Creative Leaf: A Creative iStar Modeling Tool

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Abstract. iStar models allow users to capture high-level social requirements, including alternatives and qualities. Typical approaches advocate discovering model content through traditional Requirements Engineering (RE) elicitation methods, such as interviews, observations, and domain documents. For the typical, familiar space of requirements, such techniques may be sufficient, but stakeholders may not always know the best way to meet their needs, and may have difficultly articulating their goals. Creativity theories and activities have been successfully applied to RE in order to discover both creative and more typical requirements. In this work we describe the web-based Creative Leaf tool that facilitates a combination of established creativity techniques with iStar modeling. Divergent techniques help the discovery of ideas, while selection, evaluation and modeling techniques help to converge over ideas, integrating them into the model and system design.

Keywords: creativity, istar, goal modeling, method, tool support

1 Introduction

Goal models, such as iStar, provide a concrete graphical way to help ensure that potential system requirements meet user goals and qualities. But where do potential requirements come from? How do we find the goals and desired qualities of systems stakeholders? Traditional Requirements Engineering (RE) approaches advocate for various forms of elicitation (interviews, observations, domain documents). For the typical, familiar space of requirements, such techniques may be sufficient. But users and stakeholders may not always know the best way to solve their problems, to meet their needs, or even to identify what those needs may be. Stakeholders are biased by their own experiences, and are often too-grounded in the use of existing tools [10]. Goals, although helpful in grounding function to purpose, are often difficult for stakeholders to articulate [16]. There is a need for methods to expand the space of known requirements, to consider and evaluate possibilities beyond the typical space of functions and intentions. Such divergent thinking is critical to support the development of creative requirements, leading to innovative systems which create competitive advantages.

The role of creativity theories and techniques has been investigated and applied in an RE-context for more than ten years, e.g., [10,11,2,12,9]. The research outputs of such efforts include the design of structured creativity workshops, RE-focused creativity techniques, and a series of guidelines for applying creativity in practice. Workshops use a series of creativity activities (e.g., brainstorming, role playing, and BrightSparks). These are structured activities which attempt to guide participants through activities or steps which may produce new ideas. Although creative requirements workshops have

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seen success when applied to real contexts such as Air Traffic Control and Food Safety, workshops are expensive to run, require highly-skilled facilitators, and produce output which is often fragmented and only lightly structured (ideas, scenarios, use cases) [11]. RE-focused creativity techniques (such as [2,12]), can be useful, but the power of creativity is better harnessed by use of successive and varied techniques, in order to expand the search space in differing ways. Existing work has also begun to explore the synergies between creativity and goal modeling from the perspective of transformational creativity, but without yet providing a more general tool [15].

In order to address many of these drawbacks in both goal modeling and creativity approaches as used in RE, our work has combined the two approaches, producing a concrete tool and guiding methodology: Creative Leaf [1]. Our overall intention is to facilitate the structured capture of creative requirements – those requirements which are not obvious, typical, or which do not immediately come to the mind of the stakeholders.

Creative Leaf is an output of a design research process involving a series of formative and summative studies conducted over the last 1.5 years. We leave the reporting of these studies to further work, and in this short paper focus on describing the resulting tool. We have previously published initial visions of how the tool and method may work, using historical examples [5,7,6]. In this paper, we describe the concrete output of the design process, including embedded exploratory creativity activities, and activities designed to help users evaluate, prioritize and model their ideas.

Section 2 describes the design and functionality of the tool. Section 3 concludes the paper and makes a call for participation in the use and evaluation of Creative Leaf.

