Faction Display: Visualizing the Spectrum of Risk Estimates in a Terrorist Attack

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ABSTRACT
Detecting biased information, and deriving an accurate assessment of issues or situations from a pool of information representing multiple factions, are challenges for which intelligence analysts have developed strategies. These include researching sources, submitting products for peer review, explicitly contrasting pro vs. con positions, and comparing predictions along a spectrum of optimism/pessimism. We explore the concept of a Faction Display as a means to use visualization to support awareness of the location of a source along a spectrum of opinion. It can be used to place estimates or other assessments in the context of the source’s position among the set of factions in play. The Faction Display concept is illustrated as a “design seed” placed within the context of a safety analysis case study; the concept displays relative estimates for safe distances from Liquefied Natural Gas (LNG) pool fires resulting from a terrorist attack.

Keywords
Information analysis, visualization, bias, intelligence analysis, fixation, representation aiding

INTRODUCTION
Uncertainty and controversy are typical in topics addressed by intelligence analysts. People who can provide information on the issue at hand often are invested in some fashion with a particular interpretation. Put more strongly, people on different sides of an issue can be seen as belonging to “factions”. A faction is defined as a group with a unified stance towards a set of decisions that is in opposition to stances of other factions. Members of a faction can often be recognized by the preferential use of particular terms and frequent statement of “facts” that distinguish their stance from others. A source of information available to an analyst may represent the interpretation of a particular faction. The use of this information as neutral, or otherwise representative of more than just a narrow slice of the spectrum of stances on an issue, could result in wildly inaccurate assessments of the current situation as well as predictions for future trajectories. In addition, a common oversimplification in analysis is to treat an organization as homogeneous when it is actually comprised of competing factions with differential intent (Herrman and Fischerkeller, 1995).

In this paper, we describe strategies used by experienced intelligence analysts to avoid incorporating skewed estimates or accounts in analytic products. We propose a “Faction Display Concept” to make this process easier, particularly under data overload conditions. An implementation of the concept for use with quantitative estimates is presented with a case study: estimates on the distance away from a Liquefied Natural Gas terminal required for minimal protection from radiant heat from a fire due to an accidental or intentional spill and ignition. We discuss potential limitations and directions for further research in this area.

SENSITIVITY TO BIASED SOURCES
The potential for sources to be biased is well known in the intelligence community. Davis (1997) recommends being explicit with the characteristics of sources in reporting, and discusses factors by which to characterize sources, including: the strength of their claims (including how direct or indirect the source is from the event in question); expertise; affiliation (e.g., US government, foreign government, media, activist group); history of reliability; history of disposition or bias; and likelihood of deception.
We have conducted a number of observational studies and interviews with professional intelligence analysts (Trent, Voshell, and Patterson, 2007; Zelik, Patterson and Woods, 2007; Grossman, Woods and Patterson, 2007; Miller, Patterson and Woods, 2006; Elm, et al., 2005; Patterson, Roth and Woods, 2001). In every study, every analyst has shown sensitivity to the potential for skew in estimates based on bias.

Even when the source is a recognized expert in an area, analysts reported the need for caution. Quotes compiled from a number of interviews with senior intelligence analysts include:

- “Experts can get you into trouble.”
- “People can be extremely knowledgeable and convincing and still be wrong”
- “You can over-listen to experts.”
- “If you are a Weapons of Mass Destruction expert, you will always see Weapons of Mass Destruction. You are primed to find what is your expertise, so you have a built-in bias.”

In addition to unintentional bias, analysts have identified concerns relating to intentional deception. In many cases, area experts are aware of the potential impact of their work on policy, military, and business decisions. As stakeholders in decision outcomes, they might purposely skew their interpretation in order to influence a desired course of action – in the most extreme case because they are acting covertly for other relevant groups or nations.

STRATEGIES TO DETECT BIAS

Two strategies were described to detect bias: 1) investigating the backgrounds of key figures, and 2) peer review.

Investigation of Backgrounds

In interviews, several analysts reported explicitly using the names of key figures in “tangent searches” (i.e., without other terms in the search string) in order to obtain background information that might indicate tendencies to be biased in particular ways. For example, a particular figure might be affiliated with an extremist group. Similarly, the person may have a financial or other relationship with a group with an agenda. An interesting variant on this is “leadership analysis.” One analyst stated that leadership analysis is one of the best types of analyses done by their agency. Specifically, the agency aids (primarily international) negotiations by learning about topics to avoid (recently deceased relative, strong opposing view on a controversial topic) as well as identify common ground that could be used to build rapport (both like tennis, common acquaintances).

