Reuse and Remix: Content Recomposition System based on Automatic Draft Generation

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***Abstract*—In this paper, we propose a framework for content circulation. Reusing and remixing contents are keys to expressing activities. In our framework, a system supports decomposing and recomposing by automatic draft content generation. As a field test, we implemented the framework on a support system for a workshop, in which participants created contents based on a format of expression named *photo-attached acrostics*. Through observation of the practice, we concluded that our framework could help content recomposition. We think our framework is applicable to various manners of expressions like Web content creation.**

***Index Terms*—content recomposition, creative activity support, content circulation, automatic content generation, participatory workshop**

I. Introduction

We live in a world of rapidly increasing information and face difficulties in managing such information. We need a way to find and select wanted information, to arrange them, to think over them, and to create and publish new information.

Information retrieval and recommendation technologies will help to find and select information, and arrangement and consideration will be supported by content management and visualization techniques. Creation of information, however, is difficult to be directly supported. Truly "new" information is rarely produced but usually new combinations of information are devised. In this research, we propose a framework for recomposition of stored contents from a creativity support research perspective.

In our framework, a system shows draft contents, which are automatically generated by remixing the user's and the others contents, when a user produces a new content. A user finishes her content by selecting and modifying a draft content. Through such process, we aim to develop an iteratively growing loop of expressions. In the loop, others contents are taken in a user's newly produced content, and the content are used in others contents again.

Contributions of this research are as follows: For database application field, presenting a new model for using/reusing others contents. For expert system field, presenting a new model for leading users to better results even when there are no answers.

This paper is organized as follows: After describing related works, we present our proposed framework in section 3. We implemented the framework on a support system for a workshop. We introduce the workshop in section 4 and the developed system in section 5. We show the results and discussions in section 6.

II. Related Works

A. Creativity Support

In the beginnings of 1990s, research area called creativity support was raised. In the area, problems like how computers can support human creative activity and what kind of creative activity can be supported were discussed.

Boden distinguished two sorts of creativity: H-creativity, which indicates historically new idea/concept formation, and P-creativity, psychologically new idea/concept formation in human minds [1]. In our research, we aim P-creativity support rather than H-creativity support. For ordinary people, our target users, what they express — externalization of internal nebulous thoughts — is more important than how they express — surficial originality of expressing techniques.

In psychology field, Guilford made the distinction between convergent and divergent thinking [2]. Our approach emphasizes neither of them specially, but if daring to say, it matches divergent one. One of our aims is to support expressing, which seems to be a convergent process; but widening users' views and unsticking users' stuck thinkings are more important.

Many and many creative methods have been proposed, including KJ method [3] and brainstorming [4], and many systems to help creative methods using computer systems have been developed [5].

B. Automatic Content Generation

Our research aims to stimulate users by presenting draft expressions. It doesn't mean that the system takes a user's place to "create" expressions; it just presents candidates. Users decide to insert the draft into their expression or not, and if so, they select which candidate is added and modify it according to their will. Letting users place the generated candidates into their own content affords them to think deeply about it. Automatic content generation techniques, however, are useful for our purpose.

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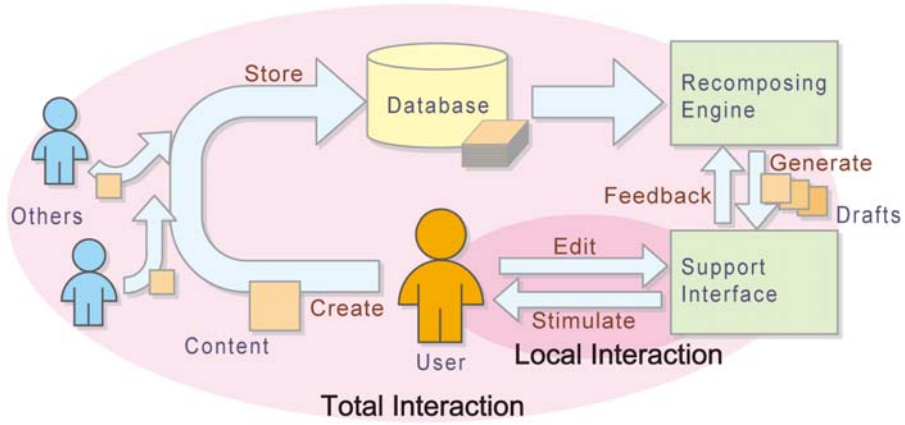

Figure 1. Proposed framework.

