

DESIGN IS SHARING STORIES ABOUT THE FUTURE

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ABSTRACT

In design and development we create and share stories about the future of operational settings. These stories concern the impact of objects-to-be-created as a source of change in a field of practice. The beneficial changes envisioned provide grounds for recruiting investments and support for prospective organizational change. In effect the envisioned impact justifies the efforts needed to create and adopt the objects in question. However, research results gathered after the objects are introduced into fields of practice show that the stories of the future are often quite wrong. In other words, there is a gap between the envisioned impact of a new development and the actual impact and reverberations of that change. This paper analyzes the factors that make envisioning the future of technology change so fragile and uses this analysis to develop a decision support method for design as an envisioning process.¹

INTRODUCTION

If one listens to communications among technology developers and their sponsors, customers, and users, they tell each other stories about the potential benefits that will come from advancing or using some aspect of technology. The future of military operations, the future of air traffic management, the future of health care delivery are just a few arenas where this process is going on intensely as stakeholders respond to pressures to achieve higher levels of performance and improve productivity and efficiency (Woods and Christoffersen, 2002).

Quite often the problem to be addressed or the performance capability to be enhanced lies in the realm of cognitive work or coordinated activity.

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The stories about the future propose solutions that would occur if others support building the objects that embody the solution or the new capabilities that would enable such objects. The stories told are envisioned operations concepts (how operations will go in the future) and include both (a) new objects-to-be-realized and (b) a set of scenarios about practice.

Stories of the future focus on anticipated benefits and attempt to obtain the listeners consent or buy in (i.e., those benefits will flow from that development). Once buy in is established effort shifts to building the object that embodies the solution—create-this-object-within-these-parameters. The framework of expectations for the parties involved in the development process is that the benefits envisioned in the conception will come to pass (and only those effects will come to pass). Hence, development naturally runs toward technology centered paths (overcoming obstacles and impasses in the process of realizing the object) as all assume that, if the object level expectations are met, the practice expectations will be met *automatically*.

However, the development efforts still rest on a base of hypotheses cloaked as stories told about the future (Woods, 1998). To design one must speculate about the impact of the object-to-be realized as a source of change in a field of practice. Hence, designs are not just objects to be realized but also hypotheses about the mutual fit of people, technology and the nature of work in that setting.

There is a gap between the envisioned impact of a new development and the actual impact and reverberations of that change (Woods and Dekker, 2000). Studies of technology change find that the actual results rarely match the design expectations and hypotheses (Flores, Winograd, 1988). First, this occurs because fields of practice are not static; rather demands, pressures and resources are changing. The introduction of new systems transforms the nature of practice in the form of new roles, new judgments, new

forms of coordination, and new paths toward and forms of breakdown. Second, practitioners adapt to the changes working around complexities and exploiting new capabilities as they re-shape objects to function as tools in their hands in ways rarely foreseen by developers and their advocates. Hence, a dynamic process unfolds where technology change generates a new set of capabilities and complexities, leading to adaptations by stakeholders, producing a changing mix of successes and vulnerabilities to failure.

In a process of historical revisionism, the successes become folded into a new story of technological inevitableness and the new vulnerabilities rationalized as just human error (which conveniently serve as further evidence for investments in new rounds of technology development).

As a result two questions face us: why is design so vulnerable to mis-foresee the consequences of technology change? And how can design anticipate the full range of effects of the changes-to-be initiated?

FOUR DIMENSIONS OF ENVISIONING

There are four basic dimensions to envisioning future operation concepts. Each of these have negative and positive poles with respect to the envisioning process (Dekker and Woods, 1999).

Plurality. There are always multiple versions of how the proposed changes will effect the character of the field of practice in the future. Different stakeholders have different perspectives on the impact of new objects on the nature of practice.

The downside of plurality is a kind of parochialism where we mistake a partial, narrow view as if it were the only or dominant view of the future of practice, unaware of the plurality of views across stakeholders.

The upside of plurality is the triangulation that is possible when the multiple views are brought together. In examining the relationships, overlaps, and gaps across multiple perspectives we are better able to cope with the inherent uncertainty built into looking into the future.

