

STORYTELLING

A computational approach for convergent thinking

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Abstract. Convergent thinking is an important skill in early design process to deal with the complexity and dynamic nature of design. In this research, by exploring the storytelling mechanism as one way to develop an idea generation representation called DIM (Dynamic Idea Map), we investigate characteristics of convergent process during the brainstorming experiments we conducted. A computational platform called Idea Story (Idea as Storytelling) is proposed which produces a narrative and helps generate a meaningful representation.

Keywords. Storytelling; convergent thinking; idea map; design narrative.

1. Introduction

Convergent thinking is an important skill in early design process to deal with the complexity and dynamic nature of design. By assuming that design is organised as different ideas, we turn this problem into representation of organisational strategies over a set of graphs that represents different ideas of a design. Based on the mechanism of DIM (dynamic idea maps) and DARIS (Lai and Chang, 2006), each idea is represented by a group of nodes called idea

entities and linked together to frame a complex map. How can we organise idea entities and make them usable for designers? A computational approach is adopted in this research to support convergent thinking strategy, storytelling, and develop a narrative and meaningful representation.

In real practice, designers often spend more time generating. Generating design solutions requires narrowing down the selection from a pool of ideas generated. Idea convergence in design involves reduction of a large number of ideas to a meaningful range. We use this approach of idea convergence as a way of storytelling in this research.

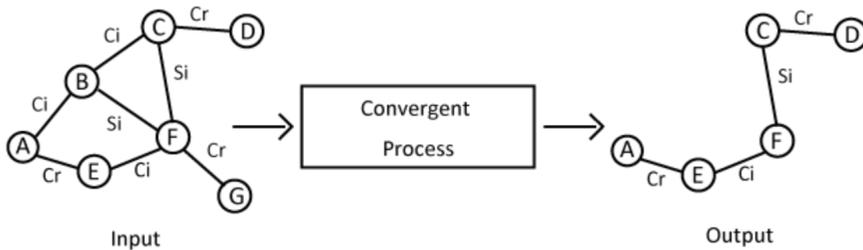


Figure 1. A convergent process over idea entities.

Why storytelling? People like listening to story and stories appeal to people. Stories and design have some similar elements: problem, approach and solution.

We believe that “Idea convergence” will allow us to move from disordered ideas to organised and meaningful sequence (so called “story of design”) which is regarded as the final design outcome in the design stage we are interested, and the initiation for other design decision convergences.

The objective of this study is to explore and define a convergent method for idea generation based on the mechanism of storytelling. In order to achieve this goal, experiment and analysis are conducted and described in details in the sections below.

2. Literature reviews

Design convergence is complex in terms of its problem space. Based on the representation and approaches for finding the solution, two main concepts in this research are DIM (for representation) and storytelling (for mechanism).

2.1. DIM

DIM (dynamic idea map) is a way to describe the behaviours and thinking patterns of designers during the brainstorming sessions. The fundamental element of DIM is called idea entity (IE). In addition to the simple ICF

representation (issue, concept and form) adapted by (Oxman, 2004), each IE contains four elements (ICF + preference). The associations between each pair of IE are based on the linkages and form a large map called idea map (Lai and Chang, 2009). Following internal/external interplay with IEs, these maps are then generated.

2.1.1. DIM elements

(1) Attributes of idea entity. The basic element of DIM is called IEs (idea entities) that constitute the knowledge related to design problems. Each IE is comprised of four attributes: issue, concept, form and prefers (Lai and Chang, 2006). Briefly:

- **Issue:** design problem that describes the problem for a domain issue.
- **Concept:** abstract design concept, which contains domain concept vocabularies.
- **Form:** the actual product in response to one domain concept vocabulary and media presentation.
- **Preference:** designer's IE preference value.

(2) Linkages of IEs. Each pair of IEs is linked via three linkages: similarity (SI→), contrast (CR→) and contiguity (→) (figure 2).

