WikiAtoms: Contributions to Wikis as Atomic Units

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ABSTRACT
Corporate wikis have suffered from low adoption rates, preventing them from reaching the critical mass required for a sustainable and useful repository. We contend that the lack of support for collaborative knowledge management is a contributing factor to this problem. In order to better prepare wikis for collaborative knowledge management we present the idea of WikiAtoms. WikiAtoms treat individual ideas and contributions on the wiki as atomic units of information. These atomic units enable interaction techniques that better support the knowledge management lifecycle (generate, codify, coordinate, and transferring) as outlined by Davenport and Prusak.

In this paper we first discuss related projects and research. We then motivate the concept of WikiAtoms, by exploring the gaps of functionality that hinder collaborative knowledge management in corporate settings. After which, we illustrate how WikiAtoms help to bridge these gaps through several examples of interaction techniques.

INTRODUCTION
Corporate wikis have suffered from low adoption rates, preventing them from reaching the critical mass required for a sustainable and useful repository [7, 9]. We contend that the lack of support for collaborative knowledge management is a contributing factor to this problem. This is evidenced by the number of issues with corporate wikis found in previous studies. Holtzblatt et al. [9] enumerated a number of factors hindering wiki adoption, many of which point to their lack of support for collaborative knowledge management. Hindering factors include varying levels of proficiency with wiki editors, extra costs of sharing content, unwillingness to share unfinished work, data ownership, dynamic access control, and usability problems. Furthermore, Grudin and Poole [7] also discussed factors that hinder wiki adoption, some of which indicate similar problems with collaborative knowledge management. Factors related to knowledge management include reluctance to edit other’s work and mismatching of management and worker expectations causing further reluctance to contribute and participate.

Our main objective is to re-conceptualize workers’ interactions with the corporate wiki for better support the knowledge management lifecycle. To achieve this goal we first look for insight on how groups manage knowledge, which is a driving motivation for wiki appropriation. In our investigation we found that previous research has identified critical processes to achieve organizational learning and knowledge management. These processes are namely generating, codifying, coordinating, and finally transferring knowledge [6]. We use these processes to frame our analysis of difficulties associated with corporate wikis and our proposed interaction techniques to mitigate them.

Building on the knowledge management lifecycle, we propose several requirements for corporate wikis to better support collaborative knowledge management. First, corporate wikis must support lightweight contribution of ideas with little regard for formatting and social concerns. Second, corporate wikis must facilitate the codification or reorganization of a collection of contributions. Workers need to be able to readily identify and move pieces of information without resorting to costly manipulations such as textual cut-and-paste. Third, coordination of ideas in traditional wikis is hindered by their lack of support for discussion. Thus, we propose that conversations about contributions must be embedded and situated within the context of the content that they reference, potentially increasing content and process common ground within a group [5]. Fourth, to finally transfer knowledge to others, group wikis must promote alignment of organizational expectations regarding content quality by supporting mechanisms of crystallizing matured content. Through the realization of these aspects we aim to bridge the gaps hindering collaborative knowledge management.

In this paper we propose to satisfy these functionalities through the concept of WikiAtoms. WikiAtoms treat individual ideas and contributions in the brainstorming stage as invisible pieces of knowledge in the form of conversational information. Each WikiAtom is a single unit of information, meant to be limited in size to encourage lightweight discussion, empower different voices, and align management/worker expectations. Throughout the process, WikiAtoms may be re-arranged and pieced together to form more cohesive and coherent pieces of knowledge. When a group consensus is achieved on the maturity of the knowledge, individuals in the group may choose to crystallize it and transition it to a traditionally structured wiki page. If group consensus is
not achieved or broken, the knowledge will become fragmented clearly indicating the disagreement. As consensus is repaired the fragments of knowledge will again be crystallized and fused together. Through this additional layer to a corporate wiki, we can better support brainstorming, reorganization, coordination, and the eventual crystallization of knowledge.

RELATED WORK
There have been several research projects that have explored different strategies to solve problems that we are approaching. There are also several different models of knowledge management that we surveyed while conducting our research.

Several models of knowledge management deal mostly with the large scale dissemination of knowledge through an organization. One such model identifies three processes including learning loops, disseminating knowledge, and applying knowledge [13]. Another model emphasizes the impact of different structures and forms of the organization [8]. Exploration of these models led us to concentrate more on models dealing specifically with knowledge creation, as the knowledge management models where too broad for our purposes.

