This forum highlights conversations at the intersection of design methods and social studies of technology. By highlighting a diversity of perspectives on design interventions and programs, we aim to forge new connections between HCI design and communication, science and technology studies, and media studies scholarship. **— Daniela Rosner, Editor**

# Mental Landscapes: Externalizing Mental Models Through Metaphors

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In HCI, we usually encounter metaphors through interface design—the desktops, windows, tablets, clouds, folders, and feeds of everyday interaction. Designers use metaphors strategically to help users understand new ways of interacting, but they can also be used to generate new ideas for products or services [1,2,3]; considering different metaphors can help expand our conceptual vocabulary as we work with the social and political effects of technologies.

We argue that there is also value in paying attention to the metaphors people use to explain their understanding, as a component of user research. Eliciting metaphors, tacit or explicit, can be part of a process of exploring mental models, for research participants themselves or for researchers seeking to gain qualitative insights around people's understandings. Systems theorist Peter Senge has called for teams within organizations to work on "surfacing, testing, and improving [their] mental pictures of how the world works" [4] to arrive at shared mental models; this approach could also be useful for people individually. However, there is no right way to externalize thoughts. As David Jonassen and Young Hoan Cho [5] put it, we need "visual prostheses" to share our mental imagery with each other.

In the Mental Landscapes project, we have developed a set of such visual prostheses: a kit of laser-cut card parts embodying a particular set of metaphors based on stylized landscapes and features within landscapes, such as hills, roads, fields, and weather. We have explored the kit's use through workshops where participants assemble and arrange a variety of elements to make abstracted model landscapes that on some level represent or translate their mental models of concepts—a form of *projective technique*. Our participants have built models representing their own career paths, life journeys, and group projects. The aim of the workshops was to help scope the possibilities for the kit's development and to explore how this kind of metaphor-based constructive projective method could be employed in user research for design and HCI.

Why landscapes? They are a common type of metaphor in speech, particularly for talking about relations between parts of a whole, or mapping the structure of one concept onto another. In organizations, we might talk about moving into *new territory* or the *stakeholder landscape*, having a *vantage point*, *mainstream* and *backwater*, *channeling our efforts*, the *lay of the land*, *descending into chaos*, *oceans of possibilities*—even *blue sky thinking*. We talk about *food deserts* and *career paths*, *networks* and *decision trees*, *world-wide webs* and *websites*, sometimes directly comparing a new concept to an existing thing in a landscape, and sometimes using the idea in a more abstract way. On a more fundamental level, we might even realize the spatial metaphors inherent in *perspective*, *field*, *area*, *stance*, *position*, *looking ahead*, and, indeed, *fundamental level*.

**Insights**

- → Design methods can help people externalize their mental models, individually and in groups.
- → Landscape metaphors provide a practical way of doing this visually.
- → 3D landscape elements can be used to enable people to visualize subjects such as career paths and experiences of group-project work.

In developing the form of the kit, we have taken inspiration from, or paralleled, approaches including Liz Sanders's MakeTools [6], Thudt et al.'s data physicalization for self-reflection [7], and other work on embodied sensemaking, modeling in systemic design, and collective imagery weaves [8,9,10].

***Career paths.*** In a pilot workshop, we used simple 2D cutouts. Six master's students in design were asked to construct visualizations of their individual career paths (Figure 1) or life journeys and think aloud as they did so, for up to 40 minutes, explaining the relevance of the metaphors selected and how the landscape was constructed, creating and modifying elements where necessary.

To give an example of a participant's creation, Figure 1 shows a landscape with color-coded hills annotated with signs. Two people, both representing the participant, with two suns and a variety of clouds, illustrated emotional aspects. She explained that the height of the hills


**Figure 1. One participant's career path landscape.**

represented achievement and the amount of downhill represented unhappiness, most significantly the sharp downhill after college, followed by a lightning cloud, gray rain cloud, and herself taking a nosedive down the hill—a (self-expressed) meltdown. After the post-college downhill, she represented her series of mostly low-paid jobs with a small purple hill, followed by a wider, green hill for her master's degree. A sun and blue clouds, with a change in color, represent her recovering and moving on from the negative emotional period following college, although it is still a part of her life. While details are specific to each participant, their use of the elements in different ways (such as the size and arrangement of the hills and weather elements) to embody particular qualitative meanings gave us insights into the kinds of possibilities inherent in the kit, and how it could be used to help people reflect on their own thinking as part of a user-research process—or ultimately inspire new forms of interface design.