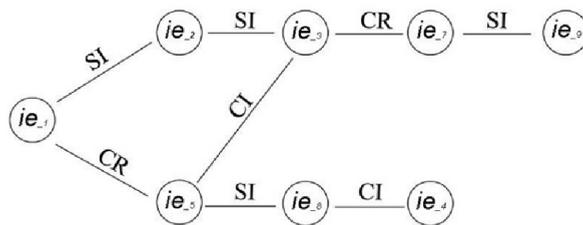


Figure 2. The graph-like knowledge structure via three linkages in idea map.

2.2. STORYTELLING

Storytelling is the basic human ability. We usually tell life experience to explore the experience or deep feelings, and to attract listeners' attention (Barton, 2000; Sullivan et al., 2008). Three major roles in a storytelling process are audience, writer, and storyteller. They affect each other.

2.2.1. Storytelling for audience

The audience is someone the story is told to. The audiences' reactions lead writers or storytellers think over elements of stories, for example, why do audiences relate more with some stories? What attracts them? What makes

audience willing to spend time watching or listening to a story? (Glebas, 2008b)

2.2.2. *Storytelling for writer*

Writers compose story in their minds and use their excellent storytelling ability to express them. Each writer establishes a personal style of storytelling. Writer (Lewis, 2001).

The important tool for writer must be their imagination. What kind of strong idea could catch audience's attention? In general, the ideas originate in past personal experiences, visits to somewhere, or encounters (Scott, 2002b; Wright, 2005b). Or ideas are found from the everyday encounters (Wright, 2005b), out of the debris from those familiar, interesting and things for that move people. Also, inconspicuous thing can become specific sources for ideas. Scott Jeffrey proposed, "Old idea + new time, place, or characters = fresh idea" (Scott, 2002a).

How can we to piece together a story from these elements? A typical story contains an unsolved problem that provides a hint to seduce reader to continue reading (Wright, 2005a) that is similar to the design problems in DIM above. Normally story usually uses three-act structure (Glebas, 2008a; Wright, 2005a):

1. **Beginning of story.** This act unfolds the story and acts as the background for introducing readers into the setting of story.
2. **Middle of story.** This act comes before the climax, elaborates small signals to guide the design ideas towards the big ending.
3. **End of story.** This act ends in climax and resolution of story. Climax has the characteristics of unexpected transition and resolution.

2.2.3. *Storytelling for storyteller*

Storytellers create virtual or real images in the audience's imagination in order to immerse audience in a world of imagination and inspire their emotions further. Storytellers use their own skills and tools (e.g., narrator's voice, character voices, singing, sound effects) and nonverbal tools such as facial expression, eye contact, gesture, body language, and so on (Moore, 1999).

3. The experiment

Informed by the reviews above, we investigate convergent processes during brainstorming. An experiment is conducted in which observation and interviews are used for tracing how ideas are generated and further developed.

3.1. PARTICIPANTS

Three architectural undergraduate students with knowledge of DIM are selected for this experiment. The participants are familiar with the concept of DIM as well as its procedure. The duration of experiment is two hours.

3.2. OBJECTIVE OF EXPERIMENT

Experiment process is divided into two stages. The whole experiment was video-taped with interviews afterwards.

Phase one involves generation of design issues for DIM. Each participant was undertook this task and after generating thirty IEs, the linkages of each pair of IEs are decided and produced in Idea Map as the result.

Phase two is the convergent phase. By asking participants to converge the diverse ideas generated from phase one, participants are requested to pick 4–6 IEs with sequential order. Based on some mechanism of storytelling mentioned above, interviews and questionnaire are used to uncover the logic behind the action (as shown in figure 3).



Figure 3. Process and outcome of experiment.

