Activating Expression Life Cycle by Automatic Draft Generation and Interactive Creation

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ABSTRACT
In this research, we propose the expression life cycle model which consists of liquidization and crystallization of expressions. We believe that activating this cycle will enrich and widen our views of thinking and feeling. After providing a framework for activating the cycle by automatic draft generation and interactive creation processes, the preliminary practices and prototypes are introduced.

Author Keywords
Expression life cycle, liquidization and crystallization, creativity support, automatic draft generation, interactive and incremental creation.

ACM Classification Keywords
H.5.2.i. Information Technology and Systems: Interaction styles. I.2.13.c. Computing Methodologies: Knowledge life cycles.

INTRODUCTION

An expression is a trace of what we see, what we feel and what we think. In other words, an expression is a formed knowledge, which had originally no certain form. Our research aims to encourage people's expressing activities. We believe that a support for expressing will be a support for thinking more deeply and more widely, and more over, it will enrich our lives. In this paper, we propose the expression life cycle model and a technical framework to activate the "cycle." By *expressions* here we mean documents, pictures, drawings and any other artifacts created by ordinary people; but we mainly discuss about digital/digitized expressions in this paper.

Some researchers modeled out people's knowledge and people's knowledge life cycle [15, 22, 16]. From the point of creativity support view, we have developed a cycle model which consists of the knowledge *liquidization* and *crystallization* processes [7]. Our basic idea is that knowledge is not a chunk of information, but emerges only within a certain context. We call the world in people's minds before formed to a certain knowledge as *Nebulous World*. A liquidization corresponds to a decomposition of knowledge into nebulous world, and a crystallization to the opposite, identifying relationships/structures among units in nebulous world.

In this research, we expand and apply the liquidization and crystallization model to expression life cycle. The main difference is that an expression has more static structure than knowledge. We dare to focus expressions and their cycles. Supports for spreading and enriching expressions will finally help to cultivate the diversity of our knowledge.

We propose a framework for activating the liquidization and crystallization cycle of expressions. The key functions of the framework are automatic generation of draft expressions and interactive and incremental creation of expressions. The expected use case of the framework is as follows: The system decomposes expressions into units, it analyzes the structure of the units, it links new relationships among the units, it generates and presents new expressions as draft expressions, then the user selects from the draft expressions, she/he edits and revises the selected expression, again the system restructures the whole nebula, it re-generates and re-presents the new draft expressions, and the processes go on and on .... This loop allows users brush up expressions incrementally, and helps the system to revise the structure and the drafts incrementally.

This paper is organized as follows: After describing related works in the next section, we provide our expression life cycle model. The proposed framework for activating the cycle is shown in Section 4 and the prototype implementations are introduced in Section 5.

RELATED WORK

In this section, we describe the relations and the differences between our work and some of previous works from creativity support, information recommendation, and automatic content generations. Knowledge models in the area of knowledge management will be mentioned in the next section.

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 [4]. In our research, we aim P-creativity support rather than H-creativity support. For ordinal 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 [6]. Our approach doesn't emphasize 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 [9] and brainstorming [17], and many systems to help creative methods using computer systems have been developed [14].

Information Recommendation

Recommendation researches are divided into two types: recommending information, and recommending relations among information. The former aims to give users likely wanted or needed information directly. Recommending information indicates filtering information, or to say selecting information. Therefore, a system can never recommend a non-existing – "new" information. On the other hand, the latter shows places where focused information are put in the whole structure and/or relations which they have partially. Presented relations are supposed to afford users to gleam new information. In this meaning, the latter one is indirect approach.

Recommending information includes following approaches: Modeling user preferences, profiles and actions such as so-called context-aware systems [8]; Social structurization like collaborative filtering [19, 2]; Structurization based on characteristics surrounding information like hyperlinks [18, 10]; And content based structurization like similarities and other natural language processing techniques [20].

Recommending relations can be based on similar techniques of recommending information. It, however, aims different point as we mentioned above. Here how the structure should be shown is as important as the structure itself is. This function is related to visualization and user interface researches. The visualized structures and relations are expected to help users to find new concept through operations and interactions.

Automatic Content Generation

Our research aims to stimulate users directly 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.

Bringsjord and his group developed a system called Brutus1, which generates literary stories [5]. 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.

