466(7307):756–760, 2010.
- B. Costello and E. Edmonds. A study in play, pleasure and interaction design. In *Proceedings of the 2007 Conference on Designing Pleasurable Products and Interfaces*, DPPI '07, pages 76–91. ACM, 2007.
- D. Crawford, editor. *Special issue: Supporting exploratory search*, volume 49 of *Communications of the ACM*. Academic Press, 2006.
- M. Csikszentmihalyi. *Beyond boredom and anxiety*. Jossey-Bass behavioral science series. Jossey-Bass Publishers, 1975.
- M. Csikszentmihalyi. *Flow: The psychology of optimal experience*. Harper Perennial, 1991.
- J. E. Davidson. The suddenness of insight. In *The nature of insight*, chapter 4. The MIT Press, 1995.

- A. de Waard. From proteins to fairytales: Directions in semantic publishing. *IEEE Intelligent Systems*, 25(2):83-88, 2010.
- H. Desurvire, M. Caplan, and J. A. Toth. Using heuristics to evaluate the playability of games. In *CHI '04 Extended Abstracts on Human Factors in Computing Systems*, pages 1509-1512. ACM, 2004.
- S. Deterding, D. Dixon, and R. Khaled. Gamification: Toward a definition. In *Proceedings of the CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts*, pages 12-15, 2011.
- N. Diakopoulos. Game-y information graphics. In *CHI '10 Extended Abstracts on Human Factors in Computing Systems*, pages 3595-3600. ACM, 2010.
- N. Diakopoulos, F. Kivran-Swaine, and M. Naaman. Playable data: Characterizing the design space of game-y infographics. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '11, pages 1717-1726. ACM, 2011.
- J. B. Dmitrieva. *Aspects of ontology visualization and integration*. PhD thesis, Leiden Institute of Advanced Computer Science, Faculty of Sciences, Leiden University, 2011.
- S. W. Draper. Analysing fun as a candidate software requirement. *Personal and Ubiquitous Computing*, 3(3):117-122, 1999.
- B. L. Dubois. From narrative toward exposition: Materials and methods sections of biomedical journal articles. In S. J. J. Hwang and W. R. Merrifield, editors, *Language in context: Essays for Robert E. Longacre*, pages 157-188. Summer Institute of Linguistics, 1992.
- K. Dunbar. How scientists really reason: Scientific reasoning in real-world laboratories. In *The nature of insight*, chapter 11, pages 365-395. The MIT Press, 1995.
- K. Dunbar and J. Fugelsang. Scientific thinking and reasoning. In K. Holyoak and R. Morrison, editors, *The Cambridge handbook of thinking and reasoning*. Cambridge University Press, 2005.
- J. Dyck, D. Pinelle, B. Brown, and C. Gutwin. Learning from games: HCI design innovations in entertainment software. In *Proceedings of Graphics Interface*, 2003.

- Encyclopædia Britannica Online. Johan huizinga. <http://www.britannica.com/EBchecked/topic/275181/Johan-Huizinga>, 2012a. Accessed 24 August 2012.
- Encyclopædia Britannica Online. Horace walpole, 4th earl of orford. <http://www.britannica.com/EBchecked/topic/634999/Horace-Walpole-4th-earl-of-Orford>, 2012b. Accessed 24 August 2012.
- S. Erdelez. Information encountering: It's more than just bumping into information. *Bulletin of the American Society for Information Science and Technology*, 25 (3):26-29, 1999.
- D. Evanko. Supplement on visualizing biological data. *Nature Methods*, 7:S1-S1, 2010.
- C. Fake. The blogs and pundits speak. <http://blog.flickr.net/en/2004/12/28/the-blogs-and-pundits-speak/>, December 2004. Accessed 11 March 2011.
- M. A. Federoff. Heuristics and usability guidelines for the creation and evaluation of fun in video games. Master's thesis, Indiana University, 2002.
- Flickr: The Help Forum. [closed] how many flickr' users?!? <http://www.flickr.com/help/forum/en-us/97258/>, May 2009. Accessed 11 March 2011.
- A. Foster and N. Ford. Serendipity and information seeking: An empirical study. *Journal of Documentation*, 59(3):321-340, 2003.
- T. Fullerton, C. Swain, and S. Hoffman. *Game design workshop: A playcentric approach to creating innovative games*. Morgan Kaufmann, 2008.
- M. Y. Galperin and G. R. Cochrane. The 2011 nucleic acids research database issue and the online molecular biology database collection. *Nucleic Acids Research*, 39(suppl 1):D1-D6, 2011.
- W. B. Gaver. Designing for homo ludens, still. *I3 Magazine*, 12, 2002.
- W. B. Gaver, J. Beaver, and S. Benford. Ambiguity as a resource for design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '03, pages 233-240. ACM, 2003.