Peer Review

Peer review was by far the most commonly cited technique to detect bias (although note that analysts used other language, such as “sanity checks”; “poking holes in an argument”; “throwing bullets at a theory”; “testing to see how much meat is on the bone”; “having a fresh pair of eyes look it over”; “track changes”; “are you seeing what I am seeing from this?”). Interestingly, the peer review strategy can be helpful even when a specific bias is not detected. Nevertheless, peer review for senior analysts and supervisory review for junior analysts reportedly includes a strong focus on reminding analysts of the vulnerability to over-relying on one particular source or expert interview. Peer review is considered so important in identifying unbalanced perspectives, which are factored in heavily in an assessment, that a strong and pervasive social norm was to have an informal peer review prior to presentation to a supervisor – and an even stronger, usually formalized expectation of peer review prior to presentation to a customer. Benefits were generally viewed during the initial framing of the problem (“hypothesis”), after an assessment is nearly complete (“explanation”), and before presentation to a customer/policymaker (“story”).

STRATEGIES FOR MANAGING INFORMATION FROM POLARIZED FACTIONS

Two individuals described strategies that they personally used on a regular basis to manage predictable bias due to association with a polarized faction on an issue.

Read For/Read Against

Intelligence analysts can have hundreds to thousands of folders stored on a personal computer. One analyst who primarily did high-level strategic analysis reported filing electronic documents under “For it” to represent the stance that a country had a particular technological capability or “’Agin’ it” for the opposing stance that the evidence was insufficient to warrant that the country had the capability. The analyst stated that the For folder is almost always much larger than the Against folder. Labeling the folders had a number of impacts on the process: 1) it served as a reminder that there were two positions given the larger representation of the For stance in the data collected by the agency, 2) it supported the strategy of reviewing both positions separately during the analysis process in order to judge which case was stronger, 3) it increased the weight of
consideration given to the Against faction given that arguing the null hypothesis (there is no capability) is a significant challenge when there will always be at least some evidence that there is, even if purposely deceptive evidence manufactured to achieve a political end.

Bracketing the Prediction Spectrum

One analyst primarily did short-turnaround (2 days) technology forecasting assessments for internal customers. His products generally included 4-6 paragraphs, where the last paragraph focused on prediction, which he viewed to be the paragraph most heavily influenced by bias. Due to the nature of the subject content, he never included documents that were written more than two years before. He stated that considering bias for the analysis on the first two or three paragraphs, which tended to be on past events, was less critical than for later paragraphs. His process was primarily paper-based in order to easily integrate open source (unclassified) and classified material. He printed and organized relevant documents by paragraph. Although he was a generalist in terms of the technologies that he researched, there were repeating patterns in terms of bias. Certain sources tended to be optimistic whereas others tended to be pessimistic regarding the rate and extent of technology adoption. For example, technology companies in press releases tended to be highly optimistic, which would be consistent with business objectives. Other technology-watchers were jokingly referred to as “Luddites,” including financial analysts known to be highly conservative. He would specifically sample both ends of what he guessed would “bracket” the range of opinion as well as sample sources that were expected to be moderate in that they would fall in-between these predictions. For the final paragraph of his report (but not any other portion), he would cut and paste a paragraph that clearly justified a reasonable and believable basis for prediction that was not close to extreme ends of the spectrum.

FACTION DISPLAY CONCEPT

The concept of a “faction display” builds upon the insight that there are likely to be two or more factions in polarized debates that fundamentally disagree on assumptions and interpretations on which estimates are based. A faction display is visualization approach that allows an analyst to compare and contrast the stances or positions of different stakeholders relative to an issue of contention. The data on expert strategies suggest that, with current support tools, significant effort is willing to be invested when there is perceived to be a high risk of variability of opinion. Experts explicitly sample the ends and middle of the spectrum of estimates in order to avoid relying upon a narrow range of skewed estimates. The primary potential vulnerability is incorporating a skewed estimate, either by not realizing that there are multiple factions with differing estimates, or by not realizing a personal tendency to align with one of the factions (disregarding other estimates and thus losing the neutrality objective). The means for addressing these vulnerabilities require being aware of the range of positions (as opposed to assuming that any one source is sufficiently inclusive). Visualization tools offer a method to support awareness of the range of positions and where (and why) each source fits in the distribution (see Woods, Patterson and Roth, 2002).

