

## Exploring Challenges of Information Dynamics Using an Animock

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In this paper, we describe the use of an animated prototyping technique to elicit feedback on the usefulness of a set of modular design concepts for dealing with information dynamics in inferential analysis under data overload conditions. The design concepts were comprised of innovative solutions that utilized technology to assist in inferential analysis. The findings generally support the “promisingness” of the design directions for addressing information dynamics challenges in inferential analysis under data overload. Elicited feedback provides insight on how the concepts might prove useful to intelligence analysts in the field. Analysts recommended significant modifications that would be difficult to change post-implementation of software, suggesting that the animock technique was useful for exploring how design concepts could address challenging issues where no current software support exists.

### INTRODUCTION

It is well-known that cognition is fundamentally influenced by information dynamics. For example, Klein et al. (2003) have emphasized that the macrocognitive function of “planning” is better characterized as “replanning” in event-driven domains. Similarly, DeKeyser and Woods (1990) found that practitioners have trouble accurately revising assessments based on information updates.

In intelligence analysis, a specific type of inferential analysis (Schum, 1987), locating and incorporating information updates in analytic assessments has been found to be particularly challenging. In Patterson et al. (2001), there were three sources of inaccurate statements in verbal briefings made by 10 experienced study participants on the Ariane 501 rocket launcher accident: 1) applying default assumptions that did not apply to the case, 2) repeating inaccurate information in original documents, and 3) repeating information that was once considered accurate but was later overturned as new information became available. For example, a study

participant described that one of the impacts of the Ariane 501 failure was the cancellation of the Cluster satellite program because the Cluster satellite payload blew up in the explosion. Although that was correct for the time that the report on which he based the analysis was written, the program was later reinstated.

In this paper, we describe the use of an animated prototyping technique, so-called animocks (Roesler et al., 2005), to explore the usefulness of design concepts to address information dynamics challenges. Specifically, an animock was used in 2.5 hour focus group elicitation sessions at two intelligence agencies. The animock illustrated a set of modular design concepts, or “design seeds” (Woods, 1998; cf., Patterson et al., 2001), that covered the three high-level cognitive functions in inferential analysis: down collect, conflict and corroboration, and hypothesis exploration (Elm et al., 2005). The animock is a dynamic storyboarding technique that represents a potential envisioned world. In the current paper researchers present the concepts, findings from the focus groups, and discuss the use of animocks for eliciting

information about envisioned support tools for particularly challenging problems where no current software support exists.

## METHOD

Two 2.5 hour focus groups were conducted at two intelligence agencies. An animated mockup, or animock, was used to seed the focus group discussions. The animock illustrated how a simulated “generalist” analyst would use software with embedded novel concepts to provide a written response to the question: What are the wireless capabilities of the European Union in five years? Three to five senior intelligence analysts representing multiple areas of expertise attended each focus group. An overview of the Summer Institute on Data Overload conducted by the new interdisciplinary initiative at the Ohio State University, Converging Perspectives on Data (CPoD), was provided.

Three interdisciplinary teams consisting of a faculty mentor, graduate students, and undergraduate students in cognitive systems engineering, design, international relations (political science), and other fields comprised each team. In ten weeks, each team created animated mockups in Flash, animocks, describing how innovative software could address data overload challenges in intelligence analysis. Each of the three produced animocks were sequentially presented. Each animock took approximately five minutes to “play” how an imaginary analyst would use the simulated tool in a face valid but unclassified scenario to address a particular challenge. At the conclusion of playing the animock, the animock was replayed with pauses at particular points to elicit comments about the usefulness of design concepts (“seeds”) embedded in the prototypes. The discussion of each animock lasted approximately 30 minutes. At the conclusion of each discussion, all of the attendees were asked in “round robin” fashion to rank the top 3 ideas for usefulness from the animock. At the conclusion of all the presentations, the analysts were polled as to the most promising design directions across all three animocks.

### ELICITED FEEDBACK ON CONCEPTS TO ADDRESS INFORMATION DYNAMICS CHALLENGES

The animock also includes design concepts that address challenges other than information dynamics, such as supporting tangent searching. Here, the authors only describe the modular design concepts addressing information dynamics. These concepts span the three main cognitive functions in inferential analysis: down collect, conflict and corroboration, and hypothesis exploration (Elm et al., 2005).

*Down collect.* There were two design concepts illustrated in the animock for the down collect process. The down collect is the information gathering stage of inferential analysis. First, at the raw data level, which are primarily documents or text messages, the software provided a pop-up alert. The alert that a document referenced in a written briefing had been updated. How this concept would work is dependent on the capabilities

of machine processing algorithms. At the simplest level, a change to a document could be detected. Changes to documents are done in a formalized way at the two intelligence agencies studied and would be easy to detect. More complex algorithms might include “duplicate document” detection technology that recognized that similar documents, perhaps by the same author or with similar titles, were available with newer report dates. The analysts suggested that, since the false alarm rate for updates would likely be high, listing of updates might be provided rather than a pop-up alert. It was suggested that this listing might be continuously available as a side overview window, or could be provided upon analyst request (prompt, demand, etc.).

