

Stop Making Sense: Close Scrutiny of Situation Awareness in Organizations

by

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BSc, Buskerud and Vestfold University College, 2006

Thesis Submitted in Partial Fulfillment

of the Requirements for the Degree of

Master of Science

Management and Innovation,

Buskerud and Vestfold University College, 2015

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Abstract

In this essay I discuss situation awareness and sensemaking in organizations with respect to mind. Various models of mind are discussed and much effort is made to disprove Cartesian dualism as a viable theory. Gilbert Ryle's model of mind as a disposition to heed as used by Karl Weick is used as the construct of collective mind. The research question is to prove situation awareness as essentially mind and thus the disposition to heed. Three small cases are investigated to show the interdependence between situation awareness and sensemaking. The dependencies between these elements are discussed regarding known epistemology and on the fundamental level. Using current ontological standings in organizational theory and ergonomics this proved to be difficult, because it gave no common consensus regarding the primitives of the mind construct. To resolve this I have made a suggestion to ontology based on a restricted view of Heidegger's notion of dasein and existential time and existential space as n-dimensional Euclidean spaces as sole primitives. Both are properties of dasein and in physical world but restricted to human existence. Ontology should prove useful to other research areas than organizational theory as a model of human mind.

Keywords: Situation awareness, Sensemaking, Mind, Organization theory

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Dedication - An Attempt to Give Something to Somebody

As a rather small boy in rural surroundings in post-war Norway I saw my first Agassizi. “What is an Agassizi?” you might ask yourself. It was a photograph in a book of a fish called Agassiz’s cichlid – *Apistogramma agassizii*, named in honor of Luis Agassiz. After some time I got an aquarium, some fish, then several, and for some reason the fish ended up being named just Agassizi. Agassiz’s cichlid was too long. Agassizii was too awkward. Agassizi was just fine. *This made sense*. I grew up. I started a lifelong quest to understand the world. I grew old. I lost a perfectly good job in the wake of 2008. I went back to school trying to make sense of the world. Last night I met Luis Agassiz. The Agassizi is named in honor of Luis Agassiz. I thought I knew all paper and books by the sense maker of all times Karl Edward Weick. Last night, after I had finished writing my thesis I found this tiny paper called “*The Generative Properties of Richness*” (Weick, 2007). Professor Agassiz is quoted saying: “*a pencil is one of the best eyes.*” The paper is in a way about perception. Weick states:

“... *perception without conception is blind; conception without perception is empty.*”

Believing is seeing. The circle is unbroken.

WWH (Weick Was Here)

To my wife

To the pencil

To John Haugeland

To Leif Inge Magnussen (My mentor)

To Jiwan Sandhu (My best new friend)

To Thor Hernes (Who still believes Weick is fragmented?)

To Johann Sebastian Bach (Who provided most of the music for this essay)

[For the ultimate experience of being in the world please listen to the Goldberg Variations reading this.]

The world makes sense, after all, fish is fish (Lionni, 1974).

Peace, hope and love, love is the greatest

Take care everyone in here (Everyone being in the World)

Undrumsdal May 17th 2015, Atle M. Christiansen.

TechTalk – Will the Real APA 6th Paper Please Stand Up

This essay came to life as a strict APA paper. The school wanted it somewhat different, but APA style in all headings and formatting is maintained. I have included some dialogue with the reader and the occasional pun to make the reading of this text more pleasant. All, but two, footnotes are included inline in hard brackets. I have not provided references for historic data, as these are general, but when I have reached beyond my memory I have used The Stanford Encyclopedia of Philosophy.

TechTalk – Ontology

As the reader will notice: This essay is essentially a search for ontology. My initial scope was to investigate the influence of heed on situation awareness. I had a strong sense that situation awareness, sensemaking and dispositions of mind were interdependent within an organization. Situation awareness is basically from *ergonomics*, sensemaking is essentially from *Karl Weick*, dispositions of mind is from *philosophy of mind* and finally the organization is from the area of *organizational theory*. Basically everyone except Weick seemed to forget what Plato told us: To seek understanding: What is the form (idea)? Much of the area of organizational theory is an attempt to explain what we simply cannot see. The result of this is that the dogma of dualism got dragged all the way from the seventeenth century.

To resolve this I had to make a decision: This essay is in essence a theoretical discourse on the philosophy of mind.