Underspecification. As a hypothesis and prediction about the impact of new objects on the nature of practice, each envisioned concept must be vague on many aspects of what it would mean to function in that field of practice in the future.

The upside of underspecification is the freedom to explore new possibilities. Innovation can occur by relaxing and

recombining multiple constraints and goals. This requires a search for leverage points and a sensitivity to the fact that new envisioned objects only become tools through use.

The downside of underspecification is remaining trapped in a disconnected, shallow, unrealistic view of what it means to practice then and now. When the view of practice is disconnected from the pressures, challenges, and constraints operating in that world, the view of practice is inherently distorted from the beginning, missing how the strategies of practice are adapted to these constraints and pressures. Starting from a distorted view of practice guarantees predictions that will prove wildly wrong as objects-to-be-designed come into contact with the pressures of actual practice. The difficulty is that in envisioning we are pursuing a moving target so that it is difficult to say how the current vectors of practice play into a changing future, called the envisioned world problem (Carroll and Rosson, 1992; Dekker and Woods, 1999).

Groundedness. Envisioned modes of operation are predictions about the effects of change on people, technology and work. As predictions, envisioned concepts can vary on a dimension of groundedness - are the predictions grounded on patterns derived from the empirical research base on how technology change effects the interplay of people, technology and work. The research base acts like binoculars helping design anticipate likely reverberations of change based on patterns abstracted from previous studies.

The downside is when envisioned concepts remain ungrounded from the research base on the actual consequences of the changes on people, technology and work. This is often the case as advocates recruit continued resource investment needed to develop objects-to-be-designed. Their claims about future impact are often at odds with or even contradict the empirical base.

Successful envisioning future operations demands that we develop means to ground predictions on relevant empirical results abstracted from observations in context. Understanding the dynamic process of change and adaptation will lead to better control of the innovation process at the intersection of people, technology and work. Armed with knowledge about the dynamics of change and adaptation, we can address potential side effects at a time when intervention is less difficult and less expensive (because the field of practice is already in a period of change and systems development is in the process of creating tangible objects).

Calibration. Finally, as predictions, envisioned concepts can vary on a dimension of calibration or confidence (calibration refers to how well we know how much we know). Envisioning a co-evolving, dynamic process of change and adaptation is highly uncertain. Advocates can easily become miscalibrated and overconfident that, if the systems envisioned can be realized, the predicted consequences and only the predicted consequence will occur. Instead, we need to recognize that our views of the future are tentative hypotheses. As such we need to remain open to revision and subject our hypotheses to empirical jeopardy in the face of feedback about actual patterns of change and adaptation.

<u>Property</u>	<u>Downside / Upside</u>
Plurality	Parochialism / Triangulation
Underspecification	Disconnected / Innovation
Groundedness	Ungrounded / Grounded
Calibration	Overconfident / Tentative

All who would design are susceptible to the fragility of envisioned world stories. To design one must speculate about the impact of the object-to-be-created as a source of change in a field of practice. The question is what standards should be applied to that envisioning process? What are envisioned world judgments based on? What should envisioned world judgments be based on?

THE ANIMOCK CONCEPT

The Animock concept is a process of creating and sharing stories about the future to enhance envisioning so that operations concepts

- are better grounded on empirical patterns of change and adaptation,
- serve as tentative hypotheses subject to empirical jeopardy,
- synchronize with the dynamics of change and adaptation,
- support anticipation of the reverberations and side effects of change
- enhance participation of diverse stakeholders in exploring and creating the future of practice.

Animock—or Animated mock up—links the scenarios told to that point with the design concepts sketched to that point in the design process in a public envisioning cycle (Figure 1). Animating mock ups of objects-to-be-realized shifts the focus from the development of the object itself to the role of the object in future operations. An animock reflects current views of future operations to various stakeholders for sharing, exploring, elaboration and critiques.