One such model we encountered was that of Nonaka, in this model the stages of socialization, externalization, internalization, and combination are numerous and iterated [12]. While this model is useful from many standpoints, it focuses on the bidirectional transfer of tacit and explicit knowledge within an organization. Through this model we realized we were interested in a model that more directly focused on how organizations handled knowledge. We found this in the work of Davenport and Prusak [6], who outlined how organizations accomplished this through the 3-stage model of generate, codify/coordinate, and transfer. For the purposes of our interface we separated the second stage, codify/coordinate, into two distinct interactions.

Several projects have adapted the work done in the Semantic Web area to provide better mechanisms for the organization of a wiki. These projects are addressing a different scope of organization and are more focused on the overall structure of the wiki and connections between pages. One exemplary project is SweetWiki, a wiki that was built to leverage different technologies from the semantic web community [3]. SweetWiki, is primarily focused on improving access to information already contained within the wiki, through the use of new emerging standards like XHTML. In contrast we are concerned more with the individual pages of the wikis and the knowledge that they represent.

A project that has similar goals of better organizing wikis but again addresses a different scope is Savvy Wiki [10]. Savvy Wiki has a similar goal of providing a method to organize fragmentary knowledge. However, in Savvy Wiki the fragments or units of information are the different pages of the wiki. Savvy Wiki provides mechanisms to create a more structured wiki overall, again this is in contrast with the scope of our project. Where Savvy Wiki is concerned with the fragmentary knowledge contained throughout different pages, we are concerned with the organization of the fragmentary knowledge within a page.

A project that aligns with both the scope of our project and one of our goals of better organization within pages is Vistpedia [4], which provides visualizations to assist structuring and organizing semi-structured content. Vistpedia, however, is interested in cases where semi-structured data is available but un-organized. Our system is concerned with the early stages of knowledge generation where there is little to no data available.

A system that shares our goal of lightweight knowledge capture is Mail2Tags [11]. Mail2Tags is a system that uses tags to organize and make available different emails of interest to the communities that have expressed interest in the topic. We differ from this system in that we are interested in the capturing of individual ideas, reorganizing them, and finally maturing these into a document such as a wiki page.

One would be remiss to not mention Google Wave a product that is similar to ours in several ways. Google Wave has a few features that are similar to ones that we are proposing. They, however, focused more on conversations in a goal to replace or improve email. In contrast, we have a focus on producing a document that a conversation occurs around, rather than within. We also focus on the reorganizing of knowledge instead of only editing and adding information.

Another group of systems that is somewhat similar to WikiAtoms is mind-mapping software. Systems such as FreeMind [2], provide a method to organize ideas or notes similar to WikiAtoms. A primary difference is that WikiAtoms are a means to an end document, whereas, mind-mapping is itself the end document. While mind-mapping software may lead to a better understanding that informs a better document, WikiAtoms is meant to morph into a document itself. Another key difference is the complexity of the medium, mind-mapping software is a much richer medium in which one can use aspects such as color, spacial relationships, and language to express meaning. Whereas, WikiAtoms is simplistic, language and structure are the only aspects used in the medium to express meaning.

MOTIVATION FOR WIKI ATOMS
We group the different issues discovered by previous research into the four stages of knowledge management as outlined by Davenport and Prusak [6].

First, the generation stage or brainstorming. In our categorization of prior work, we group several issues into this stage: the difficulties found with the usability of entering new information [7, 9], the extra cost of entering or contributing information [9], collisions in wiki editing (see [1]), employee-manager expectations mismatch [7], and anxiety of sharing work in progress [7, 9].

Second in the codification stage, we group the difficulties associated with reorganizing the information contained on the page. The stage also includes the usability problems of
The system should have the ability to enter ideas quickly and easily
Ben
I would like to be able to reorganize the different ideas in the system
Ricardo
I think that we should start gathering requirements for the system
Manual
Double Click to Add Atom...
Enter Name...

Figure 1. Entering new content for brainstorming while causing a low impact to the rest of the page.

switching between viewing and editing of the information [9].

The third stage is coordination and we group data ownership problems here [9].

At this point in our research, we do not address the transfer stage, other than to provide more affordances for the reader to determine what is finished and unfinished. However, we do concern ourselves with the crystallization of knowledge in preparation for transfer.