Stop Making Sense: Close Scrutiny of Situation Awareness in Organizations

The organization and its more or less formalized groups and individuals have been the core elements of interest in Organizational Studies for decades. Research on organizations is well justified, as essentially all modern day people either work within one- or have some other affiliation or interaction with one or several in their day to day life. Organizational studies help us build and maintain better organizations. Good organizations encompass high quality work, high efficiency, low turnover, resilience and in general they have happy employees and customers. In order to become this great organization, it is quite obviously better to rely on making the right decisions than on pure luck. To make decisions and take action we must know what is going on and grasp the consequences of our choice. To know what is going on is in terms of ergonomics (human factors) known as situation awareness. I will elaborate this further in later sections, but one may state that situation awareness in organizations can be discussed as either a part of the purpose of the organization or as an organizational process. I will argue that these are essentially the same and there is no sense in trying to differentiate between them theoretically. The grounding for this argument is what can be considered a research question for this essay: *Situation awareness is an essential part of human, again grounding in the statement that situation awareness is; in essence “mind” just as much as it is a result of the circumstances, the surroundings and any other physical property imaginable within an organization.* This is after all the world we exist in. The idea of situation awareness as “mind” is in essence a scientific area that has seen *essentially no research at all.* Almost all research on situation awareness has been on the operational part, and metrics.

Renowned philosopher Gilbert Ryle writes about the concept of mind as an inclination to act with- or without heed. In everyday language; heedlessness is considered a negative attitude and should therefore influence general performance and situation awareness in an undesired direction. On the other hand, heedfulness is considered a positive attitude and should affect situation awareness in a desirable direction. Within organizations and on the individual level, heedful performance should be a goal to work towards. It is not easy going terrain, but, I consider it more of an exercise of looking for the unfamiliar in the familiar than searching into an entirely new territory. I find very little research combining these topics, and I find this a bit

worrying: I cannot clearly see the disjunction between situation awareness and organizational theory. In the following discourse I will, step by step: *Clarify the theoretical underpinnings of situation awareness, sensemaking in organizations and the concept of mind and prove their interdependence.* No single item will exist without the other. By doing this I will bring the concept of situation awareness in organizations to close scrutiny. My initial scope for this research, and one that I still maintain, was to prove the influence of heed, as a property of mind, upon situation awareness and the general performance of organizations. This was a task that turned out to be difficult on the ontological level using current models of situation awareness. Cartesian dualism, neo-cartesianism, a strong foundation in cognitivism or simply omitting the concept of mind, seem to be a rule in these models, separating the mind from the body and relying on mental stages or states as some sort of prerequisite (Winsen & Dekker, 2015). As a result of this; I will present another view of situation awareness. In the process of doing so; I also present a critique of the theory of Distributed Situation Awareness, which proponents readily presents as a more functional and operational model of situation awareness than Mica Endsley's three stage model, which is by far the most popular and widespread (N. A. Stanton, Salmon, Walker, & Jenkins, 2009; Neville A. Stanton, Salmon, Walker, & Jenkins, 2009).

Theory

The rationale for this first section of the thesis is to: (1) Discuss current prominent theories of situation awareness, sensemaking in organizations and the concept of mind. (2) Present incentives to introduce a new view on situation awareness. I leave it to the reader to decide if this is theory or theorizing (Weick, 1995b).

Situation Awareness

The study of situation awareness (SA) has traditionally been a research field of ergonomics. The International Ergonomics Association defines ergonomics this way:

“Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.” (IEA Website, 2015). I will address this in more detail, but it is important to notice that already at their constitutional level, ergonomics is systems

inclined and orientated. Within organizational theory research (OT) there has been little focus on SA as a concept, and unfortunately little research has been published. This is a challenge as well as an opportunity, since my primary focus is to discuss SA within organizations. However, there are exceptions. Most notably are the works of Gary Klein, but I have also been able to trace down one instance where Karl Weick acknowledges and use the term SA. (Endsley & Garland, 2000; Weick, 2009).

Everyday examples where SA is important can be when you are driving your car, climbing a steep hillside, hiking outdoors in the Norwegian mountains during winter or painting your house, standing in a fragile ladder fifteen feet above the ground, without any kind of safety harness. Almost daily you can read in newspapers about people being injured, permanently disabled or even killed doing these relatively mundane activities. In a professional setting the consequences of failure may be even more devastating, imagine being a bus-driver, a flight controller or a commander of a Mediterranean cruise ship. Insufficient levels of SA in such settings can cause tragedies beyond comprehension. Every now and then we read about such incidents in the newspaper too. In the context of these examples, a layman's definition of SA is; to know what is going on. You may argue that it is not a novel idea. To know what is going on has been an important prerequisite for human survival since the beginning of mankind. And it is not new, but the study of SA is, the first attempts to study SA occurred during WW1 with the study of crews aboard military aircrafts. Work on how to theorize and operationalize SA took hold in the wake of WW2 with the study of fighter pilots and the dawn of the jet propulsion era. Fighter airplanes became almost exponentially faster and more and more difficult to fly. Flight guidance systems were virtually non-existent and very rudimentary and fly-by-wire technology was not invented yet. Add all this to air combat context and the workload of the pilots were close to any limit imaginable.