- D. H.-L. Goh, R. P. Ang, C. S. Lee, and A. Y. K. Chua. Fight or unite: Investigating game genres for image tagging. *Journal of the American Society for Information Science and Technology*, 62(7):1311–1324, 2011.
- I. G. Goldberg, C. Allan, J. M. Burel, D. Creager, A. Falconi, H. Hochheiser, J. Johnston, J. Mellen, P. K. Sorger, and J. R. Swedlow. The open microscopy environment (ome) data model and xml file: Open tools for informatics and quantitative analysis in biological imaging. *Genome Biology*, 6(5):R47, 2005.
- S. Hannabuss. Narrative knowledge: Eliciting organisational knowledge from storytelling. In *ASLIB Proceedings*, volume 52, pages 402–413, 2000.
- M. Hassenzahl and N. Tractinsky. User experience—a research agenda. *Behaviour & Information Technology*, 25(2):91–97, 2006.
- M. A. Hearst. *Search user interfaces*. Cambridge University Press, 2009. URL <http://searchuserinterfaces.com/book/>.
- I. Herman, G. Melancon, and M. S. Marshall. Graph visualization and navigation in information visualization: A survey. *IEEE Transactions on Visualization and Computer Graphics*, 6(1):24–43, 2000.
- T. T. Hewett. Informing the design of computer-based environments to support creativity. *International Journal of Human-Computer Studies*, 63(4):383–409, 2005.
- F. L. Holmes. Scientific writing and scientific discovery. *Isis*, 78(2):220–235, 1987.
- J. Huizinga. *Homo Ludens: A study of the play element in human culture*. Boston: Beacon Press, 1955.
- R. Hunicke, M. LeBlanc, and R. Zubek. MDA: A formal approach to game design and game research. In *Proceedings of the AAAI Workshop on Challenges in Game AI*, 2004.
- A. H. Jørgensen. Marrying HCI/usability and computer games: A preliminary look. In *Proceedings of the 3rd Nordic Conference on Human-Computer Interaction*, NordiCHI '04, pages 393–396. ACM, 2004.
- K. Jørgensen. The user interface continuum: A study of player preference. [http://www.gamasutra.com/view/feature/134715/the\\_user\\_interface\\_continuum\\_a\\_.php](http://www.gamasutra.com/view/feature/134715/the_user_interface_continuum_a_.php), April 2011. Accessed 2 December 2011.

