Data-Frame Theory of Sensemaking as a Best Model for Intelligence

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INTRODUCTION

Creating intelligence is a cognitive activity. Intelligence professionals – while they may use specific techniques or tools in their work – primarily *think* in order to understand complex causation and project to the future. Such meaning helps decision-makers and other consumers of intelligence understand how they can (and perhaps must) act to protect and further the goals of the nation.

In this paper we build upon earlier work introducing a "data-frame" model of expert reasoning, originally proposed by Gary Klein and his colleagues.[1] We apply this model as a transformational approach to intelligence creation. We contrast the data-frame theory to earlier, notable models for intelligence activity as proposed by Willmoore Kendall and Sherman Kent. We next discuss intelligence sensemaking in terms of the data-frame model and how that model is manifested in an intelligence context. We apply the model in a case study—that of the 1962 Cuban Missile Crisis—showing how the data-frame structure adds efficiency and clarity to intelligence creation processes.

The data-frame model emerged in the study of expert decision-makers. It expresses the core process of sensemaking as it occurs in high-end, proficient problem solving. At the same time, the data-frame model allows for expression of some of the reasoning traps that are commonly referred to as "biases." Our argument is based on the notion that intelligence activity is fundamentally a form of critical thinking and a process of sensemaking.[2]

COGNITIVE PRESUMPTIONS

The "heuristics and biases" approach seems to be the popular dominant view in explaining why people do not always make optimal judgments. It presumes that cognition is to be described largely, if not exclusively, by reasoning biases or weak general heuristics. By contrast, our approach derives not from the psychology literature of the 1970s-80s, in which dozens of biases were first disclosed in the academic laboratory. Rather, our approach derives from the study of domain experts. We interpret "biases" as cautionary tales that are entirely appropriate lessons for trainees, but are not fundamental cognitive processes, necessary limitations to the human capacity to make sense of things, and certainly not apt descriptions of how experts think. Our view is that the underlying "theory of the handicapped mind" is incomplete and indeed inaccurate, as well as demoralizing. An immediate practical question that emerges from these two contrasting views is whether analysts need tools designed to mitigate bias or whether they require tools to amplify and extend the human capacity to make sense of things.[3] To begin our presentation of the data-frame theory, we start by introducing a distinction between two approaches to the modeling of cognition: the microcognitive versus the macrocognitive.

MICROCOGNITION VERSUS MACROCOGNITION

In this era of techniques and tools, it is customary to describe intelligence analysis as a step-wise process. Such descriptions tempt because they are nice and tidy: Data are sensed; then long-term memory is accessed and data are (magically) transformed into information; information is then (miraculously) transformed into knowledge, which is then used to make decisions and take actions. This information processing or "microcognitive" viewpoint has been the dominant paradigm in cognitive science for decades, and has been carried over into military domains under the guise of OODA loops (observe-orient-decide-act) and the psychological study of intelligence analysis.[4] It has brought with it the notion that cognition, even expert cognition, is necessarily and constantly handicapped by a plethora of biases (some 40 and still counting) that can only be accommodated by reliance on flawed and simplistic heuristics. Claims are made that biases characterize all humans, including experts, and are inescapable even if you know about them.

In recent decades books have appeared bearing such titles as *Predictably Irrational*, *Bozo Sapiens, Mistakes were made but not by me,* and others.[5] It would seem that a

cottage industry has emerged, leveraging what should be limited empirical claims about human fallibility in certain kinds of reasoning contexts, and turning them into a popular myth that all humans are necessarily, unavoidably, and inescapably biased in all their reasoning and activity. The gist of these books is that we humans are cognitively handicapped: Based on this perspective we should still be living in trees.

Instead, we present an alternative view from the field of "macrocognition." At this scale, the important processes are not biases of attention, millisecond-level shifts of attention, hit rate in probability estimation, or reaction time access to long-term memory. While such micro processes are of interest in the academic experimental psychology lab, they are not very useful in the attempt to understand complex cognitive work. What *is* of importance in "the real world" are processes associated with sensemaking, including problem detection, re-planning, and mental projection to the future.

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Furthermore, it is critical to note that in the exercise of the human ability to apprehend events these macrocognitive processes are parallel, continuous, and highly interacting. For instance, research has shown that high-end causal reasoning about complex problems does not always have clear-cut beginnings and endings.[6]

The various macrocognitive processes, such as mental model formation and collaboration with others, seem to go on more or less at the same time, influencing one another all the while. Macrocognition does have its punctuated moments, such as the realization that one has determined the cause of something, or the decision to seek particular evidence. Attention might be focused (or we might say "consciousness might be occupied") primarily with mental imagery that projects a situation into a hypothetical future. By contrast, theories of cognition in the microcognitive tradition have taken such punctuated moments and stage-like phenomena and elevated them to the prototype. However, such simple chain or step-wise theories of cognition (including the cognition of intelligence professionals) do not now, and will never, reflect the reality of actual cognition.

MAKING SENSE OF MACROCOGNITION

In studying cognitive activity—such as that related to creating intelligence—it is important to remember that "when the tasks that people are doing are complex, it is not enough to simply observe people's actions and behaviors—what they do."[7] While certain intelligence creation activities are not complex, we observe that many and perhaps most are. Therefore, when one seeks to understand how the intelligence is being created one must "find out how they [the intelligence creators] think and what they know, how they organize and structure information, and what they seek to understand better."[8] What this means is that the mechanics of the task can matter less than the motivation behind the task. As Beth Crandall and others observe, "In complex systems, it is not always the literal action sequences—the steps—that matter as much as the fact that practitioners are trying to get things done; they are not simply performing sets of procedures."[9]

Klein and others add that such "sensemaking goes well beyond the comprehension of stimuli."[10] They write:

> Practitioners in real-world domains must confront and understand complex, dynamic, evolving situations that are rich with various meanings. Though practitioners spend considerable time perceiving stimuli, the stimuli tend to be very complex (e.g., the weather forecaster looks at a satellite image loop) and come in many forms, not just one (e.g., tabular weather data, forecast text messages, computer model outputs, graphics of all sorts, etc.). Furthermore, there is nothing like an "endpoint" since the understanding of dynamic events requires that the understanding itself be dynamic, not a stored, frozen "meaning."[11]

Klein's description also resonates in intelligence work, a macrocognitive activity. As defined by Pietro Cacciabue and Erik Hollnagel, macrocognition "indicate[s] a level of description of the cognitive functions that are performed in natural (versus artificial laboratory) decision-making settings."[12] As characterized by Klein and others, macrocognitive decisions are typically complex, often involving data overload…[and] are often made under time pressure and involve high stakes and high risk… Goals are sometimes ill-defined, and multiple goals often conflict. Decisions must be made under conditions in which few things can be controlled or manipulated; indeed, many key variables and their interactions are not even fully understood.[13]

These characteristics describe the real-world situations in which intelligence professionals find themselves: They work with overwhelming volumes of data that arrive rapidly, are highly volatile, and may contain sparse and noisy information. Tasking is often unclear and the phenomena about which sense must be made are not well understood. These phenomena might be labeled as "wicked problems" or "social messes," meaning (among other things) that they have no knowable, let alone clear-cut, right or wrong solutions.[14]

The macrocognitive paradigm recognizes that the practices involved (in this case with intelligence creation) occur in the real world (versus the psychology laboratory). This contrasts with the microcognitive paradigm within a laboratory setting where one considers the "invariant processes that serve as the basis for all kinds of thinking and perceiving."[15] Microcognitive approaches estimate probability and uncertainty in an attempt to solve puzzles.[16] How they contrast with macrocognitive foci is shown in the table. We find in these distinctions and ideas from the study of experts a comparison that helps us make sense of approaches to intelligence sensemaking.