Situation Awareness in Organizations

Situation Awareness per se has not been researched in much extent as a part of organization theory (OT). I mentioned Gary Klein as an honorable exception and the reason for this is that the processes incorporating SA, within OT, are considered a part of decision making (G. A. Klein, 1999; Zsombok & Klein, 2014). This again is because perception and "cognitive processes" have essentially been considered a part of psychology or cognitive psychology.

Prominent researchers of decision making are Kurt Levin, Herbert Simon, James Garner March, Daniel Kahneman, Amos Tversky and several others, but in essence all their studies are on cognition-decision and little on perception-cognition (Starbuck, 2013; Simon, 1979; Kahneman, 2011; March, 2013). In my experience we are entering a void between something “mental” and something “physical”. Between ergonomics and OT there is an opening to explore unfamiliar territory. It is not unknown; essentially all human beings are there. *Is there a void between something mental and the physical world?* Many seem to think there is. Do I have to use Cartesian dualism to answer this question too? I think not (Ryle, 1949).

The very idea of how we perceive and experience ourselves and our surroundings shape our awareness, decisions, future plans and actions and identify our self and society (Giddens, 1991, 2009). Studying SA in organizations and connecting it to organizational theory will provide me with the opportunity to understand organizations and their constituting individuals as being in the world (Hubert L. Dreyfus, 1991). SA is well documented and researched in situ as an interface between what we perceive, our experience and what we do (Endsley, 2011) .

Mainstream Situation Awareness.

Despite being widely popularized and much studied during the last 25 years SA remains ill-defined as a concept (Matheus, Kokar, & Baclawski, 2003; Sarter & Woods, 1991; Neville A. Stanton, Salmon, & Walker, 2015). There has been much debate about the theoretical underpinnings, whether it is an individual construct or in the world, some authors diminish it by thinking of it as phenomena like workload and fatigue that affects work quality (Hollnagel & Woods, 2005; N. A. Stanton et al., 2009). Although Mica Endsley’s (1995) theory of SA is by far the most popular and is widely accepted, the understanding and use of SA in official and public domains remains debatable (Pritchett, 2015; Vaitkunas-Kalita, Landry, & Yoo, 2011). To offer common grounds for discussing and measuring SA Endsley introduced a three stage model that has been widely cited;

“Situational awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future.”(Endsley, 1988, 1995, 2011).

These three stages of the model are referred to as the three levels of SA, often quoted as perception, comprehension and projection. In popular terms; - what is going on, - what does this

mean and - what to do next. Initially the model was quite simple and easy to comprehend. Especially since it was time-linear or sequential and based on mental models as tools for understanding the different levels of SA. I strongly suggest that this is, at least some of, the reason for the popularity of Endsley's model. Further, Endsley separated SA from the means of acquiring it, and SA was interpreted as a state of mind, a product. Endsley named the process of acquiring SA situation assessment, which incorporated sense-making, making this disparate from SA and not even a part of it (Endsley, 1995). I could elaborate this further, but recently things started to be a bit confusing. As the keen reader may have noticed, I use past tense as I am writing about these SA characteristics.

Mica Endsley's "Kehre" [Mica Endsley's Turn]