The second design concept was that the data could be collected and displayed at a more processed level where particularly important text is highlighted and displayed on a zoomed-out iconic representation of a document (or selected portion of a document) in a working area. This “magnified phrases” concept is displayed in Figure 1. Under data overload, hierarchies of magnified phrases, identified by folders or tags, would likely be needed to group related items. To address information dynamics challenges, analysts asked for these phrases to be sorted and viewed by various timestamps, including report date and other relevant dates.

*Conflict and corroboration.* There were three design concepts for the conflict and corroboration process to ensure information accuracy when working with magnified phrases. The conflict and corroboration process involves sorting of data. First, analysts wanted the ability to add free-text stickies (see Figure 1) to particular magnified phrases or groups or phrases to remind them to return later to verify information or conduct additional searches for information updates.

Second, the analysts wanted the ability to easily tag documents about the reliability of the magnified phrase or related document. This tagging would allow them to track information which might be more likely to be overturned, such as predictions about future events that may have happened between the time of the written report and the present time. For example, in Figure 1, the analyst has marked a magnified phrase with a green square tag to represent the information is reliable. During the second focus group, a number of options for tagging were discussed, including automatic versus manual tagging and structured versus unstructured tagging. The group of three senior analysts and one junior analyst eventually settled on wanting to add manual tags with only four levels: reliable, not reliable, questionable, no evidence. It was felt that the prior concept, the free-text stickies, could be used to flexibly.

Third, the analysts described that the recency of information is not the only consideration in information accuracy. Older information that comes from a particularly reliable source, such as a trusted covert agent, might be more trustworthy than more recent information from open source reporting. Through discussion, one focus group agreed that sorting magnified phrases by the following options would be sufficient: date, source, title, classification (e.g., classified versus unclassified), and types of intelligence (e.g., human intelligence versus

signals intelligence).

*Hypothesis exploration.* There were two concepts for the hypothesis exploration phase of intelligence analysis. First, the animock illustrated automatically ordering magnified phrases on a timeline by report date, with the option for the analyst to move the document to an event date that might be more significant (Figure 2). Analysts described wanting to select groupings of particular magnified phrases for the timeline, generating hierarchical timelines, removing magnified phrases, and support for transforming the defaulted timeline into a figure that would be incorporated into a

briefing, such as by replacing a magnified phrase icon with a label that could link back to the original document.

Second, an analyst asked for the ability to visualize and reconfigure emerging themes from working with a hierarchical timeline representation. For example, if manually created tags should be modified based on generating a more refined conceptual model, he wanted support for that process. Similarly, another analyst wanted support for seeing holes in an emerging conceptual model.