Macrocognition phenomena of concern to domain practitioners	Parallel traditional microcognition topics of concern to cognitive scientists
Planning and problem detection	Puzzle solving
Using leverage points to construct options	Strategies for searching problem spaces
Multitasking management	Serial versus parallel processing models
Uncertainty management	Estimating probabilities or uncertainty values

Table: A comparison of macrocognitive and microcognitive foci.

Source: Klein, et al., "Macrocognition," 82.

In adopting such a microcognitive model, intelligence committed a "Fundamental Elevator Error" (that we alluded to above): The exception to the rule (cognition sometimes does seem to proceed in discernible steps with clear endings and beginnings) was elevated to the prototype. What is a better and more useful alternative? We believe it is the "Data-Frame" Theory of Sensemaking (D/F Theory) and we turn to this in more detail next.

DATA/FRAME THEORY

We know from studies of expert decision-makers in diverse domains, ranging from business leaders to military commanders, that the starting point for sensemaking is recognition of a situation or a problem, which is understood in terms of some sort of framework or story.[17] The determination of an initial understanding (referred to as a "frame") is a *necessary* first step in making sense of things. The frame results as one—often tacitly—asks, "What is going on in this situation?" A frame is necessary because it specifies what counts as data. Klein, Brian Moon, and Hoffman note that, following the comprehension of data through the formation of an initial frame, there are alternative reasoning paths. One involves questioning the frame.[18] This in turn leads to an elaboration of the frame or the formation of an alternative frame—referred to as "reframing."

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Elaboration and reframing occur frequently when people are confronted with, or discover, new information from developing situations. They may engage these processes to find explanations and causes for what is occurring. Such understanding can in turn provide information on how to respond, or on how to probe for further clarifying information. An example can be seen in the news media's explanations of rapidly developing "crises" and normal events, reporting changes to reflect reframing based on iterative understanding of emerging situations.

The disturbances in the Middle East during 2011 are a case in point of how issues are framed and those frames are questioned, preserved, or reframed. The descriptions of the evolving situations and interpretations and explanations of them provided by news reporters changed repeatedly, even continually, as indeed they should. At first, former Egyptian President Hosni Mubarak was characterized as staying in power because he was said to have the support of his military, and next was said to have resigned because he lacked the support of his military. More reframing occurred when Mubarak was believed to be about to resign but then did not do so. One cause of this belief was that he was about to address the Egyptian nation. Such a speech – it was said – *must* be about his imminent resignation. Yet, Mubarak neither announced his intention to resign nor did he do so during the speech.[19]

APPLYING THE DATA-FRAME MODEL TO SENSEMAKING

The D/F model is shown in figure 1. In looking at this, one notes that it seems unusual compared to step-wise models such as information processing ones. For instance, there is no "exit" point—when intelligence is created. There is no box that says "start here." Indeed, the model is all chickens-and-eggs. (Figure 1)

What is important is that one makes certain observations or receives certain evidence, and in making sense of these "data" one develops a notion or *frame* about what they represent. That frame is highly dependent on knowledge—other related frames that define what the data are that lead to the new frame. For example, unless one has pre-existing frames about what is (and is not) a cow, one cannot identify what that brown and white horned animal is. Here it is also germane to note that different people will have different frames about what a cow is. As Ellen Langer notes, "[a cow] is a steak to a rancher, a sacred object to a Hindu, and a collection of genes and proteins to a molecular biologist."[20] One may even carry differing frames simultaneously. One might be both an adherent of Hinduism *and* a molecular biologist, *and* even a resident of rural Texas, and thus have different contrasting frames of what constitutes a cow. Generally, while one frame may predominate at one particular time, people can and often do consider multiple frames.[21]

Further, one's reasoning does not stop at this point. The next task in which one might engage is to question the dominant frame. One gauges the quality of the data in order to detect, identify, and track inconsistencies. One assesses the plausibility of the frame. If the frame seems plausible then one might next seek to elaborate the frame. Here one seeks additional data and discards data that are irrelevant.[22] New relationships within data sets are explored. This may lead to a morphing of the frame, resulting in either an enriched frame or a different one requiring additional questioning. With two (or more) competing frames one might compare them to see which is (or are) most plausible. Continued interpretation of data through the frames leads to searches for yet more data that might either deny or clarify the plausibility of the existing frames. It should be noted that this ongoing interactive and iterative process may lead to a determination that more than one frame may provide a convincing interpretation of the phenomenon being examined. Such is the nature of complex, indeterminate causality.

In addition to describing the ebb and flows of expert reasoning, one can chart paths through the D/F model that would characterize reasoning which some would identify as biased. How this works in practice becomes clear if one considers a case study—in this instance, a notional review of the U.S. Intelligence Community's examination of events occurring in Cuba during the spring, summer, and autumn of 1962 (the precursors to what became known as the "Cuban Missile Crisis").

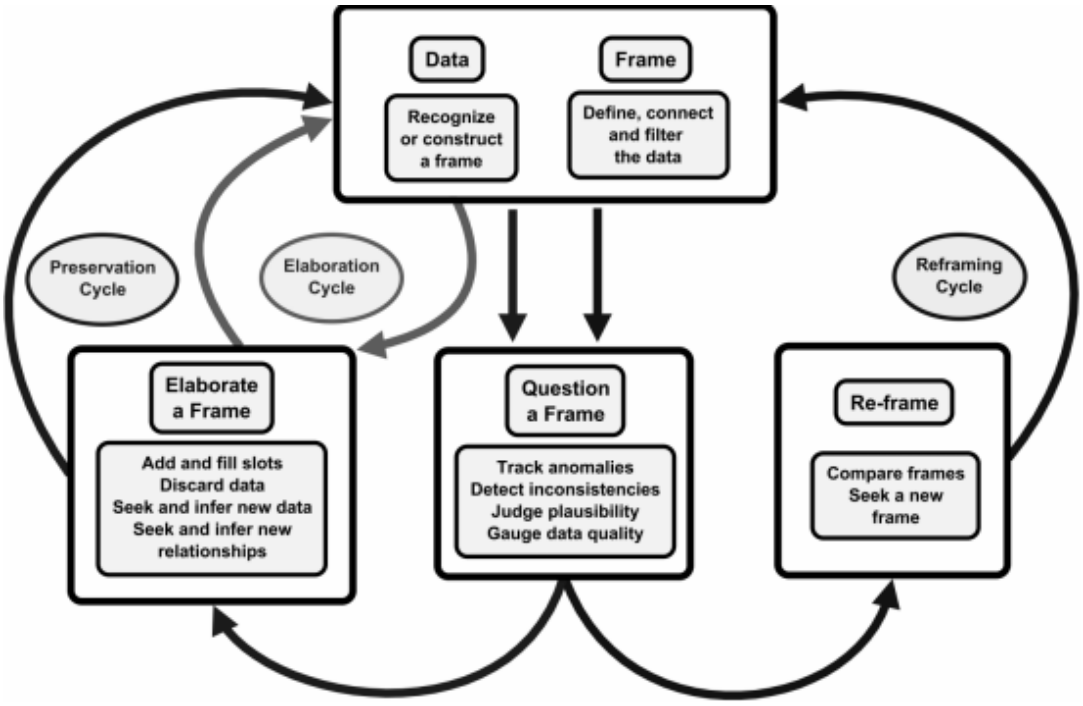

Figure 1: Data-Frame Theory of Sensemaking.
Source: Robert R. Hoffman, 2011.