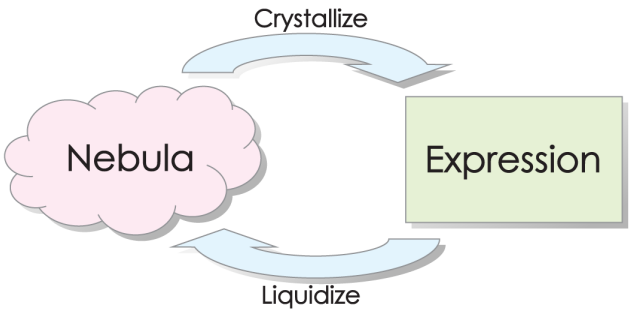

Figure 1. Liquidization and Crystallization of Expressions

AARON programmed by painter Harold Cohen is known as a painting software [13]. 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/his expression. If she/he is insufficient, she/he can modify parameters or edit the output, then "create" her/his work. Here the output can be a stimulation for the user.

Multiple document summarization [11, 3] is technically related to our research. We have not implemented these techniques, but these will be helpful.

EXPRESSION LIFE CYCLE MODEL

Expressions are interpreted based on the context – both the context inside the expressions and the context that the readers are placed in, and therefore the meanings or the values of the expressions depend on case by case. There is nothing like "true meaning" of the expression. An expression is only an expression, and just plays its roles in the context. This is also what French philosopher Jacque Derrida claimed.

Cutting an expression off from a context and placing it into other context open new possibilities of interpretation. New interpretations stimulate people and cultivate new expressions. Expressions are placed into various context and again get other interpretation. In this section, we provide a model for this expression life cycle.

SECI model [15] is well-known in the knowledge management area. 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" [22]. And Ohmukai *et al.* expanded Shneiderman's model to distinguish information activity layer and communication activity layer [16]. In their model called ICA model – Information and Communication Activities model, two layers of information activities ("collect," "create" and "donate") and communication activities

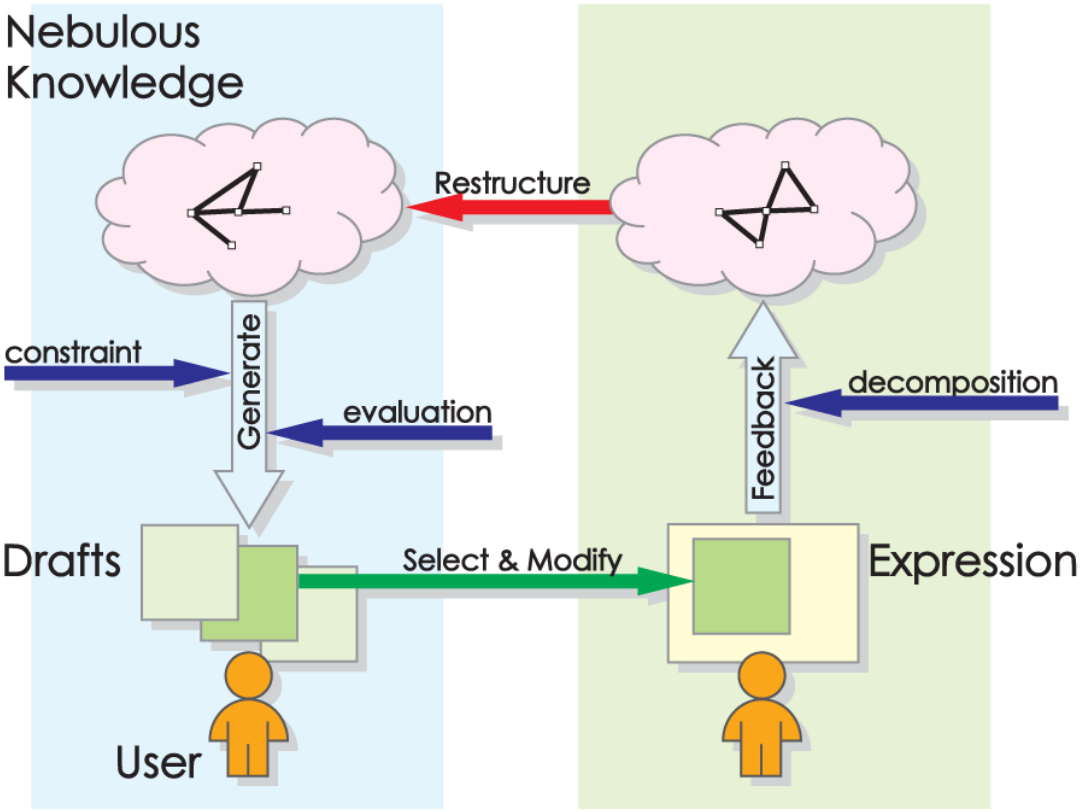

Figure 2. Automatic Draft Generation and Interactive Creation

("relate," "collaborate" and "present") form cycles related to each other.

