Embodied, Constructionist Learning: Social Tagging and Folksonomies in E-Learning Environments

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Social Tagging and thereby *folksonomies* celebrate enormous growth rates on the Internet. In this paper we will identify the underlying processes from an *Embodied Interaction* perspective [1]. We will support our thesis that folksonomies are embodied conceptualizations and are therefore helpful in E-Learning settings by results from various concerned disciplines like Knowledge Management and Educational Theory. We will give an example of an E-Learning software for children (Robologo) in which Social Tagging is used to learn programming that showcases how embodiment of conceptualization is achieved through tagging in the system.

Keywords Social Tagging, folksonomies, constructionist learning

1. Meaningful Interaction by Embodied Conceptualizations

Social and tangible computing are areas in the field of Human Computer Interaction, which try to overcome the obvious gap between "machine" and "human being" by enabling **embodiment**, i.e. "*the property of our engagement with the world that allows us to make it meaningful*" [1, p.126] .
In particular, interfaces as contact points can be designed to be more or less "familiar" or meaningful for users [ibd, p.100]. On the one hand, as humans are social beings, it seems to be a good idea to introduce social computing as interaction form, on the other hand, people understand and assign meaning to the world because they are embedded in this world, therefore a physical aspect of understanding has a place as well in the interaction design for humans and computers. Dourish' definition of "**Embodied Interaction**" as "*creation, manipulation, and sharing of meaning through engaged interaction with artifacts*" highlights the role of artifacts in the processes of creating meaning.

The idea, on which this paper is based, consists in applying this embodied interaction perspective to research results from Knowledge Management (KM) and E-Learning (EL), and furthermore on the current success story of Social Tagging, in order to obtain a working design of an E-Learning environment for children. On the one hand, **KM** tended to overlook the social component of knowledge [2,3] and just in the last years, this aspect is seriously taken into account, frequently centered around the term "Community of Practice" (CoP) [4]. On the other hand, the learning theories "Constructivism" - and for our purpose particularly "Constructionism" - are predominantly thought well of in the design of **E-Learning** scenarios. Right now synergies between KM and EL are investigated intensively (e.g. workshop LOKMOL [5], extra journal edition "E-Learning und Wissensmanagement" [6]), especially the "**user as consumer and producer**"-scheme seems to be a valuable link. Moreover, software systems comprised under the term "**Social Tagging**" are recently experiencing considerable interest and acceptance (i.e usage) rates within the Internet community. Here, users are producers as well as consumers of meaningful content. **Our thesis in this paper is that this high acceptance is based on its meaningful interaction**

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process with respect to conceptualization. In particular, these systems make use of the fact that they enable an embodiment of concept development and the underlying processes are therefore valuable for individual learning.

We support this thesis in section 2 by discussing the Social Tagging phenomena with respect to knowledge and learning under an embodied interaction perspective. Concretely, we will present in section 3 an implementation of such concept embodiment within the integrated development environment (IDE) Robologo for children's programming.