Some patterns emerged, such as the use of aerial views (e.g., Figure 2) and branching structures of influences, possible choices, and paths not taken. Some participants said it was difficult to show their perspective of the landscape within a two-dimensional format—for example, things that were present but not directly on the path taken. This suggested a way to improve the kit: moving to a 3D format.

***3D kit.*** Insights from the pilot enabled us to develop an improved and revised kit that provides greater variety while enabling three-


**Figure 2. An aerial-view life journey. Tributaries represent foundational contributions toward experiences. Rocks within eddies represent periods lacking clear direction.**

Figure 3. The modeling process.

Figure 4. A group explains their Life Landscape.

dimensional expression. In addition, we wanted to explore how the landscape metaphors could be used to think through other topics, and in a group rather than individual context. The 3D kit (downloadable at http://imaginari.es/mental-landscapes/) comprised elements representing:

- Hills, mountains, and raised ground, of many sizes and colors—both 3D cones and flat elevations held vertically using slotted blocks
- Lakes, ponds, and rivers, of many sizes and colors, plus whirlpools or eddies
- Fields/areas of land, or roads, of many sizes and colors, including a ground sheet and lengths of brown construction paper
- Trees and cacti of different shapes and sizes
- Silhouettes of people of different sizes

**Considering different metaphors can help expand our conceptual vocabulary.**

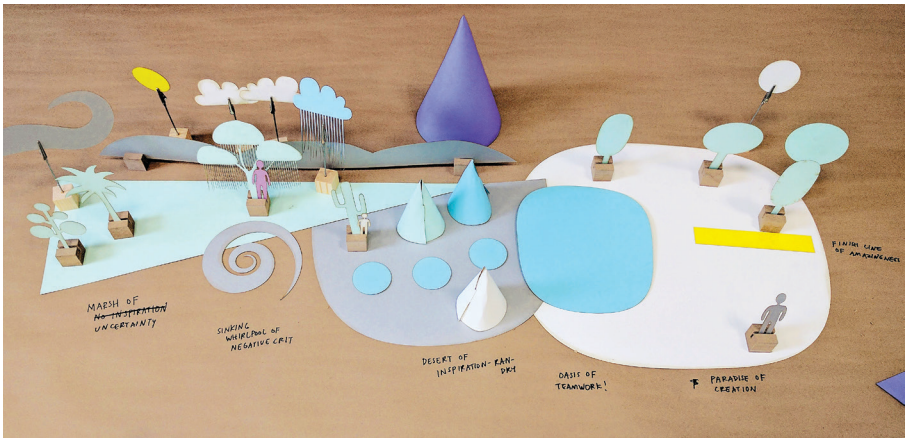


**Figure 5. A project landscape annotated by the group as they built it.**

**Figure 6. Here, as explained by the group, initially extreme weather represents a communication breakdown; a rising sun represents the group starting to understand what was going on. The mountain and swirl of people represent the pressure and opportunity of a major career fair at that time in the project.**

• Weather elements: sun/moon, clouds (cirrus and cumulus), clouds with rain, clouds with snow, clouds with lightning bolts, held vertically using crocodile clips on rods. Whirlpools could also be used as cyclones.

The kit also includes generic shapes that can be used or modified as well as sticky notes for use as labels or annotations (replacing headstone-like signposts in the original 2D kit). Some opportunistically collected real elements—rocks and fallen leaves—were included in the Life Landscapes workshop. Our design process for the kit aimed to maximize the ability of participants to express their thinking, while not overwhelming them with the sheer quantity of pre-made elements. We wanted to preserve the affordance of being able to think through how seemingly disparate experiences might relate to one another over one's life, without prescribing a particular narrative format. From a practical perspective, we needed to be able to manufacture the elements through the laser-cutting of card, chosen as a balance between cost and variety of color availability. The resulting kit elements have some visual parallels with a variety of papercraft landscapes. The material choice of thin card both affords and signals annotation and rapid alteration, and we explicitly gave participants permission to do this.