Specifically, there are several analytic functions (Elm, et al., 2005) for which the faction display concept might be useful:

- Down collect: display search results which highlight estimates on a parameter to identify the range of the opinion spectrum
- Down collect: encourage broadening search to include terms associated with other factions for the same concept
- Information validation: verify that members of a faction agree on an estimate
- Information validation: identify the estimates associated with each faction
- Hypothesis exploration: provide a location to document assumptions behind estimates
- Story construction: justify a number contained in an analytic product by providing access to the basis for the estimate in relation to alternative estimates
- All functions: Aid peer review and collaborative cross-checking by providing a shared representation of factions and associated estimates, assumptions, and terms

Design Seed for Display of Spectrum of Estimates

Often many debates over issues with technical considerations revolve around varying quantitative estimates. These types of cases offer a starting point for exploring the use of semi-automatic methods of generating a visual display of the spectrum of positions on a polarized issue. We have developed a “design seed” and have applied it to a current topic of polarized debate by different factions in order to explore this concept.

One issue in the debate over the safety of Liquefied Natural Gas (LNG) terminals is the range of dangerous radiant heat coming from an LNG fire. Supplying a search engine with elements of the radiant heat limit (5 kW/m²) and a request for a range of numbers results in documents from sources that are both in favor and opposed to siting LNG terminals in the United
States. Capturing metadata information allows further organization of the display, such as sorting the estimates according to what type of organization provided the information. See Figure 1.

No software products have yet been discovered that explicitly support detecting and tracking biases in numerical estimates (Elm, et al., 2005). Existing tools can theoretically be tailored fairly easily for this use in that the application to numerical estimates can be viewed as an extension of tracking the source for textual material. There is potentially a role for automated algorithms at various points in the process, although it is highly unlikely that any completely automated process can address bias issues.

As the graphical display in Figure 1 depicts, estimates that are extreme, or otherwise do not follow general patterns, are easily recognized as such. The estimate and the source can be quickly evaluated. In the case depicted here, it was determined that one extremely large estimate was based on modeling a more catastrophic incident than the others. Another estimate was identified as lower than would be predicted based on its source (a government web site). Upon investigation it was determined that a consulting group with strong industry connections developed the report. The patterns presented in the visual display offer cues that those particular estimates warranted further scrutiny.

This design seed incorporates capabilities for the user to re-order and add or delete estimates, edit metadata, and make annotations to estimates. This supports flexible use of the tool. Such flexibility may allow it to be used for a broader range of issues, including more qualitative sorts of issues. This specific approach depicted here is limited to the topic of quantitative estimates ranging along a single dimension. Its utility in these circumstances depends on the range of estimates on the topic, and how the estimates relate to a stance on the topic.

There are also more subtle possible drawbacks. When a computerized interpretation of a situation is off (due to an incomplete model of the world), a user is confronted with greater cognitive challenges, and performance suffers (Smith, McCoy and Layton, 1997). Another risk would be the product of too much success; a possible response from factions to the use of this technique by analysts would be to game the system by producing redundant estimates disguised as being different.

As is the purpose of a design seed, it points out many possibilities for expansions of the concept:

- Identifying the basis of differences between sets of estimates (e.g., one outlying estimate based on different assumptions vs. strong differences between types of sources)
- Adding additional tradeoff dimensions (e.g., short-term vs. long-term, economic growth vs. social protection) that supplement the basic “pro-con” dimension
- Locating “factions” with “stances” towards one decision that are grouped into “coalitions” on these dimensions (possibly using source information beyond automatically collected metadata)
- Grouping reports/data as a second level behind this display
Overlaying multiple displays for “profiles” of one individual or organization over time and on multiple decisions
• Using faction-specific search terms as a broadening tool and source-discriminator
• Using the display to aid analyst-analyst debates on controversial interpretations
• Using the display to aid analyst-policymaker communication, such as how to build consensus or stimulate conflict (“empire building”)

This list of expansions should convey the numerous possibilities for not just this specific design seed but also for larger faction display concept.

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