2. Social Tagging and Embodied Learning

In contrast to "Social Software" which is the generic term for software that "*enables people to rendezvous, connect or collaborate through computer-mediated communication and to form online communities*" [7, 2006-10-24], in "**Social Tagging**" systems users more specifically label system-specific objects like bookmarks (e.g. del.icio.us [8] or scientifically Connotea [9]) or images (e.g. flickr [10]) with any number of free text tags to organize and share their respective objects. While other equally successful Social Software applications like Blogs and Wikis are applied in the educational domain and are referred to as "E-learning 2.0" [11], Social Tagging is seldom discussed as a new technology with a great potential to support self-steered learning.
But Social Tagging provides a "*brilliantly lazy*" [12] way of constructing **personal (private) context** (see e.g. [13]). From a Constructionist viewpoint tags themselves are self-constructed, meaningful "objects-to-think-with" [14]. They can serve as learning objects "*where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe*" [ibd]. That is, whereas from a knowledge management perspective it builds a nice, i.e. a rather informal, entry door for formal knowledge management procedures like semantic mark-up [15], from a Constructionist perspective it generates a **social (public) context** (see e.g. [16]) - hence providing an opportunity for learning. Moreover, (the well-known social constructivist) Vygotsky describes in [17] a child's development as "*transformation from an interpersonal process into an intrapersonal one*" [p.57], i.e. learning takes place in a communication setting between people and *thereafter* inside the person.
Note, that the entity of tags of all users in a Social Tagging system builds not only a continuously developing navigation structure but also a communication *setting* between people. This navigation structure is called "**folksonomy**" [18] - short for "folks" and "taxonomy" because of its quality as a bottom-up organized, decentralized hierarchic structure. Tags are represented in it by their frequency of occurrence at a certain point of time. In most representations (tag clouds) the font size stands for the frequency of occurrence; other ways of structuring tags are also possible like clusters of similar tags. We would like to emphasize that for a user of such Social Tagging systems the line between private and public is rather fuzzy as it is fully dependent on a user's awareness state.
We argue that exactly this fuzzy line enables and supports learning processes and enables **embodied learning**. In particular, if we look at Social Tagging from an Embodied Interaction perspective, we note that the interaction between either people (shared tagging) or computer and human (tagging) is "embodied" in the emergent folksonomies. That is, latter are embedded in the world and their reality depends on being embedded [1, p.18]. Dynamic folksonomies force the user to constantly go through the coupling process [ibd, p.138ff] and reflect on the connection between item and tag. Bruner recapitulates in [19, p. 12] that "*if earlier learning is to render later learning easier, it must do so by providing a general picture in terms of which the relations between things encountered earlier and later are made as clear as possible*" which directly implicates the advantage of Social Tagging in learning processes as **embodied social conceptualizations**. Moreover, these conceptualizations enable users to control the coupling process by "disengaging and reengaging"[1, p.139] or analogously "diving in and stepping out" [20], driving a self-steered learning process. According to Marlow et al. in [21], taggers are not only motivated by

social goals like self-presentation and expression of opinion, they use the system to their personal advantage by interpreting it as personal knowledge management system.

3. Robologo – a Tag-Based Programming Environment for Children

Since the early 60's and Seymour Papert's work on "Logo" and the "Floor turtle" [22] physical objects and simplified programming languages are used to teach programming to children. The development in the field continued and a wide variation of construction kits consisting of software and physical hardware exist by now, for instance the commercial "Lego Mindstorms" System [23]. For Robologo we continued to work on the Open Source Software "Jackal [24]" - a Logo dialog interface to program "Handy Crickets", which are inexpensive programmable devices [25]. We adapted Robologo to allow programming on another hardware platform (Lego Mindstorms), we extended the IDE with visual elements, and connected it to a web service to allow tagging and support communication among children using the software.

These programmable physical objects (so-called programmable bricks) are necessarily embedded in the 'real' world as they use sensor inputs to get values from their environment and act through actuators like motors as output devices in the world; they serve as objects-to-think-with [14] and tangible representation of program code.

In workshops with children aged between eight and thirteen using different software we observed that children had problems to understand the connection between the physical object and its representation in the IDE as the commands for the bricks in the programming language as well as the IDE are abstract and frequently meaningless to children without former knowledge in programming. Even though the visual elements in Robologo help to organize and categorize these commands (e.g. Robologo offers 12 main categories that were created by children in a participatory design process, see Figure 1) this feature turned out to be of small help or even confusing for young newcomers. For example, the category "Movement" directs children to find and use the appropriate command to activate an actuator but – e.g. if the physical object does not move – it is rather counterproductive.

In order to address this problem in Robologo, we extended it by Social Tagging features. Now, children can use tags to annotate commands and categories (and their representing icons) and create a connection between the real world and the IDE what makes their interaction with the IDE meaningful and embodied.