2 Creative Leaf

A screenshot of Creative Leaf is shown in 1. The left hand panel contains a palette with iStar elements. The included elements and links were based on an early version of the iStar 2.0 core [4]. We have plans to update the palette to conform to the latest version of the iStar core. To support high-level creative thought, the tool allows user to draw ideas and assumptions along with the typical iStar elements. These new elements can be connected to other elements with the typical iStar links, in other words, they are first-class modeling elements. The middle of the tool contains the canvas, where the model can be drawn, and the creative ideas placed. The right hand side contains the creativity panel. Each of the gray boxes are clickable, opening a window guiding users through a particular creative activity. The right and left panels are collapsible, allowing modelers to focus on the center canvas when needed, particularly when using smaller screens.

2.1 Implementation Details

The iStar modeling capability of Creative Leaf is based off the Leaf Beta tool developed at the University of Toronto by Alicia Grubb et al.[2]. The Leaf code has been modified and adapted, e.g., to add ideas and assumptions. (Creative) Leaf uses both the JointJS and Rappid[3] HTML 5 diagramming frameworks. JointJS is available via an open

[1] `http://creativeleaf.city.ac.uk/`
[2] `http://www.cs.toronto.edu/~amgrubb/leaf`
[3] `http://www.jointjs.com/`

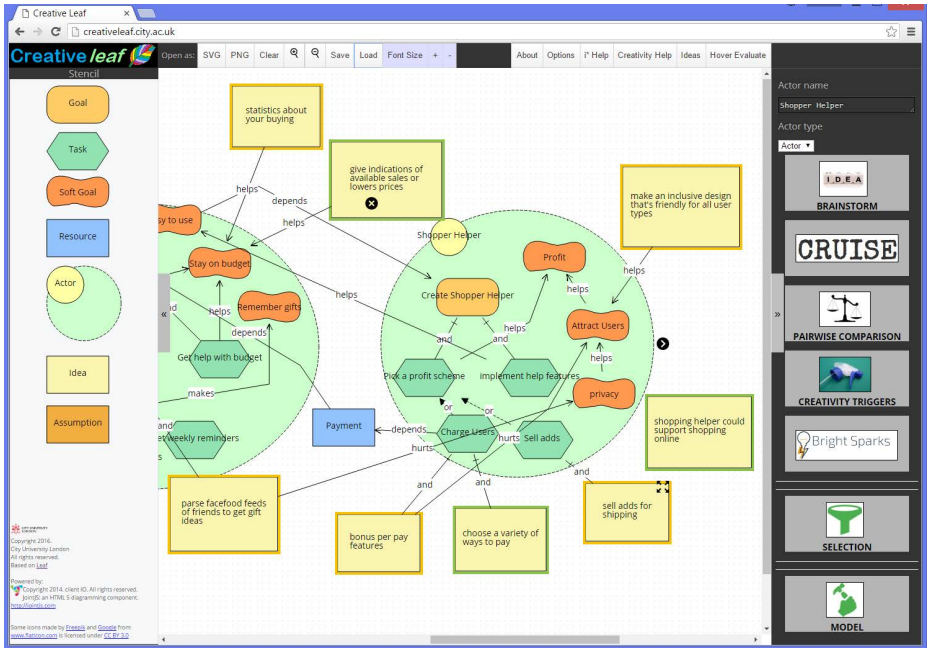


Fig. 1: Screenshot of Creative Leaf Tool

license, while Rappid is a commercial product, but provides free academic licenses. Code is written in JavasScript, using CSS and HTML files for formatting and display. Creative Leaf code is stored on a private GitHub repository, forked from the Leaf code base. Access can be made available to other institutions which acquire a license for Rappid (all other sections of code apart from the Rappid libraries are Open Source and are available on request).

In addition to modeling and creative functions, the tool has an embedded tracking function which tracks user actions with time stamps. Users have the option to turn off or on this tracking at first use, and later via the Options menu. Creative Leaf uses a series of unobtrusive prompts to guide users to the next likely activity, particularly when the user is inactive for some period of time. These prompts can also be disabled via Options.