- J. Juul. *Half-real: Video games between real rules and fictional worlds*. The MIT Press, 2005.
- A. Kallergi and F. J. Verbeek. Onto-Frogger: Playing with semantic structure. In M. S. Marshall, A. Burger, P. Romano, A. Paschke, and A. Splendiani, editors, *Proceedings Workshop on Semantic Web Applications and Tools for Life Sciences (SWAT4LS)*, volume 559 of *CEUR-Workshop Proceedings*, 2009.
- A. Kallergi and F. J. Verbeek. Onto-Frogger: The making of. In *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries*, NordiCHI '10, pages 691–694, New York, NY, USA, 2010a. ACM.
- A. Kallergi and F. J. Verbeek. Video games for collection exploration: Games for and out of data repositories. In *Proceedings of the 14th International Academic MindTrek Conference: Envisioning Future Media Environments*, MindTrek '10, pages 143–146, New York, NY, USA, 2010b. ACM.
- 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.
- 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.
- A. Kallergi, Y. Bei, P. Kok, J. Dijkstra, J. P. Abrahams, and F. J. Verbeek. Cyttron: A virtualized microscope supporting image integration and knowledge discovery. In C. Backendorf, M. Noteborn, and M. Tavassoli, editors, *Proteins killing tumour cells*, Cell Death and Disease Series, pages 291–315. ResearchSignPost, 2009a.
- A. Kallergi, Y. Bei, and F. J. Verbeek. The ontology viewer: Facilitating image annotation with ontology terms in the CSIDx imaging database. In *Workshop on Visual Interfaces to the Social and the Semantic Web (VISSW2009)*, February 2009b.
- D. A. Keim, F. Mansmann, J. Schneidewind, and H. Ziegler. Challenges in visual data analysis. In *Proceedings of the 10th International Conference on Information Visualization, IV 2006*, pages 9–16. IEEE Computer Society, 2006.
- M. Kemp. *Seen/unseen: Art, science, and intuition from Leonardo to the Hubble telescope*. Oxford University Press, 2006.

- M. Kemp. Seeing the smaller picture. *Nature*, 453(7195):596–596, 2008.
- A. J. Kim. Putting the fun in functional. <http://www.slideshare.net/amyjokim/putting-the-fun-in-functiona>, 2008. Accessed 18 October 2012.
- D. Klahr and H. A. Simon. Studies of scientific discovery: Complementary approaches and convergent findings. *Psychological Bulletin*, 125(5):524 – 543, 1999.
- K. Knorr-Cetina and K. Amann. Image dissection in natural scientific inquiry. *Science, Technology & Human Values*, 15(3):259, 1990.
- H. Korhonen, M. Montola, and J. Arrasvuori. Understanding playful user experience through digital games. In *International Conference on Designing Pleasurable Products and Interfaces*, pages 274–285, 2009.
- A. Kozbelt, R. A. Beghetto, M. A. Runco, J. C. Kaufman, and R. J. Sternberg. Theories of creativity. In J. Kaufman and R. Sternberg, editors, *The Cambridge handbook of creativity*, pages 20–47. Cambridge University Press, 2010.
- A. Kuchinsky, K. Graham, D. Moh, A. Adler, K. Babaria, and M. L. Creech. Biological storytelling: A software tool for biological information organization based upon narrative structure. In *Proceedings of the Working Conference on Advanced Visual Interfaces*, pages 331–341. ACM, 2002.
- W. Kules, M. L. Wilson, m.c. schraefel, and B. Shneiderman. From keyword search to exploration: How result visualization aids discovery on the web. Technical report, University of Southampton, 2008.
- E. Kuts. Playful user interfaces: Literature review and model for analysis. In *Breaking New Ground: Innovation in Games, Play, Practice and Theory: Proceedings of the 2009 Digital Games Research Association Conference*, 2009.
- P. Langley. *Scientific discovery: Computational explorations of the creative processes*. The MIT Press, 1987.
- S. Lindek, N. J. Salmon, and E. H. K. Stelzer. Databases for two-and three-dimensional microscopical images in biology. *Handbook of Biological Confocal Microscopy*, pages 861–869, 2006.
- M. Linkert, C. T. Rueden, C. Allan, J. M. Burel, W. Moore, A. Patterson, B. Lorange, J. Moore, C. Neves, D. MacDonald, et al. Metadata matters: Access to image data in the real world. *The Journal of Cell Biology*, 189(5):777, 2010.