3.3. FINDINGS

Two findings are uncovered during the experiment. One is that the preferences of IEs in the sequence affect participants, choices. Second is that participants tend to select a key IE as a major point of climax in the sequence. After that, participant will pick any other IE based on the association with the existing IE in the sequence. Further linking will be followed from the existing IEs incrementally to accomplish the whole process.

4. Idea story mechanism

Based on this research, we developed a mechanism, Idea Story (Idea as Storytelling), which assists designer to converge ideas similar to storytelling. Idea Story is divided into two parts: Story components and procedure.

4.1 IDEA STORY COMPONENTS

A main component of Idea Story is story sequence.

4.1.1. *EvenIE and linkage: the basic elements of story sequence*

Every story sequence is composed of a series of “EventIEs” (figure 4). Three factors of IE relate to problem of story, conceptual process, and final result of event.

DIM	Story
IE	Event
Issue	Problem
Concept	Process
Form	Result
Preference	Writer's Preference
Linkage	Relationship of event

Figure 4. Mapping from DIM to story structure.

4.1.2. *Data structure of story sequence*

There are three types of EventIE: “Initial EventIE”, “Elaborate EventIE”, and “Transition EventIE”. And one story sequence has one Initial EventIE, one Elaborate Sequence, and one Transition EventIE (figure 5).

1. Initial EventIE is an IE which has the most linkages in a map. Initial EventIE is the event in the beginning of story (figure 6). Most Ideas which are generated by designers are around Initial EventIE.
2. Elaborate EventIE is an event in the middle of story (figure 6) Many Elaborate EventIE makes up an elaborate sequence.
3. Elaborate sequence is a path or sequence that with many EventIEs connects Initial EventIE and Transition EventIE. This sequence must match two conditions:
 - Do not allow that any two related EventIEs of concept and form are the same. It is necessary that two same events occur again.
 - To keep more EventIEs with larger preference value in generated story sequence.
4. Transition EventIE is the IE with the most preference value. Transition EventIE is an event in end of story (figure 6). Transition EventIE is the most important



Figure 5 (left). The structure of story sequence. Figure 6 (right). Transform from story to idea story.

event of story and also what designers want to pursue in design. This study suggests three factors to assist designer to set IE preference value in DIM:

- Favourite: depends on designer’s favourite IE.
- Importance: the IE is more important for designer.
- Special: the IE is significantly different from others in idea Map. And it might be a breakthrough or turning point in the story.

4.2. IDEA STORY PROCEDURE

In this study, we model the Idea Story Process based on storytelling process (figure 7). The Idea Story System, Designer, and Users play different roles in three stages. Furthermore, designer plays three different roles in each stage.

4.2.1. Step1: simplification stage

In the first stage, we simplify a huge DIM to several story sequences.

1. Find Initial EventIE and Transition EventIE.
2. Search one path as Elaborate sequence, search the path by computation according to existing Initial EventIE and Transition EventIE. Elaborate EventIE of Elaborate sequence is assigned better preference value.
3. Compose the computation results and story sequence.

4.2.2. Step2: combination stage

At this Stage, we assist designer to process ideas through four steps: display, collect, confirm, and synthesise.

1. Display the story sequence: a series of pictures represent the EventIEs of story sequence shown one at a time. Based on montage theory, designer self-

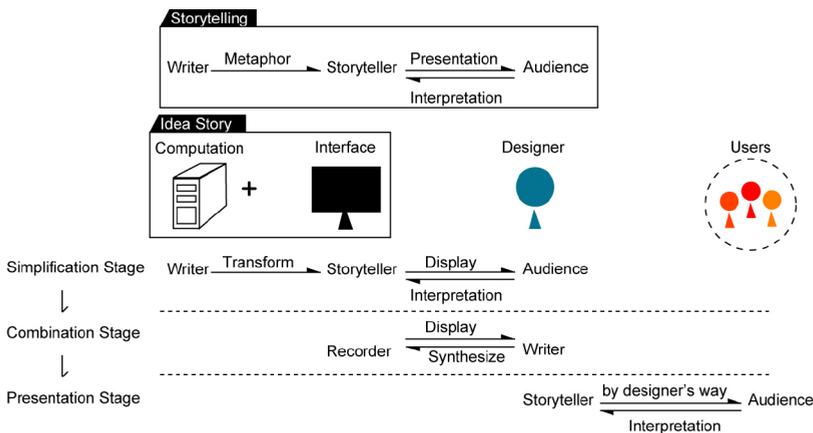


Figure 7. The vv process.