A DATA-FRAME ANALYSIS OF THE 1962 CUBAN CRISIS

Defining the Frame

During the spring, summer, and early fall of 1962 a number of anomalies were observed in and related to Cuba. Among other things, it was observed that ships allegedly carrying grain to Cuba were riding too high in the water for this to be the case. Refugees were reporting "farfetched tales of African troops with rings in their noses, lurking Mongolians, and even Chinese troops."[23] Amid this noise were troubling reports of Soviet troops and materiel (including nuclear missiles) on the island. Indeed, as made sense later, "there were literally thousands of reports of missiles in Cuba in the period *before* any missiles were actually brought there."[24] Behind such observations was a high state of tension between communist Cuba and the anti-communist United States. Such tensions also were exacerbated by the abortive invasion by Cuban refugees backed by U.S. forces at the "Bay of Pigs." Such evidence led to the creation of a frame notionally depicted in figure 2 about what was going on.[25]

The nuclear missile frame is an example where pre-existing frames about what constitutes a nuclear missile filter the data (in this case the reports of the refugees). A prevalent and pre-existing view about nuclear missiles was that they were strategic weapons and therefore the frame was of strategic *offensive* nuclear missiles (such as the medium-range SS-4 and intermediate range SS-5 nuclear missiles that were subsequently discovered in mid-October 1962). What was not in the pre-existing frame was the idea that nuclear missiles could be tactical and *defensive*. Thus, evidence (the refugee reports of nuclear missiles) was discredited because other evidence of strategic missiles being deployed to Cuba was ambiguous. While Director of Central Intelligence John McCone believed nuclear *offensive* missiles were present based on the fact that SA-2 air-defense radars were seen on the island, he "apparently reasoned that the purpose of installing such expensive missiles had to be greater than merely denying the United States overflight capabilities (the SA-2 could shoot down, as Francis Gary Powers discovered, a U-2)."[26] What was not considered, it seems, was that the reports might refer to 100 nuclear-tipped tactical cruise missiles deployed on the island during the spring and summer of 1962.[27] Their purpose was apparently defensive. The offensive nuclear missile frame led to filtering of the data that prevented the consideration of this alternative perspective.

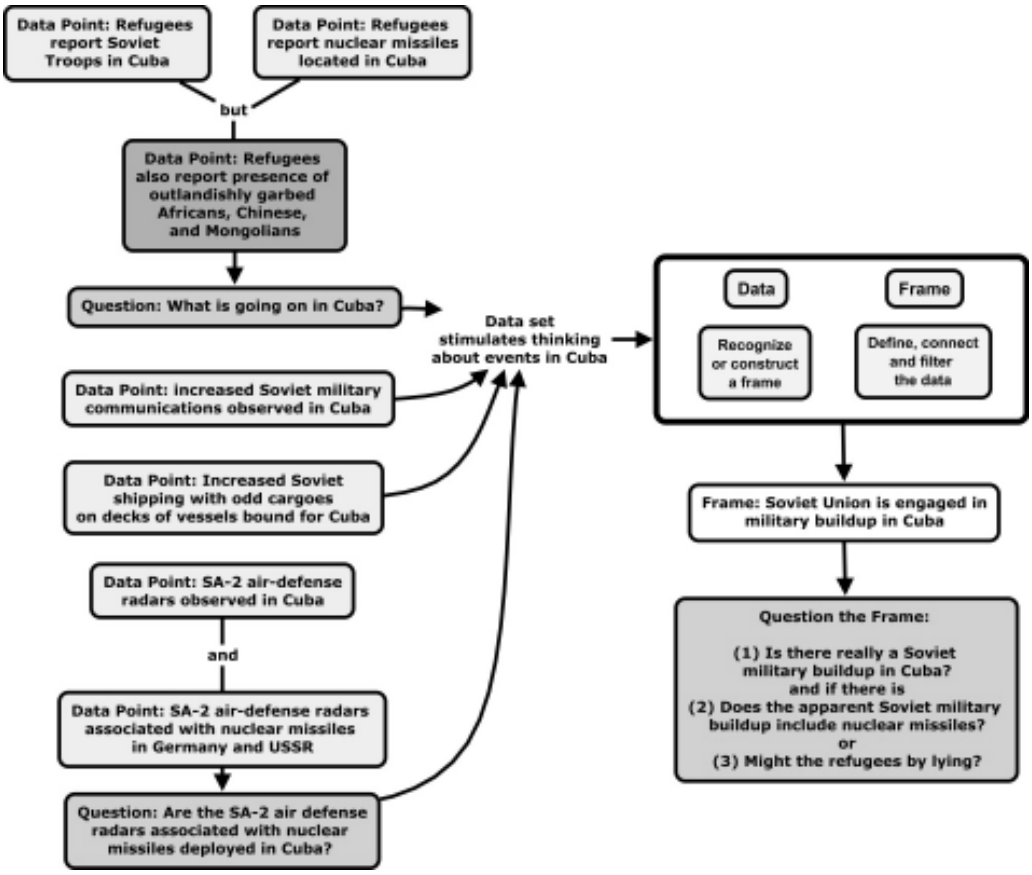

Figure 2: Constructing a frame about what is going on in Cuba.
The figure presents some of the evidence that caused consternation within the White House and the U.S. military.

Source: Authors.

In sum, such an analysis forms a first step in characterizing a data-frame sensemaking activity: Evidence (observed phenomena filtered by our perceptions) further stimulates our thinking as we strive to make sense of the phenomenon. In the 1962 Cuban example another initial conclusion (i.e., a frame) was that the Soviet Union was deploying considerable troops and materiel to Cuba. Once conceived, the frame connects the data, making linkages in the case at hand between the refugee reports, increased Soviet military-associated communications in Cuba, the observations of ships traveling to Cuba supposedly carrying grain but riding too high in the water for this to be the case and with strange cargoes on their decks, and observations of SA-2 radars on the island. These combine to create an initial frame on which all involved might agree: The Soviet Union was (from the perspective of the summer of 1962) engaging in a military buildup on the island of Cuba.

QUESTIONING THE FRAME

New evidence, once it is decided that it *is* evidence, is always an expression of a hypothesis, either that the frame is confirmed or that it is not confirmed. As data are filtered through the frame, several questions might arise about what is occurring on the island of Cuba: First, is this really a buildup of forces and if so are there nuclear missiles involved? Alternately, are the refugees lying, in part or completely? One might ask in exploring this question why the refugees would lie. A corollary to this question involves what to make of the observations of the ships, communications, and the SA-2 air defense radars, if the refugees are lying. These explanatory gaps and disconnects bridge the creation of the frame to the next step, that of questioning the frame.