*Figure 1:* Design concepts for conflict and corroboration

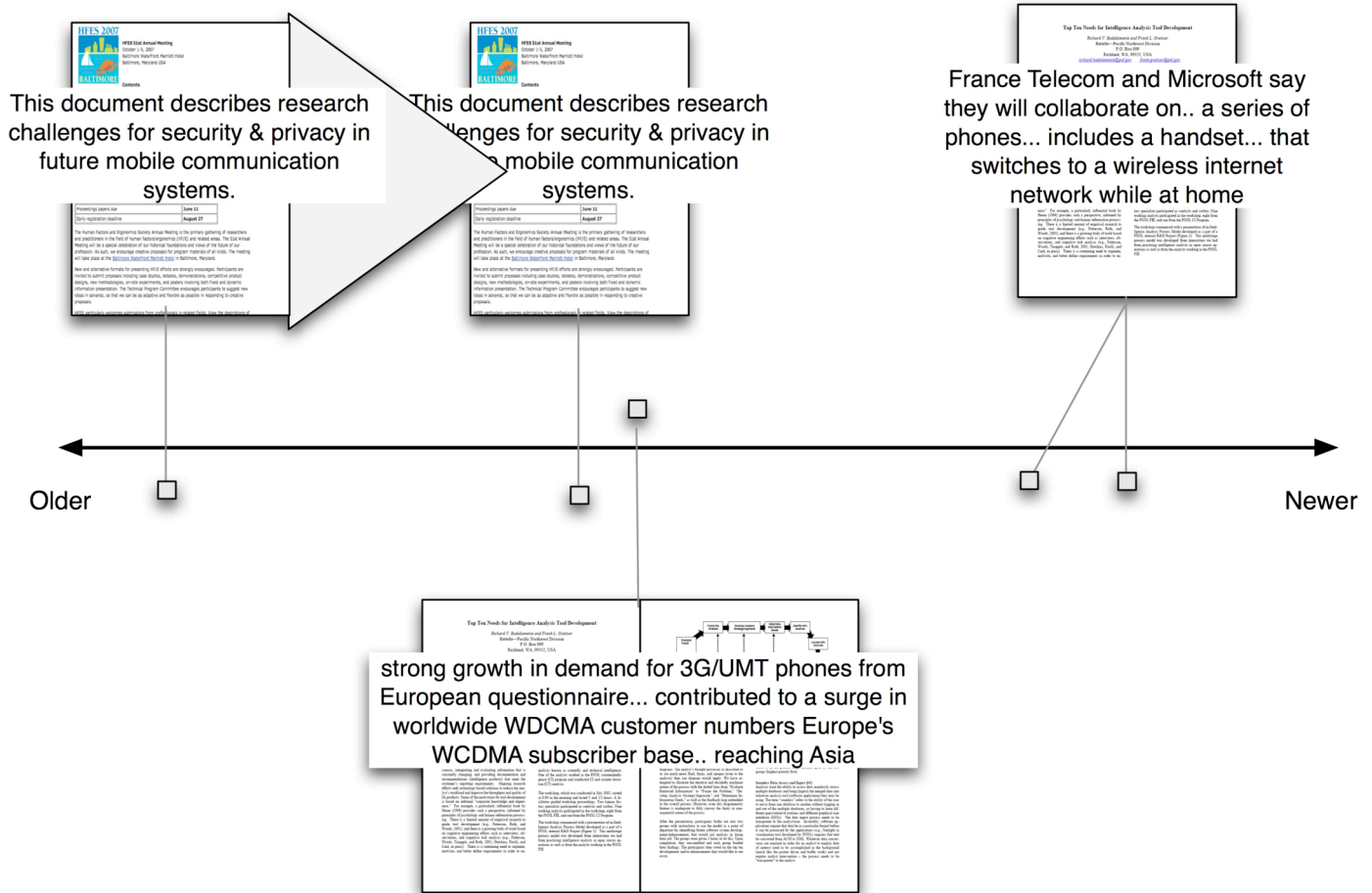


Figure 2: Movable timeline design concept for hypothesis exploration.

Overall, as summarized in Table 1, the animock technique elicited feedback both on how the design seeds could be modified to be more useful as well as generating ideas for additional design concepts. Note that this type of feedback differs significantly in the traditional type of feedback generated during usability testing in that nearly all of the modifications would be extremely difficult to make after software code has been generated.

Additionally, the feedback adds information about potential useful design directions that could be manipulated in subsequent designs. The animock simulated an analyst completing a task rather than having a functioning prototype, with allowed the researchers to elicit information specific to the design concepts rather than the usability of the system. Finally, analysts commented on how that was a useful idea but what would be more useful is what is illustrated by the feedback. Thus, the animock served as an illustration of an envisioned system that resonated with the analysts and provided them with a tangible vision on which to start providing feedback. Further the animocks showcased potential challenging problems within the realm of inferential analysis, which were further expounded upon and re-framed by the participants.

The animock was relatively simple to make and is a self playing illustration which creates a talking point in which to elicit feedback about design concepts as well as future directions to be explored. The benefits of this type of session is the nature of the knowledge elicited builds on the researcher's envisioned world and current world. This technique is limited in that this information is a good starting point but needs further refinement and testing before actual implementation.

In this paper, we described the use of an animated prototyping technique to elicit feedback on the usefulness of a set of modular concepts for dealing with information dynamics in inferential analysis under data overload conditions. The findings generally supported the potential capability of the design directions for addressing challenges in inferential analysis and offered insight on how the concepts might prove useful to intelligence analysts in the field. Nearly all of the feedback would require significant modifications that would be difficult to change post-implementation of software.

Table 1: Summary of design concepts with elicited feedback

Cognitive function	Design concept	Elicited Feedback
Down collect	Pop-up box that a referenced document has an update	Want “on demand” list of possible updates to documents rather than pop-up alert due to high false alarm rates
Down collect	Magnified phrases	Viewing magnified phrases by report and other dates*
Conflict & corroboration	Magnified phrases	Adding free-text “stickies” as reminders to return later to verify information or conduct additional searches for information updates*
Conflict & corroboration	Magnified phrases with automated and manual tagging	Have manual tags with only four levels for accuracy of a magnified phrase: reliable, not reliable, questionable, no evidence
Conflict & corroboration	Magnified phrases	Sort phrases by date, source, title, classification level, and types of intelligence data*
Hypothesis exploration	Magnified phrases on timeline	Select groupings of particular magnified phrases for the timeline, generating hierarchical timelines, removing magnified phrases, and support for transforming the defaulted timeline into a figure for a briefing
Hypothesis exploration	Magnified phrases on timeline	Ability to see emerging themes, reconfigure tags, and detect holes in emerging conceptual model

\* New concept or functionality elicited during focus group session

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