Bringsjord and his group developed a system called Brutus1, which generates literary stories [6]. Knowledge bases and grammar rules are programmed in advance, and it generates quite readable and natural stories. When sufficient knowledge and enough rules are provided, machines can generate high-quality unexpected expressions.

AARON programmed by painter Harold Cohen is known as a painting software [7]. AARON generates paintings according to parameters given by Cohen. There is an interesting story: Someone asked him "who is the 'creator' of the paintings?" Cohen claimed that AARON does not paint, but Cohen paints using AARON. This is the very what we emphasize: A system is a tool for creation. An output of the system can be an expression only after evaluated and accepted by the user as her expression. If she is insufficient, she can modify parameters or edit the output, then "create" her work. Here an output is a stimulation for a user.

Multiple document summarization [8, 9] is technically related to our research. We have not implemented these techniques, but these will be helpful.

C. Knowledge Models in Knowledge Management

Our research aims to design a new loop of content circulation. As for knowledge management area, SECI model [10] is widely known. SECI is the abbreviation for Socialization, Externalization, Combination, and Internalization, which are the processes of knowledge cycle. Shneiderman categorized creative activities into following four activities: "collect," "relate," "create," "donate" [11] And Ohmukai *et al.* expanded Shneiderman's model to distinguish information activity layer and communication activity layer [12]. In their model called ICA model — Information and Communication Activities model, two layers of information activities ("collect," "create" and "donate") and communication activities ("relate," "collaborate" and "present") form cycles related to each other.

Hori and his group developed a cycle model which consists of the knowledge *liquidization* and *crystallization* processes [13]. They called decomposition of expressions into units in proper granularity with every possible connection among each as *liquidization*. And as *crystallization*, they called new expression formation from decomposed partial units based on new relationships within the context. Our research is based on this concept [14]. In our proposed framework, a system decomposes and recomposes collected users expressions.

III. PROPOSED FRAMEWORK

Fig. 1 illustrates our proposed framework for content circulation. Contents created by multiple users are stored into the database. The recomposing engine decomposes stored contents and generates draft contents. Here we aim not to create complete contents but to stimulate users. The support interface shows drafts to a user and she edits and finishes her content. These operations spread to the recomposing engine and it shows other drafts.

We show two levels of interaction loops here. Direct and local interaction between users and the support system is shown in editing and stimulating loop. Remixing and reusing stored contents form indirect and total interaction loop.

This model is applicable for various manners of creation and publication of contents. For example, writing process of papers or blog entries include information collection phase and editing phase. Of course authors need to add their own original opinions, but candidate combinations of related information will help their considerations. Format of expression can vary and is not limited to text expressions. While we expect the framework can be applied to any types of contents, we dare focus on text content in this research. Decomposition and recomposition are realized by usual text processing techniques. We wanted to focus not on techniques for implementation but on the content circulation framework itself. For that reason, we held a participatory workshop where participants created their contents and recomposed them into new contents.