Late march 2015 Endsley published two papers on SA in a special issue of "*Journal of Cognitive Engineering and Decision Making*" commemorating the 20th year anniversary of Endsley's 1995 article (Endsley, 2015a, 2015b). In short, the main focus of these articles was to address fallacies regarding the understanding and interpretations of the 1995 model of SA. The remaining part of the magazine is seven responses from other prominent scientists with relevance to SA. Much of this critique is rather harsh, Gary Klein for one, titled his article; "*Whose Fallacies*", and Christopher Wickens once again use the opportunity to address the dichotomies of Endsley's model; "*Situation Awareness Its Applications Value and Its Fuzzy Dichotomies.*" Klein blames Endsley herself for many of the fallacies, while Wickens, although full of appraisal for Endsley's work, concludes by stating that; "*SA has an uncertain future as a testable theory.*" (G. Klein, 2015; Wickens, 2015, p. 93). Stanton, being the bold opponent, with presumably the most relevant alternative model of SA, use the following title: "*Let the Reader Decide: A Paradigm Shift for Situation Awareness in Sociotechnical Systems*" (Neville A. Stanton et al., 2015). It is beyond my scope to dive too deep into this, but a few points needs to be addressed. First, none of the characteristics of SA that I mentioned in the beginning of this paragraph are true according to Endsley, I should probably rephrase; true anymore. All are parts of Endsley's so called fallacies. One could argue that Endsley is an advocate of a pre-2015 – and post-2015- model of SA, and a fiercer author than me probably will, but I will not. As for now I will simply credit Endsley for pointing out the evolution of her 1995 model of SA, by doing so I simply omit endless discussions about differences in previous and current interpretations of her model. [By both her

and others.] Scientists should, however, be aware of the fact that research on SA based on Endsley's model relies on an historical interpretation of an evolving model.

Endsley's Situation Awareness model anno 2015

If we use Endsley's recent publications as a foundation, we have an adapted model of SA that is highly operational (2015a, 2015b). The theories underpinning her model is more problematic, but I will address this later. From the initial discussions we have: "*Situational awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future.*" Endsley have labeled the three different components of SA as levels:

- Level 1 – Perception
- Level 2 – Comprehension
- Level 3 – Projection

The three levels are not nominated by their sequence of occurrence. As an example; it is possible to know what to do without experiencing either the perception or comprehension of any sensation. It can still be SA (Wickens, Lee, Liu, & Gordon-Becker, 2013). Waving sequentiality opens up for cyclicality. If you have a projection it is quite possible that this leads to more or even different perception. Since the cyclic understanding of SA implies that the actants continuously use different levels of SA, this recognizes SA as a process rather than a state of mere information gathering and data-processing. Viewing SA as a dynamic process, sensemaking can be a part of SA, thus opening up for *meaning* to be SA-data in addition to data gathered by general perception in the environment. In her discourse Endsley list sensemaking together with situated SA, team SA and distributed SA as a recent model of SA (Endsley, 2015b). In order to maintain good academic writing, I will simply state that this will raise a few eyebrows among OR scientists. There are differences however, between sensemaking and SA, I quote Endsley:

- (1) "*SA is often based on a highly automatic process of situation recognition, using schema of prototypical situations that is dynamic and ongoing, whereas sensemaking is characterized as primarily of the conscious deliberative type.*"
- (2) "*Sensemaking is generally backward looking, whereas SA is forward looking. Sensemaking focuses on forming reasons for past events and diagnosing the causative factors for observed faults.*"

(3) *“Although sensemaking ends with whatever explanations it derives, SA theory also includes how people use those diagnoses and explanations to inform their fuller understanding of the situation.”* (2015b, pp. 18, 19)

Again, this opens up for argument, noting the differences Endsley list: This is simply not sensemaking, at least not the way Weick, who she originates the term, writes about it (Weick, 1995a, 2009; Weick, Sutcliffe, & Obstfeld, 2005). Endsley continues her argumentation by comparing SA to Klein’s data-frame model (D/F) of sensemaking (G. Klein, Phillips, Rall, & Peluso, 2007). Klein argues that Endsley’s comparison between SA and D/F is wrong and based on a misconception of his model (G. Klein, 2015). Noting this obvious weakness in Endsley’s argumentation I will simply state that she use sensemaking as a plausible mean for meaning to be a part of her SA model. Whether sensemaking is a part of SA process remains highly debatable and essentially a viewpoint of Endsley. For the remainder of this essay I will treat sensemaking as essentially disparate from SA as a process, but they remain highly reliant upon each other. I will prove this later in my discussion.

It is also important to note that SA as a process is very much goal-oriented, more so than outcome-oriented or data-driven (Endsley, 2011). As an example think of a pilot in a civil cockpit; more than anything else he must keep the plane on its wings, safe and sound towards the destination of the flight. Safe flight is the primary goal, there may be other goals, but they are, and must be treated secondary.