Systematicity (or "structured analysis") can be added to the process of questioning a frame by breaking the questions asked into a handful of broad categories covering anomalies and inconsistencies in the data, plausibility of both the data and the sources of the data, and perhaps the data quality as well. In the case of the Cuban crisis these categories and representative data samples are shown in figure 3. Of note is the fact that certain data are seen to be more highly suspect when they appear in several categories. Generalizing, this may be a means for determining whether a datum is to be considered unreliable.

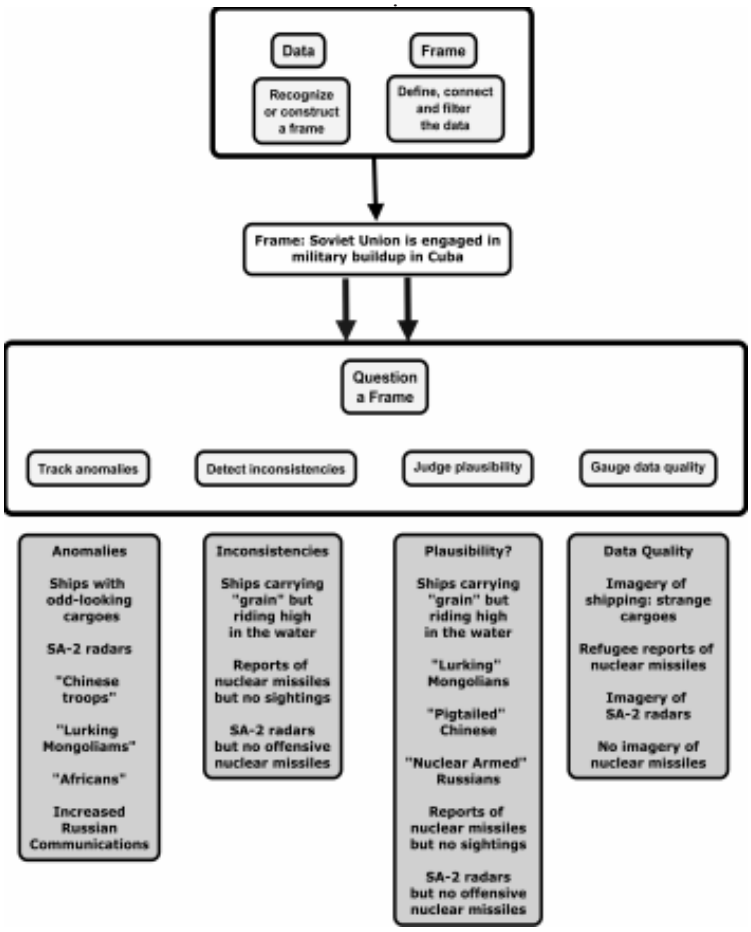

Figure 3: Questioning the frame about what is going on in Cuba.
Source: Authors.

Challenging the frame and the way it influences how the supporting data are expressed can also reveal some of the assumptions held by the frame's creator. For example, the presence of SA-2 antiaircraft radars in Cuba may be seen as anomalous and inconsistent with the apparent absence of offensive nuclear missiles. An implied assumption here is that the principal use of the SA-2 in Cuba would be to protect such missile launch sites (an opinion, as has been noted, that was held by DCI McCone). Yet, the imagery is clear: The SA-2 systems *are* located on the island. However, so far (from the time frame of the spring and summer 1962) the imagery failed to reveal the presence of nuclear missiles despite the claims of refugees to the contrary.

NEXT STEPS: PRESERVING, ELABORATING, AND REFRAMING

Based on the results of the initial questioning of the frame, one is left with questions regarding what to do next. One has yet to achieve satisfaction in making sense of the situation. One asks, "Is the frame sound?" In other words, do the data and the associated frame(s) make sense? In what ways does the frame have to make sense of the situation (i.e., should we not assume a completely "rational" adversary)? The frame may be preserved (and possibly elaborated upon). Or, is the frame somehow inadequate and, if so, what is required to make better sense of the data—i.e., what makes a better frame? Here the strategy is to reframe one's sensemaking about the issue.

Depending on the issue, one may find that in questioning the frame one has split the issue into several frames. The problem that is being worked, the "situation" being explained, is now a different problem or problems, or a different situation or situations. In our counterfactual example of the Cuban crisis (figure 3, above), we see this was the case. Portions of the frame were preserved while other portions required reframing. This resulted in splitting the initial frame. Now a consideration of the new (sub)frames occurred.

PRESERVING THE FRAME

In preserving the frame we have decided that the frame is sufficient and accurate. In our example, the data are clear: there is an ongoing military buildup in Cuba. Imagery revealed the SA-2 presence on the island. Soviet ships (figure 4) were carrying materiel despite claims of their carrying grain. Soviet communications on the island had increased. Thus, the results of questioning the frame about what was going on in Cuba generally confirmed the initial assessment: a military buildup was occurring. However, why the buildup was occurring remained unknown—and was not fully understood for over thirty years.[28] Additionally, a number of questions remained about the details of the buildup, and why they were occurring. These led to further elaboration of the frame and ultimately to reframing.

Figure 4: Cuban Missile Photograph PX 66-20:11
The Soviet ship *Poltava* enroute to Cuba, 15 September 1962.
Source: United States Department of Defense photograph in the John F. Kennedy Presidential Library and Museum, Boston.

As seen in the Cuban case, preserving a frame had its dangers: hypotheses were confirmed. Thus, as Richards Heuer (among others) notes, contradictory data or "events that contradict[ed] prevailing expectations tend[ed] to be ignored or distorted in perception."[29] In preserving the frame about what is going on in Cuba, the refugee reports of nuclear weapons were deemed unreliable for the same reasons that refugee reports about the "lurking" Mongolians were discounted; they were outlandish. The idea of nuclear weapons in Cuba contradicted the prevailing expectations.

ELABORATING THE FRAME

Some of the posed (and unposed) "why" questions could be answered by elaborating on the initial frame. By enriching the frame, greater understanding is feasible. However, elaborating a frame can also reinforce and buoy false premises and conclusions.