IV. PHOTO-ATTACHED ACROSTIC WORKSHOP

We designed and organized a workshop as a field practice [15]. In the workshop, participants create contents based on rules. We designed a new format of expression called *photo-attached acrostics* to highlight the process of decomposing and recomposing. Acrostic is

Figure 2. Example of photo-attached acrostics

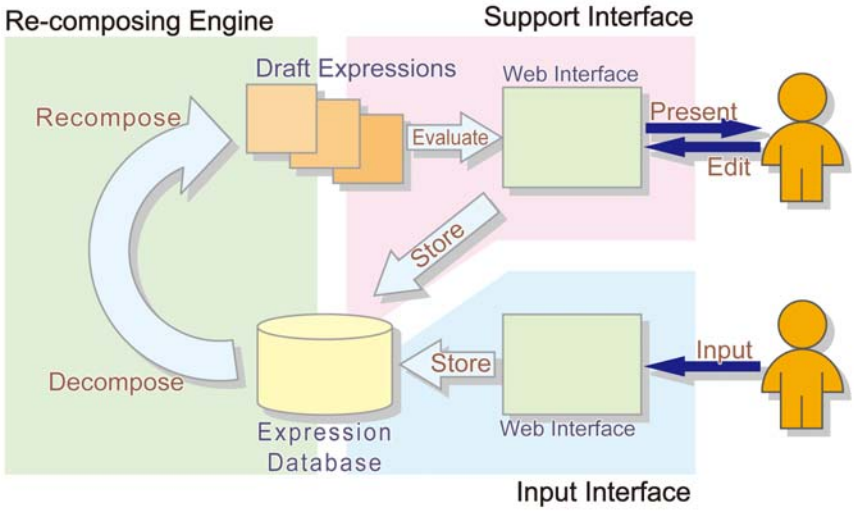

Figure 3. Architecture of developed system

"a poem or other writing in an alphabetic script, in which the first letter, syllable or word of each line, paragraph or other recurring feature in the text spells out another message[1]." We modified it to include pictures for each sentence. Participants take and select photos, write sentences whose first letters match a message given. Here a pair of sentence and photo should correspond and both photos and sentences should be along a theme given. An example of photo-attached acrostic is shown in Fig. 2. The message of the example is "ABCDE."

In the workshop, participants create an acrostic using their own photos at first. Then next, they are divided into groups and collaborate to create new expressions by remixing their expressions. Collaboration with others will raise new context and stimulate participants. In the third step, they create expressions by themselves again, using all pictures used in the former steps. Participants are requested to place others' (partial) expressions in their new expressions. We aim that participants form new opinions/ideas stimulated by others. At the same time, the workshop facilitator shows other new remixed acrostics using the developed information system described below.

V. Support System for the Workshop

The system consists of four parts (Fig. 3): expression database, expression input interface, expression recomposing engine, and expressing support interface. It has the same structure with the framework illustrated in Fig. 1, but is modified to highlight its dataflow.

Users input their works, which are created in manual and analog manner in the workshop. The expressing support interface shows draft expressions, which are generated from the expression recomposing engine (see Fig. 5).

The expression recomposing processes are as follows:

- Decomposition phase
  1) Analyze morphological structures of text.
  2) Calculate term relation weights and term weights. We use term dependency for term relation weights and term attractiveness for term weights [16]. Term dependency $td(t,t')$ from term t to t' is given by:

$$td(t,t') = \frac{sentences(t \cap t')}{sentences(t)} \quad (1)$$

Here $sentences(t)$ indicates the number of sentences in which term t appears, and $sentences(t \cap t')$ is the number of sentences term t and t' appear at the same time.

Term attractiveness $attr(t)$ of term t is a total of incoming term dependencies. T is the set of all appearing terms.

$$attr(t) = \sum_{t' \in T | t' \neq t} td(t,t') \quad (2)$$

[1] Acrostic - Wikipedia, the free encyclopedia: http://en.wikipedia.org/wiki/Acrostic