When we start with animating our design concepts we must consider the scenarios or stories of future operations. Animating an early design concept requires a storyboard, since how the concept behaves over time has to be specified. A story without such planning is a series of fortuitous coincidences, that only justify, rather than stress, the concept.

This focuses design-for-usefulness as a process of telling, sharing, and revising stories about the future across the different groups who have a stake in that future. This process does play out early in any design process, but typically it plays out in ways that are implicit, not open to revision, ungrounded, parochial, disconnected, and overconfident. The Animock is a critical tool to shift this exploration of possible futures into more positive channels. It focuses the process on the usually implicit story that accompanies sketches of design concepts. Sharing these stories invites richer exploration of future consequences and reverberations of the change envisioned, if we can support the process of telling these stories.

As the design evolves an animock evolves and becomes a tangible representation of what would be useful—a shared hypothesis that guides development, but a hypothesis open to revision as new evidence comes in to revise the model of success in future operational situations. As such, animocks have the potential to cope with the moving requirements problem in development.

Surprise in the Use of Animocks

Animocks in themselves do not produce better stories of future operations, rather they only make the stories dynamic, explicit, sharable, and critique-able. If they are used effectively they can reinforce the upside of the four dimensions or envisioning and guard against the downsides, this reducing the risk of errors of premature commitment in development projects.

The issue is how the animock helps designers prepare to be surprised as they explore the reverberations of the technology change in question. Surprises are events, behaviors, or side effects that were not anticipated in the design to that point. Surprises indicate places where what is anticipated about the character of future operations breaks down. This could occur from:

- ~exploring how people will adapt to work around complexities or exploit new capabilities,
- ~exploring how situations will place new complexities for practitioners to adapt to,
- ~exploring how developers’ model of practice is incomplete or off target.

Developers are making predictions as they make design commitments. An animock is a tool to play back these predictions in a new form as a staged projection of a possible future to be better able to see the tangible consequences of design decisions.

Animocks and Engines for Story Telling

An animock is more than a concept in a scenario; it represents the ability to play out stories of future operations. Animocks are part of a simulator capability or theatre for staging operational stories (Figure 2). As such three critical resources are required.

Animocks depend on (1) a setting or stage and the activities that will play out. This is a representation of the tasks and activities that practitioners will have to carry out through the artifacts and resources available. The stage specifies the space or range of conditions operators can occupy and constraints on their movement through these possibilities.

Animocks depend on (2) actors as a means to capture how people in the situation would see the situation as it unfolds. Since the animock is intended to serve as an observation tool, the theatre provides the ability to adopt and contrast multiple points of view as the story unfolds through actors assessments and decisions.

An animock, in a sense, provides developers and other stakeholders with the ability to see and experience a design and the anticipated operational setting through another participant's eye. This marks a change in viewpoint that is crucial. It allows designers to take a look into their anticipated world from an in-scene point of view and to question the assumptions that come with the usual omniscient god's eye view of development processes. This view from the inside is what prepares stakeholders to notice surprises – behaviors that fall outside their model of the future.

Animocks depend on (3) a set of drivers that initiate and pace activity—a storyline. The dynamic behavior that characterizes an animock relies on a script that defines keyframes across which things change. This temporal structure needs to be scripted to provide authentic pacing, synchronization demands, time pressure, anticipatory cues, and uncertainty.

Together these three components create or design a story (storyboard) that is open but constrained. Open in that the story can be elaborated or re-told depending on the perspectives gathered around the animock representing different knowledge sources about the nature of operations, about people in such settings and about the artifacts that people can manage as resources to accomplish goals.

Constrained in that the story is based on principles of narrative structure such as multiple perspectives and temporal pacing and on patterns in cognitive work and coordinated activity. These patterns from the research base, such as human-automation coordination (Billings, 1996), escalation of cognitive demands (Woods and Patterson, 2000), or oversimplification fallacies (Feltovich et al., 1997) serve as story archetypes to guide the creation and exploration of stories embodied in a series of animocks.

By navigating the temporal flow and shifting perspectives the varying perspectives gathered around an animock can look for surprising behaviors and constraints.