Another point that is essential to Endsley’s view on SA is: *“Technological systems do not provide SA in and of themselves. It takes a human operator to perceive information and make it useful.”* (Endsley, 2000, p. 6). She further takes the opportunity to discuss the abilities of future smarter technological automation system in her latest publication: *“Although one could postulate that one day we may have computer systems that are intelligent enough to have ‘situation models’ analogous to human SA, as long as a human being has the requirement to have overall responsibility for the performance of the system, he or she will need to have the SA required to insure that the computer models are performing correctly.”* (Endsley, 2015b, p. 27). In contradiction to other more systems oriented proponents of SA Endsley disproves that SA can reside any other place than within the operator. As an even more intelligent process (Endsley, 2015b). I would not categorize Endsley as a behaviorist. In my view, her evident omission to consider mind- and mind-related processes, even meaning to some extent, shows some signs of

functionalist view. [She also advocates mental models and schema based on experience.] This is a broader more pragmatic view of mind, not relating to any narrow ontology as Cartesianism.

Much of Endsley's work on SA has been on how people acquire it and how to measure it, as a starting point see: (Endsley, 2000). I shall not dwell on what Endsley thinks about how we mentally acquire SA, but to some extent it involves both long-term and short-term memory. Training for SA improvement is very much possible and many external factors can degrade SA performance (Endsley, 2011; Endsley & Garland, 2000; Wickens et al., 2013).

There is one important statement in Wickens review of Endsley's SA model that more or less sums it up: *"I argue that SA is directly lodged within perception-cognition, not within action selection, choice, or decision making. Human performance is a product of both stages, but SA is not."* (Wickens, 2015, p. 91). This is in my opinion highly plausible, and hard to counter argue, and the only possible shortcoming of this statement relies on the prerequisite that there is perception-cognition, action selection, choice and decision. Several investigations in dynamic high velocity environments have proven that there is no such thing as selection, choice or decision, actants simply engage in action. This makes SA more or less the only factor to define human performance, many may influence it though. One can omit this argument however, at least at the philosophical level, by simply stating that this is some sort of decision making also, making this engagement alone a part of SA process as Endsley and Wickens advocates (G. Klein, 1997; G. A. Klein, 1999; G. Klein, Calderwood, & Clinton-Cirocco, 2010).

Distributed Situation Awareness

In the wake of Endsley's 1988 and 1995 papers a few other models emerged. Neville Stanton and colleagues presented a new model essentially based on Endsley's work with a paper in (2006) based on intentions published (?) in a conference paper in 2004. In this conceptual phase the theoretical foundation was somewhat shallow. What they did was in essence to apply Endsley's three stage model onto a system of actors. Stanton formulated his fundamental ideas of distributed situation awareness (DSA) in six tenets. I will discuss some of these, the first tenet is: (1) *"SA is held by human and non-human agents. Technological artefacts (as well as human operators) have some level of situation awareness (at least in the sense that they are holders of contextually relevant information)..."* (N. A. Stanton, 2006). The idea of DSA as I see it, is to place SA, not in the mind of one or several operators, but rather distributed within a system (N.

A. Stanton et al., 2009). This first tenet is a bit puzzling. Do technological artefacts have some level of situational awareness or are they holding relevant information? SA is surely not the same as information (Endsley, 1988; G. Klein et al., 2010; K. Smith & Hancock, 1995). Further, it is highly dubious that artefacts can be aware of any sensation (Endsley, 2015b; G. Klein, 2015). Stanton uses an example of a gas analyzer to which he credits the ability to perceive, comprehend and project, but this is in my opinion far beyond the abilities of a real time instrument, which at best may be able to extrapolate a rising or falling tendency based on simple regression. Another thing that is equally puzzling is that he uses a rather rudimentary definition of a system as simply consisting of human actors and artifacts. Systems can be much more. Systems are also procedures, social norms, regulations, standards, networks, symbols, politics, collective mind and interrelating between the human and non-human elements of those systems (Bolman & Deal, 2013; Raz, 1975; Weick & Roberts, 1993; Weick, Sutcliffe, & Obstfeld, 2008).

(i) Holding information within artefacts, as Stanton further writes, is as I see it, is a part of the process of sending and receiving information, brilliantly formulated in a mathematical theory of communication, a process that can only lose, never gain, information and change the degree of entropy in the data-carrying signal (Shannon, 1949, 2001). (ii) Some of the most prominent critic about Endsley's model, is that it is a mere model of information processing (Endsley, 2015b; Hoffman, 2015). (iii) The whole idea of DSA is to move parts of SA from the individual operator and into the system (N. A. Stanton, 2006; N. A. Stanton et al., 2009). (i), (ii) and (iii) do not hold together: (i) and (ii) gives the inverse of (iii), there is no (i) or (ii) as both statements are true. This is a shaky foundation to build any theory upon, I believe Stanton and colleagues sensed this, from 2006 to 2009 "a system" became "a sociotechnical system" and references to the scientists at the Tavistock institute, mostly Bamford, Trist and Emery, started to occur in Stanton's writings. "Information" became "knowledge" giving way to implement Edwin Hutchins' theories of distributed cognition, as an explanation to what was going on within the sociotechnical system (Salmon, 2010; N. A. Stanton et al., 2009; Neville A. Stanton et al., 2015). However; despite waving a foundation in distributed cognition, Stanton and colleagues still state that the three levels of SA are based on schema theory on the individual level. This being a dichotomy, as pointed out by schema-theorists, they introduced the idea of two kinds of SA, compatible and trans active SA. This is best viewed as some kind of "theory-shopping," selecting whatever fits. To make this work Stanton must recognize both neo-Cartesian cognitivism and distributed