We ran two larger group workshops with the 3D elements: Life Landscapes—again on life journeys; and Project Landscapes, in which participants modeled group projects they had recently worked on together.

***Life Landscapes.*** In this workshop, 29 master's students from two design classes, in groups of five to seven, were given 30 minutes to visualize the questions "What do the past and future look like as a landscape?" and "Where are we going?" using the kit. The focus for most groups was their own perceptions of their journeys before, during—and imagined journey after—graduating, but the scope was left open for groups to interpret the questions in different ways. The collaborative challenge here was to create a shared vision from what started as a disparate set of individual experiences (Figure 3). Figure 4 shows one group explaining their landscape, centered around a set of tributaries (different backgrounds) coming together with the students on a raft together (their degrees), heading—potentially via a whirlpool—for a variety of possibilities ahead, from rocky shallows, to deserts with cacti, to hills representing different kinds of careers.

***Project Landscapes.*** For this workshop, 45 undergraduate design students worked in groups of three to five for 30 minutes, re-forming groups they had previously worked in together on a recent project. Groups were asked to use the elements to create landscapes representing whatever aspects they found important to emphasize: topics, challenges, project stages, roles, interpersonal relationships,

**When projects encountered difficulties, many groups represented these with lightning, rain, and hills.**

and so on. Groups used and modified the elements in different ways to represent different aspects of their projects.

After constructing their landscapes, each group talked it through, and it is their terminology and names we draw on here in describing the meanings attributed to elements. Some projects started with "rocky" beginnings, represented by cones or hills. Others started with trees, rivers, and stars, representing periods of ideation, or general feelings of optimism. When projects encountered difficulties later on, many groups represented these periods with lightning, rain, and hills. Several groups came up with names to represent specific parts of their project experiences, such as a "plateau of exhaustion" before the project came to an end, or even in one case a "hell." In Figure 5, for example, the group illustrated how at the beginning of their project, they were in a "marsh of uncertainty." During their first crit, negative feedback was represented by a "sinking whirlpool" and rain clouds. The gray, dry "desert of inspiration" represents not having a lot of ideas, but the blue circles represent the team enjoying working together. Eventually they found an "oasis of teamwork," which led to "a paradise of creation" and eventually completing the project.

Participants' comments suggested that they found the process fun and creative, while also unavoidably abstract. For some, the kit helped them understand their teammates' perspectives better—after the project was over—especially in terms of stress, productivity, and emotions at points throughout a project. In this sense, the format is more useful for surfacing—and reconciling—overarching understandings than probing deeply about specifics. But in triggering discussion, it has value in enabling members of a team to interrogate each other's perspectives and mental models of a situation (echoing ideas from Senge [4]). There is value in the reflection process for the team members themselves, even without any external analysis of the details.

***Value for HCI and design.*** Using design methods to generate knowledge is a growing approach within research through design, and various forms of modeling and metaphor-based work can make a contribution here to what might traditionally have been text- or interview-based forms of inquiry. Exploring which elements of mental models are shared between group members—and which are not—and the discussion around these issues once surfaced, can give useful insights for researchers seeking to understand understanding. For example, different metaphors used by participants could inspire a new form of interface design for life planning or project-management tools. Imagine collaborative project-planning software—or even an augmented reality or tangible interface—enabling team members to shape and annotate elements in a landscape such as that shown in Figure 6, where not just the other events (e.g., the career fair) in people's calendars, but also the *meaning* of them to people, along with each other's perspectives on communication, different visions for the project, and so on, were visible and engageable.

Beyond interface design, there is also something interesting in using these kinds of methods to shed light on the unexamined metaphors and mental models that are present in our collective (or not) societal imaginaries of abstract concepts such as technology, life, career, family, and work—and issues such as climate change, our relationship with nature, resources, artificial intelligence, mental and physical health, national identities and international migration, social equity, government, new forms of economy, and quality of life. As such, our aim in developing the kit further will be for it to be useful at multiple levels, from individual reflection to community-based participatory design workshops—giving a community the opportunity to reflect on and learn about its own thinking—and expanding beyond solely landscape metaphors.

## Endnotes


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