2.2 Exploratory Creativity

The Creativity panel on the right of the tool allows users to work through a number of established creativity activities. Following the model of the Creative Problem Solving (CPS) method, creative activities are aimed to support either divergent creativity, generating ideas, or convergent creativity, selecting, combining and developing ideas [13]. The first five activities within Creative Leaf support exploratory creativity, while the last two begin to support convergence.

Exploratory creativity activities in Creative Leaf include Brainstorming, CRUISE creative search, Pairwise Comparison, Creativity Triggers, and Bright Sparks (Hall of Fame). More information about the general form of these activities can be found within

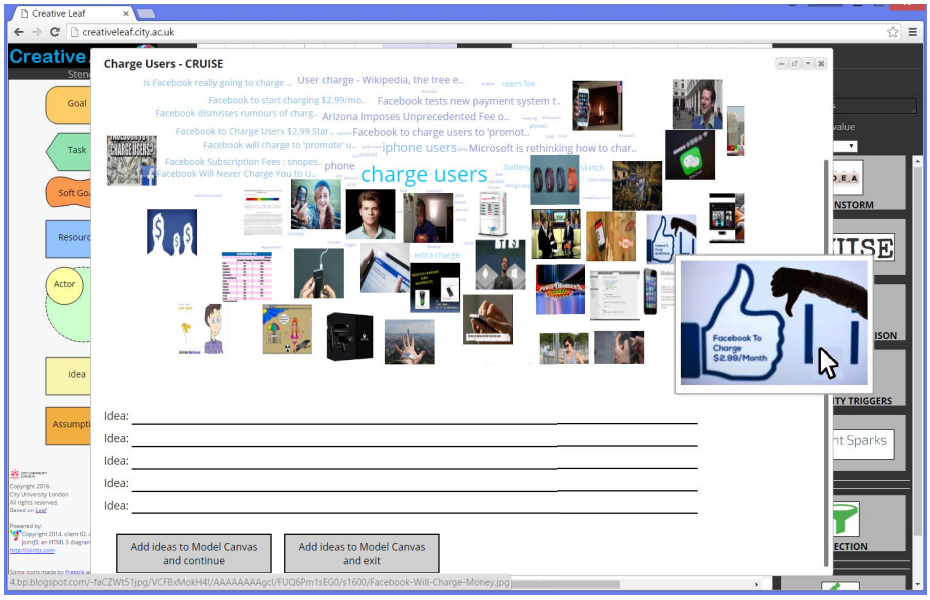


Fig. 2: Screenshot of CRUISE Exploratory Activity within Creative Leaf Tool

the BeCreative Creativity Support tool [1]. Each activity (apart from Brainstorming) takes as input some piece of the iStar model. Ideas can be recorded in the tool by typing in the text field on the bottom part of the activity window. When the users are done an activity (they've run out of ideas), they can "Add ideas to the Model Canvas and exit" where each idea appears as a yellow idea "post-it" on the model. Such idea elements can be moved around and attached to other model elements via the typical iStar links, e.g., this idea helps this Softgoal/Quality. We describe each Creativity Activity in more detail in the following.

Brainstorming is the very general activity encouraging people to capture all the "obvious" ideas, which they already have in mind. Studies showed that without this initial activity, users ignored the structure and prompts of further activities and only listed the ideas they already had. The CRUISE activity calls an external creativity service, a result of the Collage Project [4]. The input search string is a selected iStar element, actor or idea. The CRUISE service returns a cloud of images, links and text which are tangentially related to the search string. Ideas prompted by the output are captured at the bottom of the window. An example screenshot of the CRUISE activity can be seen in Fig. 2.