As Carroll has noted, “New tools alter the tasks for which they were designed, indeed alter the situations in which the tasks occur and even the conditions that cause people to want to engage in the tasks” (Carroll and Campbell 1988). Thus to design is to participate in the process of change with other stakeholders. The process plays out as we engage in a process of building and sharing stories that envision future operations - what it will be like to practice after the objects-to-be-realized have been deployed.

Animocks are a tool for steering envisioning toward the upsides of the four dimensions: a tool to help triangulate multiple perspectives to bring what lies ahead into better focus; a tool to connect envisioning to the pressures of practice; a tool to ground envisioning on empirical patterns at the intersection of people, technology and work; a tool to test and revise our hypotheses about the future to provide a continuous target about would be useful.

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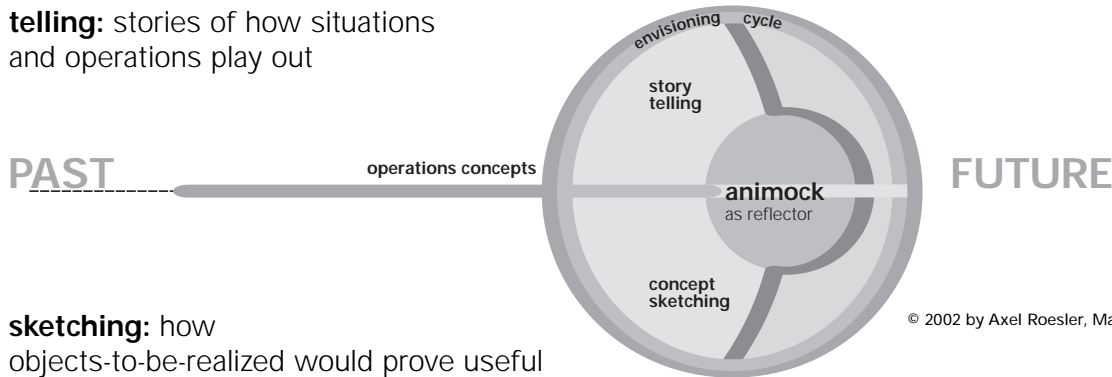
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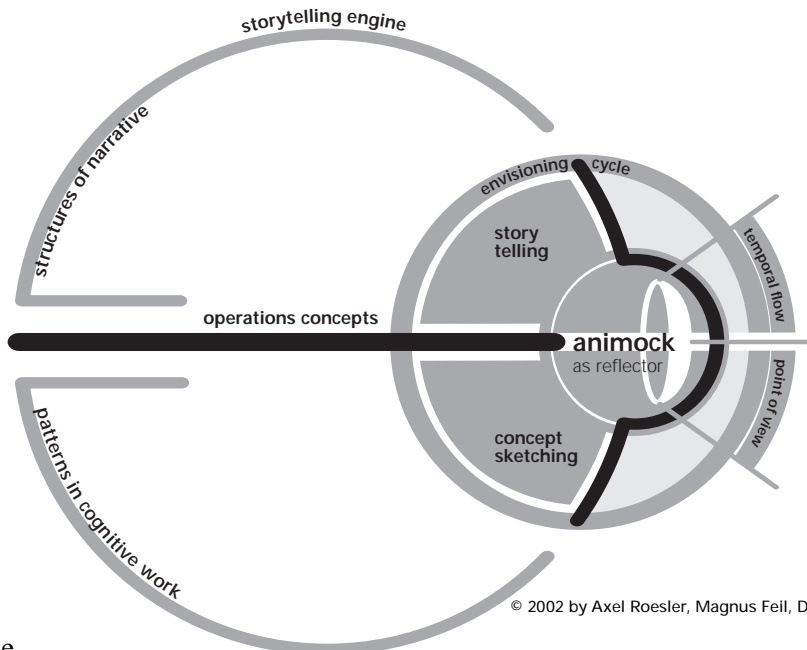
telling: stories of how situations and operations play out



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sketching: how objects-to-be-realized would prove useful

Figure 1. The Envisioning Cycle



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Figure 2. The Storytelling Engine