- interprets the blanks between two pictures.
2. Collect the story sequences and approximate to design prototype.
 3. Confirm main story sequence: After collecting many story sequences, designer has to decide one story sequence as a primary focus.
 4. Synthesise the final story sequence based on the main story sequence. Designer must deeply think some things. **Designer could add new EventIE, delete existing EventIE, or replace existing EventIE** in order to make the main story sequence become better. During this period, designer may need to note some messages and synthesise a satisfactory resolution.

4.2.3. Step3: presentation stage

In the final stage, designer must make a conclusion for Idea Story via final resolution of story sequence.

5. An example

We follow the sequence and test in a practical project with an architectural designer. The given problem is to design a low rise (2–3 floors) street-house. The site is 4.5m × 30m (figure 8). The primary design issue is circulation.

With given DIM that has 30 IEs and linkages, designer sets the preference of every IE. System then **generates 21 story sequences according to designer's preferences**. From these results, designer picked up 4 story sequences as favourite sequences. One of these sequences then became the main story sequence. The IEs of main story sequence are ie3, ie21, ie25, ie15, ie16 and ie13. Then, designer changed the IEs in the main story sequence. He deleted ie25, and replaced ie22 and ie30. The IEs of final story sequence are ie3, ie21, ie22, ie30, ie15, ie16 and ie13 (figure 9). Finally, designer draws the sketch and describes the final story sequence (figure 10).

There is a courtyard with plants in the middle of street-house. In this way, residents could see the outdoor space through French windows in every floor. They also go to the outdoor platform and enjoy this garden in the courtyard. The main stair of street-house is also in the courtyard. The main stair and the outdoor platform of every floor are connected to each other for connecting each living unit. The public circulation is the front section of street-house on 1st floor. As a result, residents interact in the front section of street-house whereas the back section of street-house remains for private circulation.

6. Conclusion

This research provides a computational approach, Idea Story, to realise one way to develop convergent thinking of ideas. By exploring the storytelling

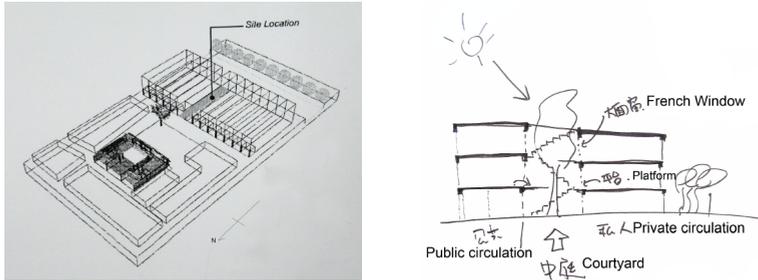


Figure 8 (left). The site location image. Figure 9 (right). Designer records Idea Story by sketch.



Figure 10. The final idea sequence is close to what designer has in mind.

mechanism via DIM, we conducted an experiment for investigating the incremental unfolding of convergent processes during design brainstorming.

The Idea Story mechanism not only converged from large number of ideas in DIM to a simple story sequence but also provides a way to inspire designers in the “Combination” stage. It provides a story sequence by computation to enable designers to interpret, compare, and modify ideas for finding a final solution. Further, designers would discover their own track as they build design knowledge increasingly.

However, the result of the convergence by only one designer might not be suitable for team situation. Further research on team idea convergence will be invaluable to justify the concept of Idea Story in more use cases.

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