- M. Lynch. The externalized retina: Selection and mathematization in the visual documentation of objects in the life sciences. *Human Studies*, 11(2):201–234, 1988.
- T. W. Malone. Heuristics for designing enjoyable user interfaces: Lessons from computer games. In *Proceedings of the 1982 Conference on Human Factors in Computing Systems*, CHI '82, pages 63–68. ACM, 1982.
- G. Marchionini. Exploratory search: From finding to understanding. *Communications of the ACM*, 49(4):41–46, 2006.
- A. Marcus. Fun! fun! fun! in the user experience we just wanna have fun...don't we? *ACM interactions*, 14:48–49, 55, July 2007.
- M. E. Martone, J. Sargis, J. Tran, W. W. Wong, H. Jiles, and C. Mangir. Database resources for cellular electron microscopy. *Methods in Cell Biology*, 79:799–822, 2007.
- V. Marx. Beautiful bioimages for the eyes of many beholders. *Science*, 297(5578):39, 2002.
- R. E. Mayer. Fifty years of creativity research. In R. Sternberg, editor, *Handbook of creativity*, chapter 22. Cambridge University Press, 1999.
- F. Mäyrä. Play in the mobile internet: Towards contextual gaming, 2008. URL [http://www.uta.fi/~frans.mayra/Mayra\\_Contextual\\_Gaming\\_IR9-0.pdf](http://www.uta.fi/~frans.mayra/Mayra_Contextual_Gaming_IR9-0.pdf). Accessed 11 March 2011.
- J. Meheus and T. Nickles. The methodological study of creativity and discovery – some background. *Foundations of Science*, 4:231–235, 1999.
- A. Monk, M. Hassenzahl, M. Blythe, and D. Reed. Funology: Designing enjoyment. In *CHI '02 Extended Abstracts on Human Factors in Computing Systems*, pages 924–925. ACM, 2002.
- J. Newman. *Videogames*, chapter 7. Routledge Introductions to Media and Communications. Routledge, 2004.
- G. Newton. Drill clouds. [http://lab.cisti-icist.nrc-cnrc.gc.ca/cistilabswiki/index.php/Drill\\_Clouds](http://lab.cisti-icist.nrc-cnrc.gc.ca/cistilabswiki/index.php/Drill_Clouds), 2008.
- R. S. Nickerson. Enhancing creativity. In R. Sternberg, editor, *Handbook of creativity*, chapter 20. Cambridge University Press, 1999. pp. 392.

- B. O'Connor. Fostering creativity: Enhancing the browsing environment. *International Journal of Information Management*, 8(3):203-210, 1988.
- J. O'Madadhain, D. Fisher, P. Smyth, S. White, and Y. B. Boey. Analysis and visualization of network data using JUNG. *Journal of Statistical Software*, 10(2):1-25, 2005.
- K. Overbeeke, T. Djajadiningrat, C. Hummels, S. Wensveen, and J. Frens. Let's make things engaging. In *Funology: From usability to enjoyment*, chapter 1, pages 7-17. Springer, 2004.
- R. J. Pagulayan, K. Keeker, D. Wixon, R. L. Romero, and T. Fuller. User-centered design in games. In J. Jacko and A. Sears, editors, *The human-computer interaction handbook: Fundamentals, evolving technologies and emerging applications*, Human Factors and Ergonomics. Lawrence Erlbaum Associates, 2003.
- R. Pausch, R. Gold, T. Skelly, and D. Thiel. What HCI designers can learn from video game designers. In *Proceedings of the CHI*, volume 94, pages 177-178, 1994.
- L. Pauwels. An integrated model for conceptualising visual competence in scientific research and communication. *Visual Studies*, 23(2):147-161, 2008.
- H. Peng. Bioimage informatics: A new area of engineering biology. *Bioinformatics*, 24(17):1827, 2008.
- D. Pinelle, N. Wong, and T. Stach. Heuristic evaluation for games: Usability principles for video game design. In *Proceeding of the 26th Annual SIGCHI Conference on Human Factors in Computing Systems*, CHI '08, pages 1453-1462. ACM, 2008.
- S. Pinnegar and J. G. Daynes. Locating narrative inquiry historically. In *Handbook of narrative inquiry: Mapping a methodology*. Sage Publications, Inc, 2007.
- D. Polkinghorne. *Narrative knowing and the human sciences*. State University of New York Press, 1988.
- C. Reas and B. Fry. Processing.org. <http://processing.org/>, n.d.
- J. M. Reitz. Odlis: online dictionary for library and information science. [http://www.abc-clio.com/ODLIS/odlis\\_A.aspx](http://www.abc-clio.com/ODLIS/odlis_A.aspx), 2012. Accessed 14 August 2012.