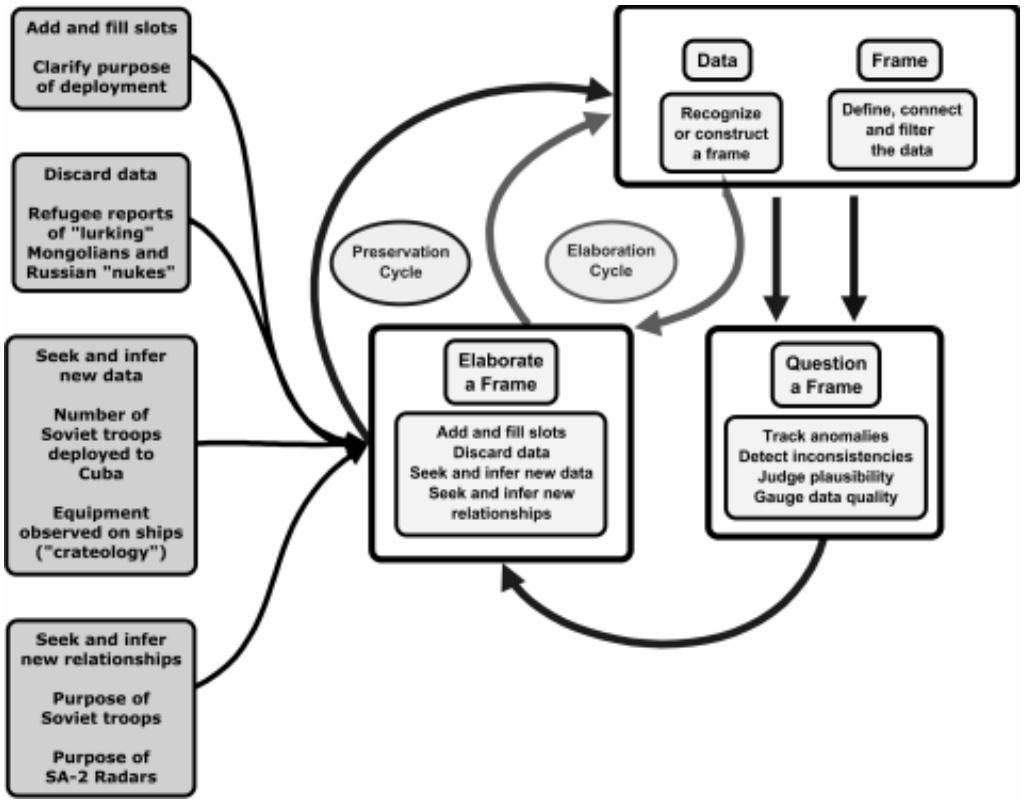

Figure 5: Preserving and elaborating the frame.
Source: Authors.

In the Cuban case, some of the frame elaboration focused on how many Soviet troops and how much materiel were being deployed and to what end (figure 5). As was the case with the alleged presence of the nuclear missiles, such considerations depended on whether the deployment was seen as defensive or offensive in nature, with different numbers associated with each position. According to Garthoff, while one informal CIA estimate put the number of Soviet troops in Cuba between 45,000 and 50,000, the official CIA estimate was between 4,500 and 5,000.[30] Even after the crisis (early 1963) the exact number of deployed troops remained elusive although the number rose to approximately 22,000.[31] The actual number was closer to 42,000 (a Soviet Group of Forces).[32]

There seem to be several factors that explain why elaboration of the frame did not yield a more accurate number for the deployed troops. First, assumptions about the purpose of the deployment no doubt figured in the erroneous calculations. Sherman Kent publicly revisited his (erroneous) estimate of Soviet intentions in Cuba as being defensive in nature, "substantially improving air defense and coastal defense capabilities in Cuba."[33] Indeed, Kent believed that "the Soviets would be unlikely to introduce strategic offensive weapons into Cuba" for fear of a presumed U.S. reaction.[34] Defensive operations, it was apparently believed, required a smaller number of troops than did offensive operations. Elaboration of the frame buoyed the position that the deployment was defensive in nature. This was later determined to have been correct. The subsequently discovered offensive missiles were deployed with another purpose in mind. As Graham Allison and Philip Zelikow note, the purpose of Khrushchev's deployment of *offensive* missiles to Cuba was to force the U.S. and NATO out of Berlin.[35]

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In sum, while elaborating a frame can indeed lead to a larger ground truth, care must be exercised that the process does not simply add a mass of data to an existing but

invalid frame, preserving it more strongly.[36] This is a matter of experience and skill, specifically the skilled reasoning found in critical thinking.[37] Even so, we note that people do make mistakes and do reach wrong conclusions. However, as Moore argues, skilled critical thinkers are equipped to avoid many of these gaffes.[38] This occurs because critical thinking models involve active questioning of what one is thinking, including the results of that thinking.

REFRAMING

If sufficient anomalies and inconsistencies are revealed as one questions the initial frame, one concedes the conclusion that the frame is invalid. It just does not work as neatly or well as one would like. Therefore, the data must be reinterpreted, and the issue "reframed" (figure 6). Such reframing can be wholesale, so that the initial frame is completely discarded and consideration of the issue starts at the beginning of the process. Reframing can be partial, wherein portions of the initial frame are retained but are significantly modified. If two or more frames are in consideration, the reframing process also includes a comparison of those frames.

In September 1962 such a reframing occurred in the Cuban case. Analysts at the Refugee Processing Center in Miami, Florida, apparently began to have doubts about their discounting of the claims of refugees that there were nuclear missiles on the island. Their initial frame (which became a deductive rule derived from a series of inductive, but as it turned out likely invalid, conclusions) was that the refugees were dissembling.[39] They were doing this possibly in an attempt to get the United States to intervene militarily in Cuba a second time. The refugees' underlying premise (it was believed) was that nuclear threats originating 70 miles from Florida were something the United States could not ignore.[40] The analysts reached this conclusion despite the fact (as Garthoff relates) "there were literally thousands of reports of missiles in Cuba in the period before any missiles were actually brought there."[41] However, in September other reports began to appear of long trailers (such as those that transported missiles) knocking down mailboxes at night on Cuban back roads—exactly what a surreptitious deployment might cause.[42] A recently arrived refugee reported seeing a convoy of missiles he identified as SS-4 medium-range ballistic missiles (after being shown photos of SS-4s).[43] The analysts took these reports