WikiAtoms supports these stages in the following ways. It better supports Generation by allowing easy entry of new WikiAtoms onto the page, without particular concern for where they are. By placing restrictions which limit content entry, WikiAtom attempts to lower managerial expectations, and thereby worker anxiety for sharing undeveloped ideas. Holtzblatt, et. al. found that pages with distinct items, such as bulleted lists, seemed to better address issues with ownership of data [9]. In this vein, WikiAtoms employs the concept of atomicity providing clear bariers to users. WikiAtoms better supports Codification and Coordination through the facilities of restructuring and comment- and question-posing, respectively. WikiAtoms also supports Crystallization through the maturation of atoms into a wiki page.

Cross-cutting these stages is the concept of unfinished vs. finished work. We use WikiAtoms to better afford crystallization rather than simply bulleted lists vs. prose. That is, currently there is no clear demarcation of a concept that is in-progress, no feel for where the new ideas that are not yet integrated belong.

INTERACTION TECHNIQUES

In this section, we illustrate how we address the various pitfalls of group collaboration from traditional wikis with WikiAtoms. Before using an example scenario, we first call out how specific functions of WikiAtoms address the issues outlined in the introduction.

Generation

In (Figure 1) we illustrate how we better support the generation stage through the quick capture of ideas from collaborators. Here different collaborators are entering ideas, these ideas are properly attributed and currently unorganized, indicating that this page is still in flux. To add new atoms, a user will double-click the “new atom” space and quickly adds an- other idea or atom to the page. In this way the collaborators do not concern themselves with formatting or organization and can focus instead with seeding new ideas and knowledge into the page. Through the use of these atomic units, multiple users adding new ideas will not conflict with each other. Additionally, through the affordances that WikiAtoms gives to the page, expectations are more properly aligned between managers and workers.

Codification

In (Figure 2) we illustrate how the atoms are able to be reorganized and related to each other. Users can move atoms to change their order as well as their depth in the hierarchy. Figure 3 illustrates how ideas are related to each other through ancestor relationships. In this way the collection of atoms can bond together and topics or sections begin to emerge. Also, new ideas are more easily incorporated into the existing structure as they arrive.

Coordination

In Figure 4 we illustrate how having discussions on individual WikiAtoms functions within the atoms. Discussions are brought to the forefront of the interface and are directly embedded within the page and treated themselves as Wiki-
I think that we should start gathering requirements for the system

The system should have the ability to enter ideas quickly and easily

Ben

I would like to be able to reorganize the different ideas in the system

Ricardo

I agree that would be cool, do you want to only support drag and drop or what?

Ben

Figure 4. Hovering over a WikiAtom and you can comment or discuss it, placing a comment inside the WikiAtom.

Atoms. Through this discussion, groups can coordinate and seek agreements on the various ideas that are being proposed and incorporated into the wiki page.

Crystallization

In its final stage of the lifecycle, WikiAtoms, having been organized and related to others, fuse together to form complete and crystallized sections and pages. In Figure 5 we illustrate the process of starting with atoms, fusing them together, and finally performing some quick edits to make them read more naturally. In this way the curator of this information does not have to restructure the wiki page as it is crystallized, it happens through the interactions of the group. This last stage of curation or crystallization is mostly concerned with the language of the atoms not the content or structure.

Example Scenario

To further illustrate the interaction techniques that we have proposed in this section, we will outline a brief scenario of use. The scenario that we will use is a development group forming the requirements for a new system named WikiAtoms. The development group consists of the team lead (Manuel) and two developers (Ricardo and Ben.) Manuel has taken the role of curator for this page, but any of the actions can be done by any member of the team.

The requirements gathering process is initiated by Manuel,
the header and cleans up some of the language, as he does this he realizes that the WikiAtoms that were used to build this can be found later on easily by referring to the reference back to the atom.

**FUTURE WORK**
There remains an admittedly large amount of work for the WikiAtoms project. First, we plan to implement a Proof-of-Concept system to work through and finalize the different interactions discussed in this paper. Second, we will implement a quick capture system in OS X and Windows. Quick capture can be implemented by having a series of plugins for most of the existing knowledge management tools (emails, calendars, browsers) or by having services (e.g. OS X services) that capture the current text selection. The combination of these two, cover most of the applications used for knowledge manipulation today. We also want to look at setting this system on top of Twitter to provide a searchable repository, similarly to Mail2Tags [11] perhaps tweets with specific tags are added the the system as an atom. In the far future we plan to evaluate the impact of WikiAtoms on collaborative knowledge management applications, comparing the quality of ideas and the satisfaction of the group members to a traditional wiki application.

**REFERENCES**