- C. Rhodes and A. D. Brown. Narrative, organizations and research. *International Journal of Management Reviews*, 7(3):167-188, 2005.
- A. W. Rivadeneira, D. M. Gruen, M. J. Muller, and D. R. Millen. Getting our head in the clouds: Toward evaluation studies of tagclouds. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '07, pages 995-998. ACM, 2007.
- M. Robertson. Identifying digital gaming literature relevant to the library and information science community. *Library Student Journal*, 4, 2009.
- M. A. Runco. Creativity. *Annual Review of Psychology*, 55(1):657 - 687, 2004.
- B. C. Russell, A. Torralba, K. P. Murphy, and W. T. Freeman. LabelMe: A database and web-based tool for image annotation. *International Journal of Computer Vision*, 77(1):157-173, 2008.
- K. Salen and E. Zimmerman. *Rules of play: Game design fundamentals*. The MIT Press, 2004.
- P. Saraiya, C. North, and K. Duca. An insight-based methodology for evaluating bioinformatics visualizations. *IEEE Transactions on Visualization and Computer Graphics*, 11(4):443-456, 2005.
- R. K. Sawyer. *Explaining creativity: The science of human innovation*. Oxford University Press, 2006.
- M. Schaechter. The age of imaging. <http://schaechter.asmblog.org/schaechter/2008/03/the-age-of-imag.html>, 2008. Accessed 14 June 2011.
- J. W. Schooler, M. Fallshore, and S. M. Fiore. Epilogue: Putting insight into perspective. In *The nature of insight*. The MIT Press, 1995.
- H.-J. Schulz and H. Schumann. Visualizing graphs - a generalized view. In *Proceedings of the 10th International Conference on Information Visualization*, IV 2006, pages 166-173. IEEE Computer Society, 2006.
- P. Sengers. The engineering of experience. In *Funology: From usability to enjoyment*, chapter 2, pages 19-29. Springer, 2004.
- R. J. Sheehan and S. Rode. On scientific narrative: Stories of light by Newton and Einstein. *Journal of Business and Technical Communication*, 13(3):336-358, 1999.

- B. Shneiderman. Dynamic queries for visual information seeking. *IEEE Software*, 11(6):70–77, 1994.
- B. Shneiderman. Creating creativity: User interfaces for supporting innovation. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 7(1):114–138, 2000.
- B. Shneiderman. Designing for fun: How can we design user interfaces to be more fun? *ACM interactions*, 11(5):48–50, 2004.
- B. Shneiderman. Creativity support tools: Accelerating discovery and innovation. *Communications of the ACM*, 50(12):20–32, 2007.
- J. Sinclair and M. Cardew-Hall. The folksonomy tag cloud: When is it useful? *Journal of Information Science*, 34(1):15–29, 2008.
- K. Siorpaes and M. Hepp. Games with a purpose for the semantic web. *IEEE Intelligent Systems*, 23(3):50–60, 2008.
- B. Smith, M. Ashburner, C. Rosse, J. Bard, W. Bug, W. Ceusters, L. J. Goldberg, K. Eilbeck, A. Ireland, C. J. Mungall, et al. The OBO foundry: coordinated evolution of ontologies to support biomedical data integration. *Nature Biotechnology*, 25(11):1251–1255, 2007.
- M. Song. Visualization in information retrieval: A three-level analysis. *Journal of Information Science*, 26(1):3–19, 2000.
- R. Spence. *Information Visualization: Design for Interaction (2nd Edition)*. Prentice-Hall, Inc., Upper Saddle River, NJ, USA, 2007.
- R. A. Stebbins. *Exploratory research in the social sciences*, volume 48. Sage Publications, Inc, 2001.
- R. J. Sternberg. *Handbook of creativity*. Cambridge University Press, 1999.
- B. Stvilia and C. Jørgensen. End-user collection building behavior in Flickr. *Proceedings of the American Society for Information Science and Technology*, 44(1):1–20, 2007.
- T. Susi, M. Johannesson, and P. Backlund. Serious games: An overview. Technical report, GLS University of Wisconsin-Madison, February 2007.
- J. R. Swedlow, I. G. Goldberg, and K. W. Eliceiri. Bioimage informatics for experimental biology. *Annual Review of Biophysics*, 38:327–346, 2009.