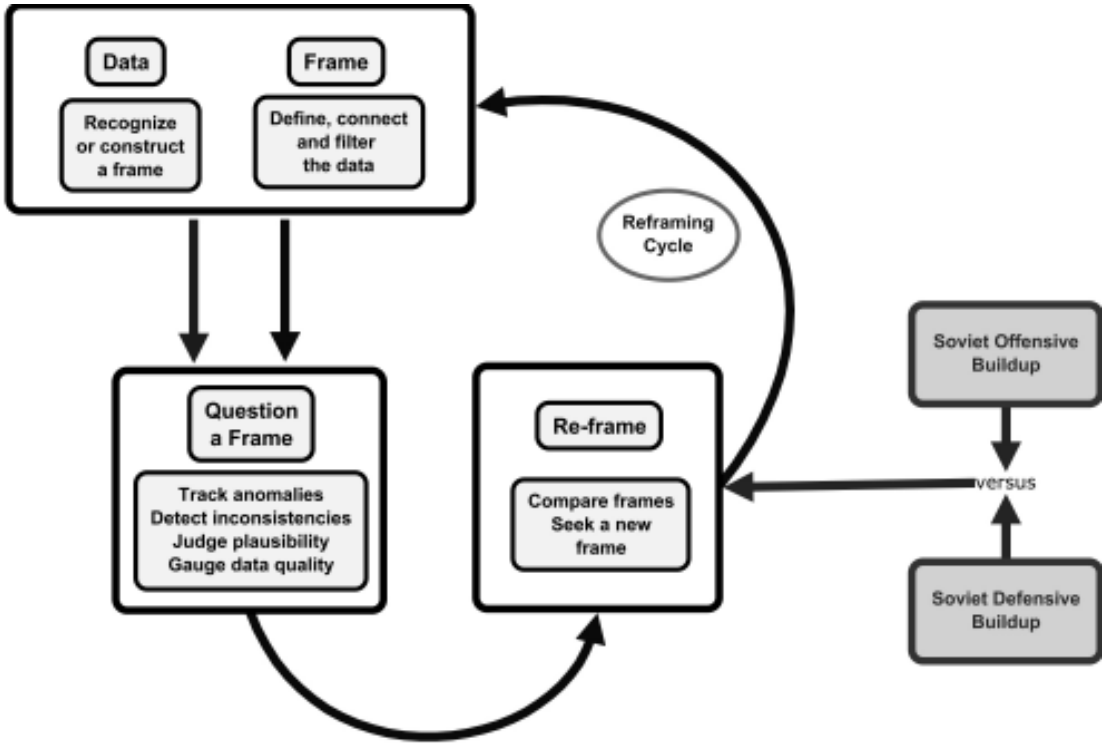

Figure 6: Reframing the Soviet Buildup in Cuba (1962).
Source: Authors.

seriously. That they did so may have been stimulated by a frame incompletely making sense of the SA-2 deployments—a case where elaborating one frame leads to the reframing of another.

The analysts now had two frames about nuclear missiles being deployed in Cuba—essentially, frames about defensive versus offensive deployments of Soviet personnel and materiel. Buoyed by data indicating a convoy of missile-bearing trucks near San Cristobal, the analysts at least partially reframed their thinking and a U-2 overflight of the area was ordered. The flight occurred on October 14, found the missiles, and the rest is history. In the process the analysts had reframed their understanding of what was going on in Cuba although some details (as has been mentioned) remained elusive for decades.

UNDERSTANDING WHY ONE DOES WHAT ONE DOES

Why be concerned about how we go about making sense of the information associated with intelligence? Reasoning about tough problems is an elegant dance. It has basic moves but they can play out in an infinite variety of parades around the dance floor. Our premise is the D/F model is a faithful description of actual, skillful critical thinking, a complex interaction of sensemaking activities. The D/F model is a way of making the complexity and dynamics of thought explicit.

Only in recognizing that the best way to describe intelligence sensemaking is in the macrocognitive approach, versus the microcognitive's mere listing of biases, can we hope to avoid repeating the errors and failures that have plagued intelligence creation since its inception? As we have noted, biases, as cautionary tales, are critical lessons learned for trainees. However, we need something beyond that, a model of expert reasoning that paints a less dismal portrait of human capacities.

The data-frame model for sensemaking as we have presented it here provides one means of explicitly and critically considering intelligence issues. It includes many of the key elements or ideas of "structured analysis," such as recognizing assumptions and seeking contradictory evidence. By factoring in structures that encourage changing conclusions based on evidentiary shortfalls, it provides an effective means of minimizing error. Why this is useful is clearly apparent if we consider (examining the incident counterfactually) that the Trojan intelligence failure to correctly assess the wooden horse found outside Troy's gates might have been avoided if a more vigorous reframing had occurred.[44]

By understanding how we reason about intelligence we are better equipped to select more appropriate strategies for making sense of intelligence-related phenomena.

Another reason for such consideration arises from the work of Beth Crandall, Gary Klein, and Robert Hoffman on analyzing cognitive tasks. They note, "It simply isn't sufficient to pick up a tool and place it in your toolbox. To use it well, you have to also understand why the tool was fashioned in a particular way and how the tool came to be."[45] Such understanding is predicated on also understanding "how people think, reason, and make decisions in the real world."[46] The data-frame model captures this in a macrocognitive (i.e., real-world) sense. By understanding how we reason about intelligence we are better equipped to select more appropriate strategies for making sense of intelligence-related phenomena. As such, our efforts become an instantiation of our critical thinking: we reason wisely about that which we make sense of and how we make sense of it.

RECOGNITION VERSUS ANALYSIS

The alternative is to simply choose step-wise strategies that we believe were successful in the past. Why do we believe they were successful? Typically this is because they gave us either the results we wanted or expected, or ones that events mimicked. However, without macrocognitive reflection how do we know? It could be that we were simply lucky. Additionally, if events are unrelated, successful strategies used in the past may be inappropriate for use now. Thus we are engaging in a methodological Russian roulette.

Admittedly, we seem to always be fighting the last war. While it is true there may be some common elements between a past strategy and event and a present-day one, there are likely an equal number or more dissimilarities. We look to these frames to define our present circumstances. The Iraq war of 2003 is a case in point. In the period before it, many people advised against our involvement, citing that it would become another Vietnam as a reason not to go. Looking earlier to the Cuban crisis we find that an even earlier crisis, that of the Japanese attack on Pearl Harbor, factored in the deliberations. Robert Jervis noted that "the U.S. did not expect the Russians to put missiles into Cuba or Japan to attack Pearl Harbor because American officials knew that the U.S. would thwart these measures if they were taken."[47] Later, Kennedy ruled out an unannounced series of airstrikes on

the deployed soviet nuclear missile bases, justifying it by noting that the United States did not "do" Pearl Harbor-style attacks.[48]

Part of the initial framing (and subsequent reframing) should therefore involve identifying these frames that may link us to past events. Yet, as Klein and others note, "[people] make most decisions using recognitional strategies, and fewer decisions by comparing options analytically. This generalization is based on studies in domains such as firefighting, critical-care nursing, and military decision making and is tempered by the features of the domain."[49] Yet, it is the past events that allow us to initially understand the present situation. From one perspective, framing thus is a "bias." However, we deem it more appropriately thought of as a necessary first step in sensemaking. Whether one moves beyond an initial frame is mostly a matter of skill and experience, not an inherent or inescapable bias. Further, as Klein and others observe, given "experience in a domain, the first option [people] generate is usually plausible (and certainly not random)."[50] In other words, we come up with a reasonable, plausible strategy for action, unless some emerging evidence shows starkly and unequivocally that the frame is wrong, or we actively question it. Finally, according to Klein and others, "[as] people gain experience, they spend more time examining the situation and less on contrasting the options, whereas novices spend more time contrasting options and less on comprehending the situation."[51] Such examination we believe presumes a challenging, elaborating, and re-conceptualizing of the frames one is using to make sense of a phenomenon.

[T]he political crisis in Tunisia, while it may have helped trigger the crises in Egypt and Bahrain, is very different from the political upheavals in both countries, and all are different from that in Libya.

Such situational metacognitive activity helps us to avoid errors in perception. Looking at current events during the winter of 2011 we observe that the political crisis in Tunisia, while it may have helped trigger the crises in Egypt and Bahrain, is very different from the political upheavals in both countries, and all are different from that in Libya. Thus, each uprising requires its own frame, certainly tied to but also distinct from the other frames we have about Middle Eastern events. The similarities—such as better desires for economic health, greater democratic freedom, or less corruption—should not blind us to the fact that each upheaval is very different.