As we mentioned in the introduction, we developed a cycle model which consists of the knowledge *liquidization* and *crystallization* processes [7]. In this research, we expand and apply the model to an expression life cycle. An expression is a special form of knowledge; it has one static form. But it is interpreted based on the context, which differs according to the situation or the state of the people and the expression. Contexts are relationships among units of partial expression and between them and units of external knowledge. These relationships always change. As *expression liquidization*, we call decomposition of expressions into units in proper granularity with every possible connection among each, and as *expression crystallization*, new expression formation from decomposed partial units based on new relationships within the context (Figure 1).

When an expression is merged against an expression and when a context is merged against a context, the original context will be broken down and liquidization will be enhanced. Placing others expressions into a context changes the context and the values/meanings of expressions. Once a user create a new expression, it raises new context, and then the new context stimulates the user again.

PROPOSED FRAMEWORK FOR ACTIVATING CYCLE

In this section, we describe our proposed framework for activating this cycle (Figure 2). Automatic draft generation and creation through interaction with generated draft are the key elements of the framework. Draft generation phase helps the expression crystallization process; but this support is not direct one, as we emphasized above – finally a human decision is required. Created expressions and modifications for generated drafts are decomposed into units and analyzed possible relations among them; this is the expression liquidization process. A new expression changes the nebulous knowledge, and then different drafts will be generated. These generated drafts stimulate users and cultivate newer expressions again. This interactive and incremental process is supposed to activate the expression cycle. The following subsections describe each feature.

Automatic Draft Generation

The left-hand side of the Figure 2 illustrates the draft generation process. Nebulous knowledge has some structure in a certain context. With evaluation and constraint, draft expression is generated from the structure. Constraints here include grammartical rules and output format of expression. Evaluations include importance of partial unit and relativeness among units. When these parameters changed, the outputs will be changed.

We never aim to create expressions instead of people, but to present candidates. We suppose that presenting draft expressions afford users think deeply rather than just present-

ing related information. Placing into their own context will stimulate users effectively.

Interactive/Incremental Creation

It is said that *to write is to think*. Externalization of thoughts helps to form concepts and ideas. Schön claimed the importance of "reflection in action" [21]. If users are insufficient for the generated draft, they have options: to select other draft (not the insufficient one), or to modify the presented draft by themselves.

Our other aim is the interactivity that: A new expression changes the background structure of nebula, and as a result, new drafts will be generated and presented. New drafts will change user's context, and then the user's expression will change again. We expect that generating and presenting drafts will activate the loop. This is the case of not only using alone, but also using within a community or a group, and more over using among multiple communities/groups. Reviewing and placing one's own past expressions may stimulate her/himself. Other people's expressions, especially from other groups, will be stronger stimulations. With reading through presented drafts, a user will create a new expression. If a final achievement has seldom relation to the presented drafts, it's OK. We aim to stimulate users, not to persuade users.

PRELIMINARY PRACTICE AND PROTOTYPE

We have conducted a preliminary test and are now developing a prototype system based on the framework described above. In this section, we introduce our two practices, which are not complete works. Our first practice is to observe if automatic generation can stimulate or not, and the second is to observe how automatic generation can stimulate.

Recently, various types of *workshops* are held in many fields for participatory learning and creative endeavors. We specially focus on creative workshops for ordinary people, where they express something in some way and discuss about them.

Image and Text Collage from Card-style Expressions

At first, we conducted experiment to observe the effects of draft generation. We decomposed, restructured, recombined the card-style expressions, and generated and presented new expressions.

We use the expressions in the workshop called *AgriGate*, which is organized by our colleagues. In the workshop, farmers and citizens express their thoughts about foods and agriculture in a card style – a story and a photo. We received 78 expressions from the organizers and generated new entries, then presented to organizers. This is the very preliminary experiment, so that we didn't feedback to workshop participants themselves.