- Tenuous Links. Multidimensional links. <http://www.flickr.com/groups/association/discuss/72157605183108160/>, May 2008. Accessed 11 March 2011.
- E. G. Toms and L. McCay-Peet. Chance encounters in the digital library. In *Proceedings of the 13th European Conference on Research and Advanced Technology for Digital Libraries*, pages 192–202. Springer-Verlag, 2009.
- O. Turetken and R. Sharda. Visualization of web spaces: State of the art and future directions. *SIGMIS Database*, 38(3):51–81, 2007.
- J. Turner and D. Browning. Workshop on HCI and game interfaces: A long romance. In *OZCHI 2010: Design - Interaction - Participation*, 2010.
- P. van Andel. Anatomy of the unsought finding. serendipity: Origin, history, domains, traditions, appearances, patterns and programmability. *The British Journal for the Philosophy of Science*, 45(2):631–648, 1994.
- J. Velasco-Martin. Sharing photos on the web: Flickr style. *Hipertext.net*, 2009. URL <http://www.hipertext.net/english/pag1038.htm>. Accessed 11 March 2011.
- L. von Ahn. Games with a purpose. *Computer*, 39(6):92–94, 2006.
- L. von Ahn and L. Dabbish. Labeling images with a computer game. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '04, pages 319–326. ACM, 2004.
- T. Walter, D. W. Shattuck, R. Baldock, M. E. Bastin, A. E. Carpenter, S. Duce, J. Ellenberg, A. Fraser, N. Hamilton, S. Pieper, et al. Visualization of image data from cells to organisms. *Nature Methods*, 7:S26–S41, 2010.
- B. K. Walther. Playing and gaming: Reflections and classifications. *Game Studies*, 3, 2003.
- R. W. White and R. A. Roth. *Exploratory search : Beyond the query-response paradigm*. Morgan & Claypool Publishers, 2009.
- K. Williamson. Discovered by chance: The role of incidental information acquisition in an ecological model of information use. *Library & Information Science Research*, 20(1):23 – 40, 1998.
- M. J. P. Wolf. Genre and the video game. In M. J. P. Wolf, editor, *The medium of the video game*, pages 113–134. University of Texas Press, June 2002.

- S. Worth. Narrative knowledge: Knowing through storytelling. In *Proceedings of the 4th Media in Transition*, 2005. URL <http://web.mit.edu/comm-forum/mit4/papers/worth.pdf>.
- K.-P. Yee, K. Swearingen, K. Li, and M. Hearst. Faceted metadata for image search and browsing. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '03, pages 401–408, New York, NY, USA, 2003. ACM.
- J. S. Yi, Y.-a. Kang, J. T. Stasko, and J. A. Jacko. Understanding and characterizing insights: How do people gain insights using information visualization? In *BELIV '08: Proceedings of the 2008 Conference on Beyond Time and Errors: Novel Evaluation Methods for Information Visualization*, pages 1–6, New York, NY, USA, 2008. ACM.
- S. Zack. 5,000,000,000. <http://blog.flickr.net/en/2010/09/19/5000000000/>, September 2010. Accessed 11 March 2011.
- P. Zaphiris and C. S. Ang. Editorial: HCI issues in computer games. *Interacting with Computers*, 19(2):135–139, 2007.
- J. Zhang. *Visualization for information retrieval*, chapter 1. The Information Retrieval Series. Springer, 2008.
- J. Zimmerman, J. Forlizzi, and S. Evenson. Research through design as a method for interaction design research in HCI. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '07, pages 493–502, New York, NY, USA, 2007. ACM.