We note that Libyan leader Muammar Gadhafi's awareness of what happened to the leaders of Tunisia and Egypt no doubt warned of a course of action that he indicated (through words and deeds) was abhorrent and sought to avoid. Such a desire influenced and limited his actions.[52] But the events in Libya remain distinct from those in Tunisia and Egypt, as a consideration of the role of the military in each country makes clear. In Tunisia and Egypt the military enjoys some independence and is considered a professional force. In Libya it seemed to be a tool of Gadhafi—his "personal" mercenary army if you will. Considering the protests in Bahrain, we find that while they are similar to others in the region, they too differ in some key regards: a Shiite majority is protesting against a Sunni minority (which also happens to rule the country). Further, the use of external forces to buoy the Bahraini regime casts the disturbances more firmly in a Shia versus Sunni light. Making sense of such distinctions is necessary if we are to appropriately respond to the individual present (and likely future) crises.

The first step in maintaining and elaborating these distinctions in our frames remains developing, challenging, and adjusting those frames of understanding, and explicit consideration of how they are influencing our thinking. This takes active work because we have to question both the emergent frames but also the frames that put them into context—those frames we use to make sense of the phenomenon. Critical thinking is, perhaps by definition, the process of doing this but more detailed (and validated) techniques remain to be developed through a rigorous multimethod approach.[53]

It is also worth noting that domain-experienced and domain-initiated intelligence professionals will employ different strategies. Klein and others also indicate "[experienced] people rely more heavily on recognitional strategies."[54] This contrasts with novices whose "approach tends to be more analytic and deliberative."[55] This is important as such different strategies impact the entire data-frame sensemaking process and explain how experienced and trainee/apprentice personnel may come to differing conclusions. In the Cuban crisis, McCone's conclusions about the SA-2 radars may have arisen from his recognition of their nuclear missile site defense function. The RPC analysts could be viewed as more analytic and deliberative (likely reflecting a lower level of domain-experience).

IMPLICATIONS

Where do such considerations leave us? We return to the subject of our previous article and reiterate that the practical application of a data-frame model of sensemaking facilitates our transformation of intelligence. By being better aware of how experts make sense of phenomena as characterized in the data-frame theory we are wiser in knowledge of how we create intelligence and of the pitfalls we can face. This positive motivation helps us to paint better intelligence for those who rely upon our work. It is respectful of the experience and skill—dare we say the wisdom—of the most experienced analysts while at the same time not demotivating them. Conversely, it can be used to explain phenomena that others interpret as bias, without at the same time assuming that trainees and indeed all humans are cognitively handicapped.

[Editor's Note: The above article follows up an earlier piece by Moore and Hoffman in Vol. 29, No. 1 of *AIJ*, titled "Sensemaking: A Transformative Paradigm."]

Notes

[1] See Gary Klein, Jennifer K. Phillips, Erica L. Rall, and Deborah A. Peluso, "A Data/Frame Theory of Sensemaking," in Robert R. Hoffman, ed., *Expertise out of Context: Proceedings of the Sixth International Conference on Naturalistic Decision Making* (Boca Raton, FL: Taylor and Francis, 2007), 117-118 (115-155). Cited hereafter as Klein, et al., "Sensemaking." Also Gary Klein, Brian Moon, and Robert R. Hoffman, "Making Sense of Sensemaking 1: A Macrocognitive Model," *IEEE Intelligent Systems* 21, no. 5 (September 2006): 88-92; and Gary Klein, Brian Moon, and Robert R. Hoffman, "Making Sense of Sensemaking 2: Alternative Perspectives," *IEEE Intelligent Systems* 21, no. 4 (July/August 2006): 70-73.

[2] Robert R. Hoffman, Simon Henderson, Brian Moon, David T. Moore, and J.A. Litman, "Reasoning difficulty in analytical activity," *Theoretical Issues in Ergonomic Science,* Vol. 12, No. 3, May 2011: 225–240. See also David T. Moore, *Sensemaking: A Structure for an Intelligence Revolution* (Washington, DC: NDIC Press, March 2011). Cited hereafter as Moore, *Sensemaking.*

[3] Brian Moon and B. Robert Hoffman, "How might 'transformational' technologies and concepts be barriers to sensemaking in intelligence analysis?" presentation at the Seventh International Conference on Naturalistic Decision Making, Amsterdam, The Netherlands, 2005.

[4] See, for instance, Richards J. Heuer, Jr., *The Psychology of Intelligence Analysis* (Washington, DC: Center for the Study of Intelligence, 1999). Heuer drew on research going back to the 1970s.

[5] See, for instance, Dan Ariley, *Predictably Irrational: The Hidden Forces That Shape Our Decisions* (New York, NY: Harper Collins, 2008); Thomas Gilovich, *How We Know What Isn't So: The Fallibility of Human Reason in Everyday Life* (New York, NY: The Free Press, 1993); Ellen Kaplan and Michael Kaplan, *Bozo Sapiens: Why to Err Is Human* (New York, NY: Bloomsbury Press, 2009); and J. Edward Russo, *Decision Traps* (New York, NY: Simon and Schuster, 1990).

[6] Robert R. Hoffman, Gary Klein, and Janet E. Miller, "Naturalistic Investigations and Models of Indeterminate Causal Reasoning: Things Aristotle and Hume Never Told You," in William B. Rouse, Kenneth R. Boff, and Penelope Sanderson, eds., *Complex Sociotechnical Systems: Understanding and Influencing Causality of Change* (Amsterdam, NL: IOS Press, 2011).

[7] Beth Crandall, Gary Klein, and Robert R. Hoffman, *Working Minds: A Practitioner's Guide to Cognitive Task Analysis* (Cambridge, MA: The MIT Press, 2006), 3. Cited hereafter as Crandall, Klein, and Hoffman, *Working Minds.*

[8] Crandall, Klein, and Hoffman, *Working Minds,* 3.

[9] Crandall, Klein, and Hoffman, *Working Minds,* 3.

[10] Klein, et al., "Sensemaking." 117.

[11] Klein, et al., "Sensemaking." 117.

[12] Gary Klein, Karol G. Ross, Brian M. Moon, Devorah E. Klein, Robert R. Hoffman, and Erik Hollnagel, "Macrocognition," *IEEE Intelligent Systems,* May/June 2003, 81. Cited hereafter as Klein, et al., "Macrocognition." See also Pietro C. Cacciabue and Erik Hollnagel, "Simulation of Cognition: Applications," in Jean-Michel Hoc, P.C. Cacciabue, and E. Hollnagel, eds., *Expertise and Technology: Cognition and Human-Computer Cooperation* (Mahwah, NJ: Lawrence Erlbaum Associates, 1995), 55-73.

[13] Klein, et al., "Macrocognition," 81.

[14] The term "wicked problem" was developed by social engineers Horst Rittel and Melvin Webber. See Horst W. J. Rittel and Melvin M. Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences*, vol. 4 (1973), 155-169. Robert Horn characterizes them as "social messes." See Robert E. Horn, "Knowledge Mapping for Complex Social Messes," Presentation to the "Foundations in the Knowledge Economy," at the David and Lucile Packard Foundation, July 16, 2001, URL: http://www.stanford.edu/~rhorn/SpchPackard.html, accessed February 17, 2011. David Moore links these idea concepts to the domains of intelligence. See Moore, *Sensemaking,* chapter 2.

[15] Klein, et al., "Macrocognition," 81.