cognition as holders of SA within the same system, making the ontology on which a future *theory* could be built dubious (Hutchins, 1995; N. A. Stanton et al., 2009; Winsen & Dekker, 2015).

The next three and the sixth tenet of DSA are of a more technical nature: (2) Different agents have different views of the same scene. (3) Overlapping SA or not depends upon their respective agent's goals. (4) Communication between agents can be verbal and non-verbal. (6) One agent may compensate for degradation in SA in another agent. In my opinion these four tenets are quite obvious and hard to argue, but the fifth tenet is a bit more problematic (5): "*SA holds loosely coupled systems together...*"

I quote Weick who coined the term loose couplings: "...*defined loose coupling as a situation in which elements are responsive, but retain evidence of separateness and identity. [...] loose coupling is evident when elements affect each other suddenly (rather than continuously), occasionally (rather than constantly), negligibly (rather than significantly), indirectly (rather than directly), and eventually (rather than immediately)...*" (Orton & Weick, 1990, p. 203). Does this mean that, as an example, an outfit like an infantry squad is loose coupled if they have no significant amount of SA between them? This is in stark contrast to findings studying a WW2 commando team; the team's strong commitment to structure was the key to their success (Bolman & Deal, 2013). This is delining strong connections, not loose couplings, at least not according to Weick's definition of it. Weick states that loosely coupled systems generally are defined by lack of coordination, void of regulations, equivocal and ambiguous (Weick, 1976). In order to prevent comparing apples to oranges, I suggest the following: SA, or any other process or product, can be either a part of the purpose of the organization (noun) or a part of organizing (verb) as a task (Bakken & Hernes, 2006). Differentiating between the two instances is not necessary. This will be like stating that there are different kinds of sleepiness. It may be differentiated, like SA, by context. Sleepiness, while driving a car or lying in your bed at night, are two entirely different scenarios. Recent response to Endsley's latest publications state that situation awareness context matters (Flach, 2015). Any organization may at some point experience loose couplings and tight couplings within the different perspectives and activities of their operations. How this relates to SA is a matter of context.

Other Models and Theories of Situation Awareness:

This is provided as reference to provide a more complete overview of current SA models. Some will be referred to briefly in future discussions, but it is not necessary for the reader to understand these models on a conceptual basis:

- Klein's Recognition Primed Decision model. This is Perception and enactment without the need for decisions to be made (G. A. Klein, 1999; Ross, Klein, Thunholm, Schmitt, & Baxter, 2004).
- Endsley's models of Team SA and Shared SA (Endsley, 2011; Endsley & Garland, 2000).
- Artman and Garbis' model of DSA as Distributed Cognition. This model actually recognizes DSA as a process of sensemaking within the framework of Hutchins distributed cognition model. I find no signs of SA, only cognition distributed within the system (Artman & Garbis, 1998; Wærn, Garbis, & Artman, 1999).
- Whintec Model – Active Situation Knowledge (ASK). A model of DSA passing on ASK between members of an organization (Lundberg, 1999).
- 3-Q Model of Awareness. This is a very interesting new model used by US defense branches. (I have no references except some power points available on the internet.)

Sensemaking in Organizations

Sensemaking may seem a bit hard to understand, but remains a staple item with OT scientists much more so than SA is, so this chapter will be briefer than my discussion of SA. I will neither provide any significant critique of sensemaking, personally I am a fierce proponent of sensemaking, and general shortcomings of sensemaking is well known (Hernes & Maitlis, 2010; Maitlis & Christianson, 2014). This is just a brief hint of what sensemaking is about, no in-depth survey, to be used as a reference for those unfamiliar with sensemaking. This is also very much about Karl Weick's framework of sensemaking.