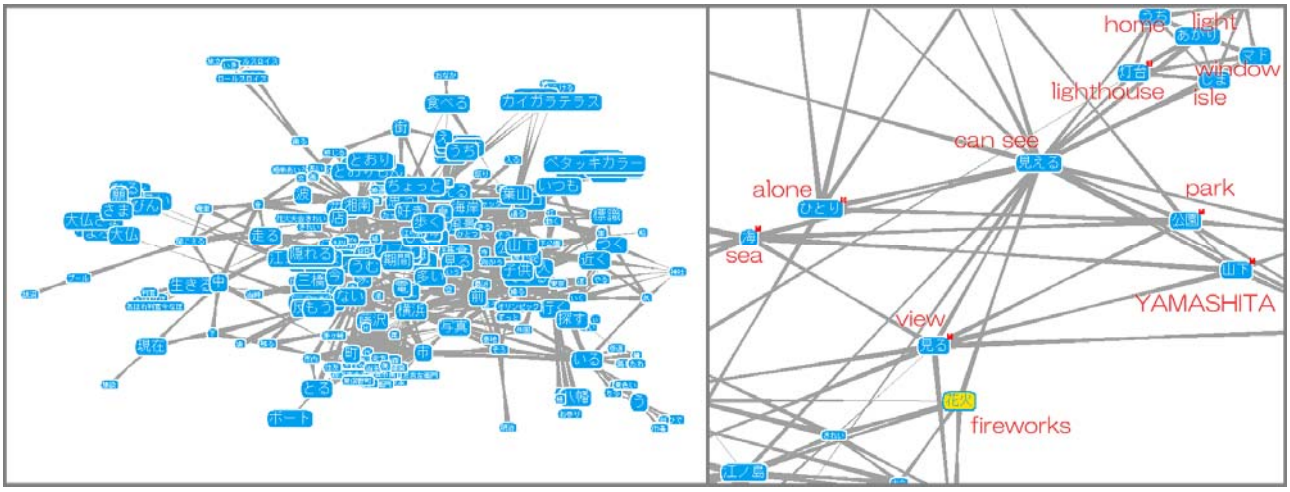

Figure 4. Extracted network in the decomposition phase. Whole structure (left) and partial enlargement (right).

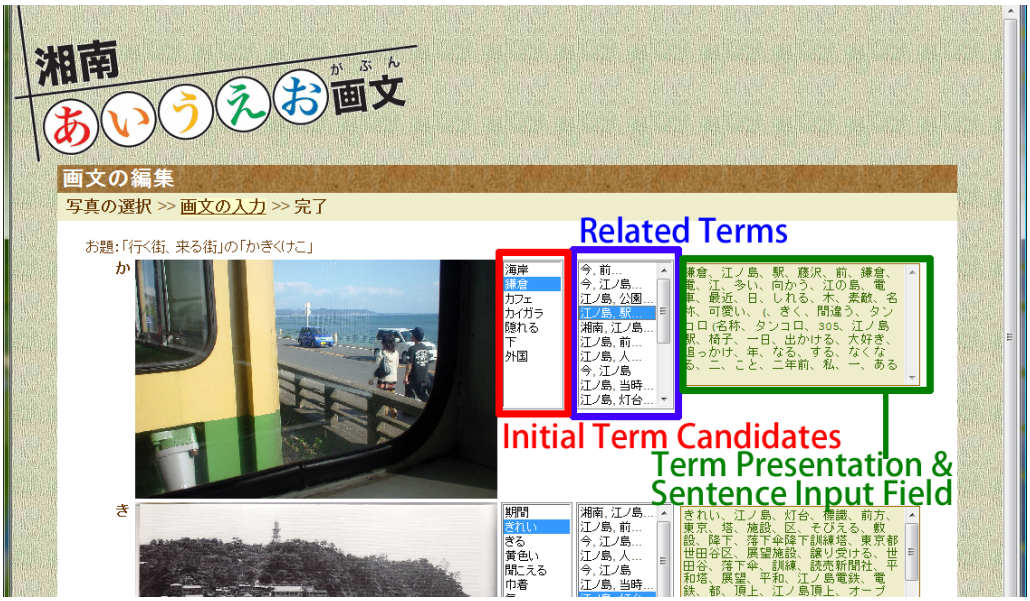

Figure 5. Screen image of photo-attached acrostic creation support interface.