[16] Klein, et al., "Macrocognition," 82.

[17] Gary Klein, Jennifer K. Phillips, Erica L. Rall, and Deborah A. Peluso, "A Data/Frame Theory of Sensemaking," in Robert R. Hoffman, ed., *Expertise out of Context: Proceedings of the Sixth International Conference on Naturalistic Decision Making* (Boca Raton, FL: Taylor and Francis, 2007), 117-118 (115-155). Cited hereafter as Klein, et al., "Sensemaking."

[18] Gary Klein, Brian Moon, and Robert R. Hoffman, "Making Sense of Sensemaking 2: Alternative Perspectives," *IEEE Intelligent Systems,* 21, no. 4 (July/August 2006), 70 (70-73).

[19] Indeed, one might conclude that, with few new facts to report, 24-hour news services exist to engage in constant reframing processes.

[20] Ellen J. Langer, *Mindfulness* (Cambridge, MA: Da Capo Press, 1989), 69.

[21] This is not new. Thomas Chamberlin formalized methods of considering multiple hypotheses in geology in the 1890s. See Thomas C. Chamberlin, "The Method of Multiple Working Hypotheses." *Science,* 15 (old series), no. 366 (February 7, 1890): 92-96. Richards Heuer built on Chamberlin's work and discussed the use of disconfirming evidence and multiple hypotheses. See Richards J. Heuer, *The Psychology of*

Intelligence Analysis (Washington, DC: Center for the Study of Intelligence, 1999), especially Chapter 8.

[22] It is equally absurd to assume that the human mind, in general, seeks only confirmatory evidence. We know that experts seek disconfirming evidence.

[23] James H. Hansen, "Soviet Deception in the Cuban Missile Crisis," *Studies in Intelligence* 46, no. 1 (2002), 56. Cited hereafter as Hansen, "Soviet Deception."

[24] Raymond L. Garthoff, "US Intelligence in the Cuban Missile Crisis," in James G. Blight and David A. Welch, eds., *Intelligence and the Cuban Missile Crisis* (London, UK: Frank Cass, 1998), 22. The emphasis is in the original. Cited hereafter as Garthoff, "US Intelligence."

[25] The figure suggests that deliberate efforts at denial and deception (as well as some self-deception by intelligence personnel) were occurring. All in fact occurred, but while important we consider a discussion of the denial and deception to be outside the scope of this article.

[26] David T. Moore, *Critical Thinking and Intelligence Analysis,* Occasional Paper Number Fourteen (Washington, DC: NDIC Press, 2006, 2007), 23.

[27] Raymond L. Garthoff, James G. Blight, and David A. Welch, eds., *Intelligence and the Cuban Missile Crisis* (London, UK: Frank Cass, 1998), 29. It should be noted that the existence of these missiles did not become known by the United States until the 1990s.

[28] See James G. Blight and David A. Welch, eds., *Intelligence and the Cuban Missile Crisis* (London, UK: Frank Cass, 1998).

[29] Richards J. Heuer, Jr., *Psychology of Intelligence Analysis* (Washington, DC: Center for the Study of Intelligence, 1999), 9. Cited hereafter as Heuer, *Psychology.* This phenomenon occurs at the initial "framing" as well. The individual's expectations form frames that filter the initial data. The assertion that contradictory evidence "tends" to be ignored is, we think, a dubious generalization to humanity, certainly uncharacteristic of experts.

[30] Garthoff, "U.S. Intelligence," 28, 58.

[31] Garthoff, "U.S. Intelligence," 28.

[32] Garthoff, "U.S. Intelligence," 28.

[33] Sherman Kent, "Cuban Missile Crisis: A Crucial Estimate Revisited," *Studies in Intelligence,* vol. 36, no. 5 (Spring 1964), 111. Cited hereafter as Kent, "A Crucial Estimate Revisited."

[34] Kent, "A Crucial Estimate Revisited," 111.

[35] Graham Allison and Philip Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis,* 2nd ed. (New York, NY: Longman, 1999), 99-109. This did not become known until the 1990s.

[36] We recognize that this statement might be construed by some readers to be what is meant by "confirmation bias." While there are task circumstances in which people will not seek disconfirming evidence, there are task circumstances in which they do. We do not doubt that there are phenomena of reasoning revealed in lab studies of heuristic decision-making, but we do question what it means to think of them as being inescapable, pervasive human biases.

[37] See Moore, *Critical Thinking.*

[38] See Moore, *Critical Thinking, 79-81.*

[39] For a diagram of this logic chain see Moore, *Critical Thinking,* 5. Moore observes that the analysts likely concluded that, because some of the evidence was ludicrous, all of it was (p. 22).

[40] The first time had been in April 1961 when U.S.-backed Cuban troops opposed to Castro's regime landed in an attempt to overthrow

that regime. The attempted invasion failed. Inadequately supplied, the troops were either captured or killed.

[41] Garthoff, "U.S. Intelligence," 22. How such identification could be made is questionable. James Hansen reports the convoys were "canvas shrouded" and traveled at night. See James H. Hansen, "Learning from the Past: Soviet Deception in the Cuban Missile Crisis," Studies in Intelligence, vol. 46, no. 1 (2002), URL: <https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/vol46no1/article06.html>, accessed 15 March 2011. Cited hereafter as Hansen, "Soviet Deception."

[42] Hansen, "Soviet Deception."

[43] Garthoff, "U.S. Intelligence," 23. Despite this apparent identification in September of the SS-4s further investigations into the kind of missiles deployed occurred in October once imagery confirmed their presence.

[44] Nevertheless, it should be noted that those who did question the frame, such as Laocoon and his sons, were killed by the gods—an ominous object lesson for those who do question intelligence frames.

[45] Crandall, Klein, and Hoffman, *Working Minds,* 5.

[46] Crandall, Klein, and Hoffman, *Working Minds,* 5.

[47] Robert Jervis, *System Effects: Complexity in Political and Social Life* (Princeton, NJ: Princeton University Press, 1997), 45.

[48] Richard E. Neustadt and Ernest R. May, *Thinking in Time: The Uses of History for Decision Makers* (New York, NY: The Free Press, 1986). And we still do not. While it debatably may be in the American character not to do this kind of an attack, it would also seem the Japanese attack on December 7, 1941, left an impression that remains to this day.

[49] Klein, et al., "Macrocognition," 83.

[50] Klein, et al., "Macrocognition," 83.

[51] Klein, et al., "Macrocognition," 83.

[52] And, given his efforts in quashing the rebellion, ended in his death.

[53] See, for example, David T. Moore, Elizabeth J. Moore, William N. Reynolds, and Marta S. Weber, "Making Sense of Non-State Actors: A Multimethod Case Study of a Wicked Problem," in David T. Moore, *Sensemaking: A Structure for an Intelligence Revolution* (Washington, DC: NDIC Press, 2011), 105-132. Multimethodological approaches have been adopted in a number of disciplines. For more on the subject, see John Brewer and Albert Hunter, *Foundations of Multimethod Research: Synthesizing Styles* (Thousand Oaks, CA: Sage Publications, 2006).

[54] Klein, et al., "Macrocognition," 83.

[55] Klein, et al., "Macrocognition," 83.

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