We decomposed the expressions and analyzed their relations based on shared words. The calculated network is shown in Figure 3, and an example of generated drafts is shown in Figure 4. The procedure of generation is as follows:

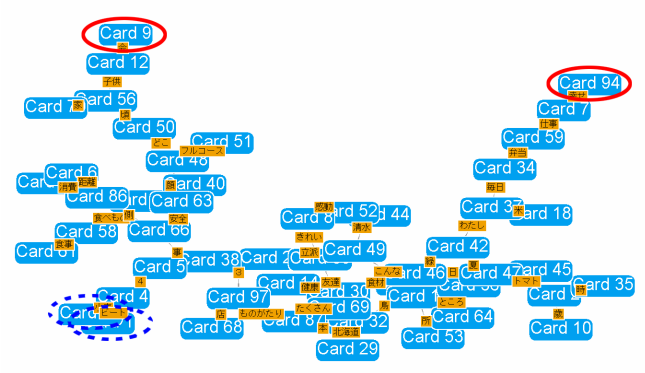

Figure 3. The Analyzed Relationship Network among the Expressions

1. Morphological analysis of card expressions.
   Sentences in Japanese are written not separated, thus, this process is required when decomposing sentences into units – words and phrases.
2. Topic words extraction.
   The five highest words based on the term attractiveness values [1]. This value is calculated based on cooccurrence of the terms. Basically, governing terms, which mean the terms cooccur with many other terms, will be highly evaluated.
3. Relationship analysis among cards.
   We define the two cards have relationship simply when they are sharing more than one word. The network is shown in Figure 3.
4. Combination of cards.
   The system joint two cards based on the structure. In this practice, the two which have the longest distance in the network (circled with solid line in Figure 3) and the two shortest (dotted). The distance in the network is the minimum number of links between two terms.
5. Collage generation.
   The system simply piles up the two images and clips out randomly; displays the sentences from the two texts by turns.

An example of the generated collage is shown in Figure 4. This is the case of the farthest two (the terms with longest distance in the network, the nodes circled with solid line in Figure 3). The sentences with solid underlines are text in one expression, and the sentences with dotted from the other. The sentences are traslated from the original Japanese sentences.

After presenting generated collages to the workshop organizers, we made a brief interview with them. The comment from the workshop organizers are like follows: *A quite local story was combined with a very wide-view story. These are the two extreme expressions around Japanese agricultural issues. This collage gave me a point that every personal activity are spread to global problems.*

This is only a case study, so we cannot conclude that the algorithms and the parameters we used are the best. However,

Figure 4. An Example of the Generated Drafts

we think our proposed way – presenting machinery generated draft –will work as a good stimulation to users in some case.

Workshop on Acrostic with Pictures

We and our colleagues are now preparing for a workshop on *acrostic with pictures*. We implement a system and install it to the workshop. In this workshop, we will observe how the system outputs can stimulate participants. We are now preparing, so the workshop is not held yet at the time when this paper is written. Thus we cannot explain the result but only our intentions and approaches.

Acrostic is "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. A form of constrained writing, an acrostic can be used as a mnemonic device to aide memory retrieval [23]." In Japanese language, we have almost the same style of expression to acrostic except for not using alphabetic letters. 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. In our first practice, we decided the theme as "Shonan" – the name of a region along a coast in central Japan, and called for participation to the people related to – e.g., living around, working around, or was born around – Shonan area.

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 acrostics with photos. We don't install our system yet, but 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. At the same time, workshop facilitators, i.e., the authors, create other new remixed acrostics using a system. The system decomposes, reorganaizes, and outputs candidate expressions. The facilitator selects one or a few from the candidates, and presents them to other participants. We will get feedbacks through discussion.

We use a system in a limited way; The facilitator will act as a user interface to participants. The acrostic generation system architecture is shown in Figure 5. The generation processes are as follows:

- Decomposition phase
  1. Input the participants' expressions into the system by the facilitators
  2. Analyze the morphological structures of text
  3. Calculate the term dependency [1] in the expressions
  4. Download the Wikipedia pages of nouns and noun phrases
  5. Analyze the morphological structures of each Wikipedia page
  6. Calculate the term dependency in each Wikipedia page
  7. Extract linked terms from the Wikipedia pages
  8. Calculate the strength of the relationships among Wikipedia terms based on cooccurences on the Web using Google [12]
  9. Integrate the networks generated in step 3, 6 and 8
- Recomposition phase
  1. Extract candidate words according to their initial letters
  2. Filter the words not to repeat a same picture
  3. Evaluate the extracted words and their relationships
  4. Generate sentences by applying grammar rules to the selected words

Wikipedia is used for supplementing words because the original expressions from the participants have a limited vocabulary. If sufficient amount of expressions are accumulated and words begin with all syllabaries are completed, Wikipedia data are not necessary.