- Recomposition phase
  1) Extract candidate terms according to their initial letters.
  2) Extract photos which include each term in 1.
  3) Evaluate photos.

  We define the weight $w_t(p)$ of a photo p for term t as follows:

$$w_t(p) = \sum_{t' \in T_p | t' \neq t} td(t,t') \cdot attr(t') \quad (3)$$

  For each initial letter, the term candidates, their related terms, and attached photos are structured.

Fig. 4 illustrates an example of word network extracted in the decomposing phase. Sizes of the nodes indicate their weights (td) and the distances between two connected nodes shows their strength of the link ($attr$). This figure just visualizes word relations which are calculated internally in the system; we didn't show users the figure directly.

Based on this network, we generate candidates of expressions and present them in creation support interface (Fig. 5). Choose one candidate of initial terms in the left textbox, then other related terms are presented in middle textbox. Choose one again, a photo combined to selected terms and the rest of related terms are shown. User can overview candidates presented on the system, select one she likes, and edit it.

In the workshop, a facilitator shows semi-automatically generated expressions, which are edited in certain rules like choosing photos with the highest weights or the lowest. With these expressions, we aim to stimulate the participants by machinery generated context. Through this step, we observe the effects of the expression recomposing engine. After the workshop, we asked the participants to try the expressing support interface. We evaluate the interface from this test.

Figure 6. Photo-attached acrostic workshop

VI. Results and Discussions

The theme of our first practice was "Shonan" — the name of a region along a coast in central Japan. We called for participation to the people related to — e.g., living around, working around, or was born around — Shonan area. Through the workshop, participants are expected to discuss together and get new opinions about the area.

The workshop was held at 8th and 16th December 2007 in Fujisawa city, the center of Shonan area, with nine participants. Most of their occupations were related to media activities or media literacy: information media-major students, an elementary school teacher, an art university professor, members of citizens' television at Shonan, and so on. While the youngest was an undergraduate student, a retired person was also included. Three were female, and six were male. The participants were divided into three groups and finally they made 30 photo-attached acrostics from 259 photos. Fig. 6 shows the scenes in the workshop. The analyses of the workshop itself are discussed in the other paper [15], so we discuss the effects of the system in this paper.

In the first step, the facilitator selected photos and terms based on certain rules so that we could observe the effects of the recomposing engine. As a result, a content, which was created by choosing photos and terms with the highest weights in the expression (2) and the expression (3) (shown on the top of each list of candidates in the support interface) happened to have a similar story structure to a participant's one. We aimed to form a different context, but made a similar story. The facilitator, however, could create much more expressions in much less time. The outputs of the system were not always new, but the number of outputs was large enough to stimulate the participants.

As the second step, we asked the participants to try the support interface after the workshop and conducted interviews with them. While positive comments like "I could easily create new acrostics" were heard, a problem was pointed. The system shows candidates for each sentence separately; connecting sentences — making story — is not supported enough.

VII. Conclusion

In this paper, we proposed the framework for content circulation. We implemented the framework on the support system for the workshop. Through the observation, we found that recomposing activities and support framework were pretty effective, but algorithms to generate drafts should be revised.

Generated drafts vary depending on a corpus — "database" in the framework. A system which recomposes all other expressions and another system which utilizes only expressions made by a user herself generate different draft by all means. Without purposes or goals, we cannot decide which implementation is the better. It totally depends on the contexts. In our first workshop, our aim was to widen participants' views, so we designed the workshop program to contain remixing process of others contents and our system also needed to remix other participants' expressions.

Our first trial dealt with a peculiar type of expression. But as we already mentioned, our framework is applicable to other types of expressions. Especially it suits on Web content creation. The Web can be a database from which a system draw others expressions, and can be a place where people present their created contents. Reusing and remixing loop of circulation is natively on the Web. We are planning to develop an application of our framework for blogging.

Acknowledgment

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