The Pairwise Comparison activity, inspired by Poincare's emphasis on creativity through connections [14], displays pairs of iStar elements from the model, avoiding elements directly connected. Users can iterate through pairs until they find one or more which inspires ideas. The Creativity Trigger activity compares available triggers with a selected iStar element, using the text and image trigger cards developed by Robertson & Robertson, and explored empirically in a recent paper [3]. Users can iterate through triggers (Connections, Convenience, Information and Choices, Participation, Service, and Trust) until they find one or more which inspires ideas. BrightSparks, like CRUISE,

[4] https://meilu.jpshuntong.com/url 4 4 a f f e d e

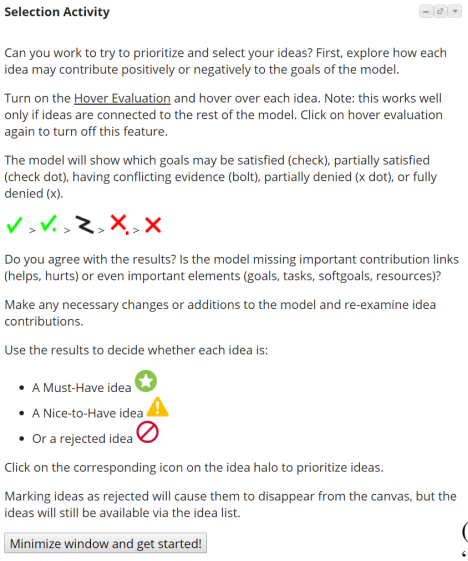
makes a call to an external service [5]. This activity takes an actor as input and asks the user to think of the actor being played by a famous persona (e.g., Batman, Joan of Arc, Henry Ford), allowing the user to iterate through personas.

2.3 Analysis, Selection & Modeling

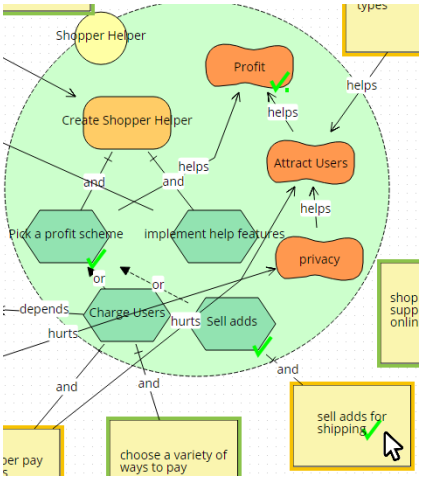
Once ideas have been discovered, the user needs help selecting amongst ideas and developing the selected ideas by integrating them into the iStar model. We offer a selection activity which guides users through the process, see the text in Fig. 3a. Part of the selection activity introduces the Hover Evaluation feature included in Creative Leaf. This feature is based on qualitative evaluation from the first author's previous work [8], but is fully automated for simplicity. When the user hovers over an element, it is treated as satisfied and the effects of that satisfaction are propagated up the model, see Fig. 3b for an example. In this way, users can explore the effects of their ideas on the model. Ideas can be marked by the user as Must-Have (green), Nice-to-Have (yellow) or Rejected (removed from canvas).

The final activity encourages users to model their best ideas in iStar, manually converting their idea to a number of iStar elements and links, connecting them to the existing model. This step is currently fully manual, but we are looking into providing users with suggested mappings of their ideas into iStar elements. Once an idea has been modeled, it is marked as modeled and removed (automatically) from the canvas. All ideas, including rejected and modeled ideas can be found via the idea list, accessible via a button on the top right of the tool. More information, including tutorial videos and a user guide can be found in the following support site: `https://sites.google.com/site/creativitygm4re`.

[5] `http://brightsparks.city.ac.uk/`



(a) Selection Activity Instructions



(b) Hover Evaluate Feature: Evaluating Idea "Sell adds for shipping"

Fig. 3: Creative Leaf Details

3 Conclusions and Call for Input

We have introduced the reader to the Creative Leaf tool, combining goal modeling with established creativity techniques. We encourage users to try out the tool, and provide feedback to the authors at `creativeleaf@city.ac.uk`. After extensive in-lab evaluation of the tool, we are looking for organizations with real problems willing to try out the tool and provide feedback. We hope to use this realistic evaluation to improve the functionality and general applicability of the tool.

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