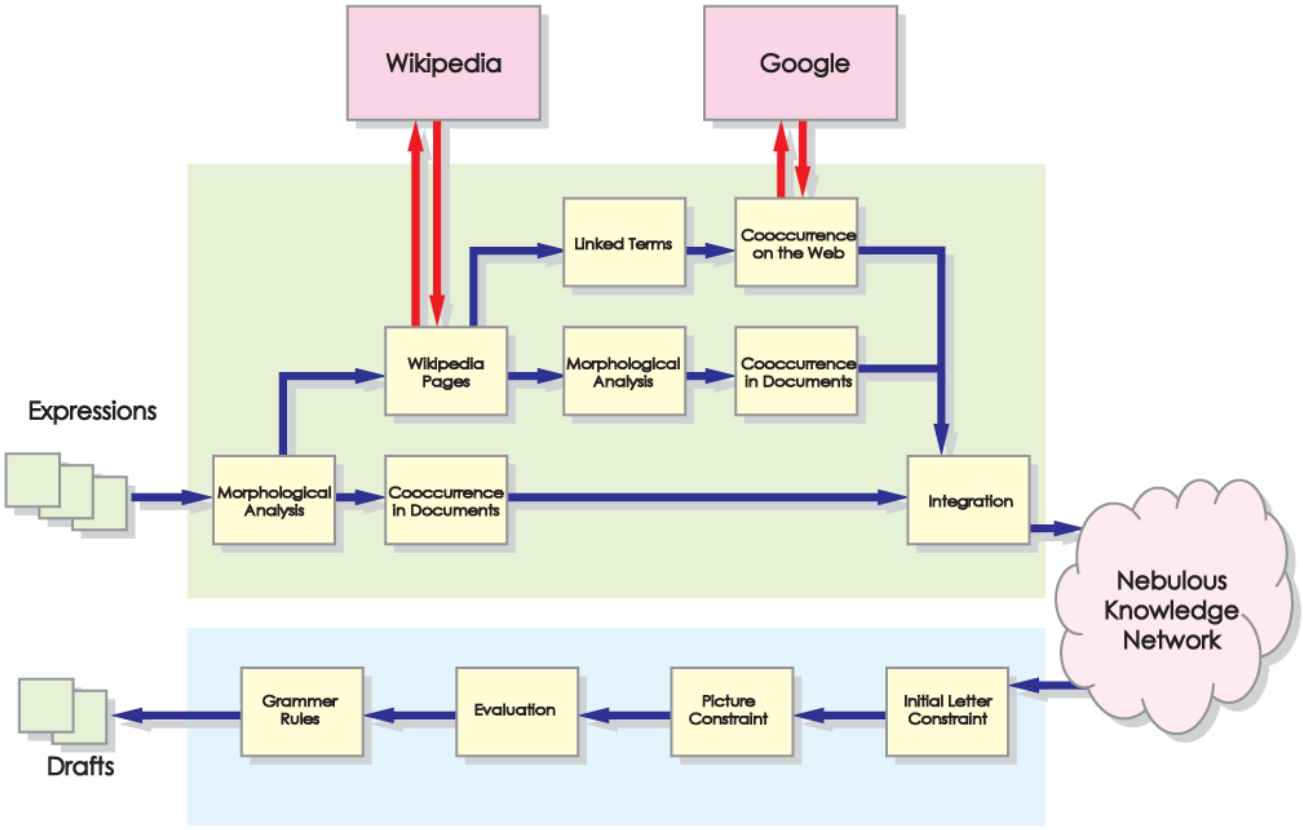

Figure 5. The System Architecture of Acrostic Generation System

DISCUSSION

The practices introduced in the previous section are now on going, so the effectiveness of our proposed model and framework are not revealed yet. Our future works include these verifications.

We aim to support people's creative activity in this research, but we think our framework can be applied to support people's collaboration tacitly. One's expression contributes to all's expression, and all to one.

In our system, decomposed words hold their origins – where a word comes from, and how it used in newer expressions. Thus the system can visualize the citation structures among expressions. This is now needed in the context of the Semantic Web. A document is influenced by other documents, and it influences other document; but it is defficult to analyze the whole structure. Our method cannot be applied to all of the Web documents, but can automatically tag with accuracy if created with the system.

CONCLUSION

In this paper, we proposed the expression cycle model which consists of liquidization and crystallization processes. We developed the framework for activating this cycle by automatic draft generation and interactive creation, and then we introduced prototypes.

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