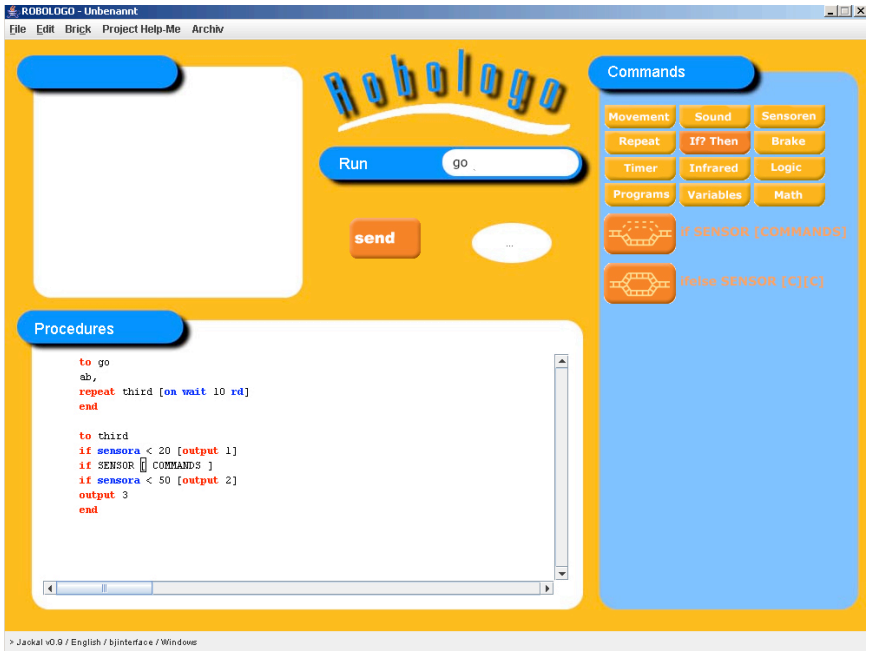

Figure 1: Robologo Interface

Figure 2 shows an example how to achieve this kind of embodiment in Robologo. An icon and a description of the command using wildcards represent a command as you can see with the "if" command. When a child adds tags to the command or category, then they appear (in form of a tag cloud) whenever the mouse moves over the icon (e.g. the term "temperature"). This visualization of the respective, collaboratively generated folksonomy lets her understand her tagging action in terms of others. She may wonder why someone tagged it "light sensor" and conclude that this is a function she had never thought of, but can make use of now.
Tags can be of very different nature e.g. giving examples of how to use the command in a syntactical correct way e.g. "if sensora > 56 [a,on]" in Figure 2, connecting to physical object for example the kind of sensor used as in "light sensor" or referring to the behaviour that is the goal of the program (as you can see in the tag "line" used for a robot that is able to follow a line).

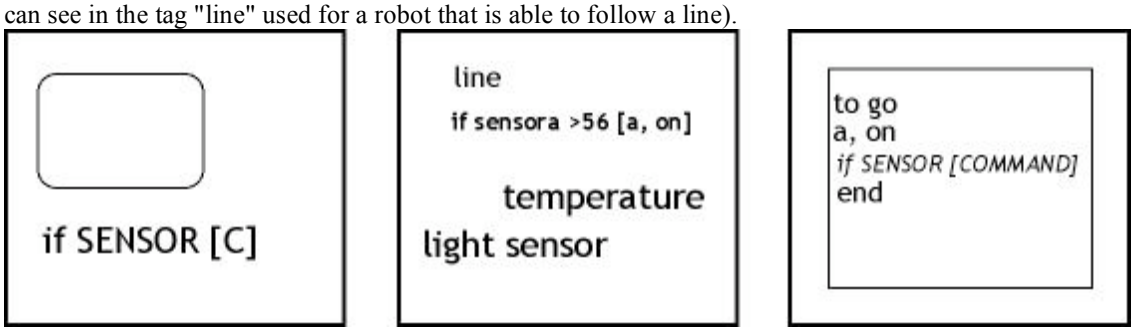

Figure 2: From Icon to Code

The example shows how a tag can add meaning to a command in the personal context of the child through the connection between the command and the real world experience or idea for the physical object. The interaction with the programming language and IDE becomes embodied in the real world and personally meaningful. At the same time each personal tag becomes a part of Robologo's public folksonomy and the social context within the Community of Practice that uses the system to program physical objects. The child is confronted with various tags when searching for the right command. This confrontation forces the child to reflect on the different tags from other users and can act as an entry point for embodied learning - in the example case for learning about the power of programming languages.

3. Conclusion

The challenge at the very heart of the design of E-Learning environments with the Constructionist learning theory in mind is captured by "*Users, not designers, create and communicate meaning*" [1]. Hence, digital artefacts need to be affordable, i.e. flexible and able to adapt to different contexts. We argued that the fuzzy line between the private and the public - which is enabled by Social Tagging - represents (affordable) opportunities for learning. With Robologo we presented an integrated programming environment that enables these learning processes via Social Tagging and folksonomies as embodied conceptualizations.
We conclude that we can extend Social Tagging systems to E-Learning environments as added-value services from within a Constructionist and KM perspective.

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