Sensemaking always supersedes action. If everything is as expected, there is no sensemaking. Sensemaking is what happens when there is discrepancy between what is expected and what is experienced (Maitlis & Christianson, 2014; Weick, 1995a). You may argue that sensemaking is a bit like learning, and it is, but there is one crucial difference: Learning leads to a change in behavior, in fact the whole purpose of it is to change behavior. Sensemaking can, but may not change behavior. Although many authors mistakenly takes it for one, sensemaking is not a theory (Maitlis & Christianson, 2014). Karl Weick describes sensemaking as a developing set of ideas (1995). If I refer to sensemaking as a framework, it has evolved a bit during the years since Weick conceptualized it. But not that much, a good start to understand it is to view the different characteristics of sensemaking summarized by the acronym SIR COPE: *Social context, Identity, Retrospect, salient Cues, Ongoing projects, Plausibility and Enactment*.

Remember that the core concept of sensemaking for Weick is that it is a developing set of ideas. He views sensemaking descriptively, conceptually and prospectively, and the different characteristics of sensemaking are contextualized. Characteristics that have been added later are *Flux, Accountability, Storytelling, Justifications and Images* (Weick, 1995a, 2009). All these characteristics are also very much general descriptions of what is going on within any organization at any given time: We recall and tell *stories*, justify our *action*, do something when we find *cues* and further. We give meaning to action and sometimes we actually do something as a result of it. It can be deliberately or not. This is in simple words sensemaking. How we make meaning is influenced by, and a result of these and probably many other characteristics. I will try

to explain some of the more important characteristics in more detail in order to provide an even better understanding of sensemaking:

- Social context:* Sensemaking is influenced by others and its context. People needs social anchors and forms social reality.
- Identity:* Everything we do is in one way or another result of our identity. Identity can have any given meaning; self-identity, professional identity or organizational identity. “*What the situation means is defined by who one becomes while dealing with it or what and who one represents*” (Weick, 1995a, p. 20).
- Retrospect:* Sensemaking is looking back, what one notice in elapsed events, this depends on how far back you look, how well you remember what happened.
- Salient Cues:* Some events always stand out as more visible than other. These are objects of special importance or special circumstances.
- Ongoing Projects:* Sensemaking is a never ending process. If you cannot keep up with the pace you might lose information. In dire circumstances it may collapse, but it will always start over.
- Plausibility:* Actors choose plausibility over accuracy; seek coherence, credible action and sufficient certainty for current purposes.
- Enactment:* Action is a mean to know what you are up against. You can ask question, negotiate build prototypes and try them out.

Adapted from Weick (1995, 1999).

The Different Stages of Sensemaking

Sensemaking can reach different stages. You may see them as different levels of maturity, or simply how enduring results of the sensemaking process will be. These levels are not sequential and may be invoked at any level independent of status of others (Weick, 2009; Weick et al., 2005).

- Sensemaking as Committed Interpretation
- The Commitment to Interact
- The Justification of Committed Interacts
- The Validation of Justification

Sensemaking in the Broader Sense

We are later going to discuss Husserl; in this sense Weick has much in common with him. In Husserl's Phenomenology bracketing is essential to extract cues. This is phenomenological reduction—a methodical procedure that leads us from “*the natural attitude*,” in which we are involved in the actual world, to “*the phenomenological attitude*,” in which the analysis of the content of the consciousness is done (D. W. Smith, 2013).

Sensemaking is about how we enact (act on) cues, in that respect it has very much in common with situation awareness. The one important aspect is temporality. Sensemaking is retrospective.

During my study [scrutiny] of Weick I have noticed a few important characteristics. Weick sticks with Plato. He assumes essentially nothing and concludes on what he observes. He is most keen at finding patterns in observed cases. By doing this he eludes being caught in categories like cognitivism, behaviorism, dualism and mental models and so on. Most consider him a process oriented pragmatist [I guess all pragmatists are in essence], but there is not much visibility of this in his writings (Hernes, 2007; Hernes & Maitlis, 2010). Even Gilbert Ryle is used as descriptive data. The process of adapting or more precisely combining Weick's work on sensemaking to more fundamental discussions about the mind and its idea was an easy one.

Weick is his own best and harshest critic. He is very thorough in his discussions and every now and then publishes articles that seem cryptic to the uninitiated but is essentially a critic of his own methods and work. Here are some very good examples of this: (Weick, 1995b, 2004, 2007)

The Mind

“There is a Giant Pink Elephant with Polka Dot Bikini Dancing with a Red Lighted Hula Hoop in the Room of Organizational Theory. Did I mention that the elephant sometimes look like a camel wearing a turban with a bomb in it?” [I am only checking that your SA is at a required level, please reread if not.] Decoded the message reads: It is hard to write about the mind. It is sometimes the residence of religious beliefs too. It is better left to the philosophers and the theologians. Generally it is not much of a problem either; the limit of theorizing is usually perception, cognition, memory, comprehension, mental models, schemata, intuition, traits, states and many other words used to explain processes and characteristics of the mind. When I wrote about situation awareness in organizations I asked if there is a void between something mental and something physical. On the other side of this void one encounter, once again, neurons and synapses and neural networks. I see a good many reasons to let this void be; scientifically, it is simply put not necessary to investigate into that part of human being. On the contrary; sometimes this may be pure escapism also. Personally I do not believe in any kind of void in the human being, I use it merely as a metaphor to illustrate a lack in research, but during the elapse of ages, human beings have filled this void with all sorts of beliefs, souls, immortality and Gods. A Pew Research survey from 2014 of adult US citizens identified 78.4 as being Christian, 4.7% belonging to another religion, 16.1 being unaffiliated and 0.8% of the population were unable to answer the question (“Statistics on Religion in America Report -- Pew Forum on Religion & Public Life,” 2014). Any number of those affiliate with religion can be agnostics, of course, on the other hand any number of them may be true believers deep down also. We have no way of finding out. Creationism as a scientific theory was viable within parts of US schooling systems until 2014, 155 years after the publication of Charles Darwin’s *“The origin of species.”* (Published on November 24th 1859.) There is some serious lagging going on in some parts of our society and within our science. Digging too deep into the concept of human mind can be a stepping stone into a virtual mine field. Sometimes you can evidently do it just by picking up a pencil and make a drawing on a piece of paper, trying to make sense.

Phronesis

Aristotle (384-322 BC) said we shall seek practical wisdom. Phronesis is the Greek word for practical thought and in English the best common word for Phronesis is; “prudence”. Aristotle goes a bit further than the mere meaning of the word; he constitutes Phronesis as one of the main human virtues, an act of mind. Prudence is very much the same as heed and is generally used as a synonym within English language.

René Descartes

Since Aristotle not much happened with the study of the mind until Descartes came along. Rene Descartes (1596-1650) was a brilliant mathematician. Together with the likes of Euler, Gauss, Leibniz and Newton, Descartes is considered one of the fathers of modern day mathematics. He was nothing short of a genius. A deep and profound understanding of mathematics led him to philosophy. Descartes firmly believed that perception was unreliable and developed deduction as a scientific method. In short the principles he used to gain a deeper understanding of mathematics should be used in all areas of scientific work. Only the principles that we cannot disprove and reject can be fundamental. In his book “*Discourse on the Method*” he postulates:

“The first was never to accept anything for true which I did not clearly know to be such; that is to say, carefully to avoid precipitancy and prejudice, and to comprise nothing more in my judgment than what was presented to my mind so clearly and distinctly as to exclude all ground of doubt.”

Descartes’ deduction led him to the single principle: - Thought (cognition) is (exist). - I think. - Then I am (exist). I think therefore I exist. Actually this is a somewhat awkward translation of its real meaning, Descartes deduction is in Latin, and so is his famous principle:

“Cogita ergo sum” [Deduction may be in French: *“je pense donc je suis”*]

In Descartes view; the world was divided in three as he believed God inhabited one all for him (God has no self), other parts being the material world and the nonmaterial world. The body worked like a machine, obeyed the laws of nature and was a part of the material world. The mind was a part of a nonmaterial world and did not obey the laws of nature. He stated that the body was viable without the soul. He observed that animals had a life. The soul was connected to the body by the pineal gland; one of few unitary (he thought so) parts of the brain Descartes knew.

The pineal gland was the seat of the soul. This division between the mind and the body is what we forever after refers to as *Cartesian dualism* or just dualism. Descartes was one of the first to properly address the mind – body problem and try to come up with a solution. Descartes published these theories in *Passions of the Soul* (1649) and *The Description of the Human Body* (1647) and to this day his theories are still discussed, defended and opposed. Proponents find in particular his concept of a mind, separate from the body, not obeying the laws of nature comforting. When I think of it; I cannot see any other way than dualism to explain how an immortal soul can leave the body and travel to God (or some other place) when you die. Opponents of dualism find the separation of mind and body unjustified, the mind is just a part of our body as any other, accepting the prospect of finitude (Giddens, 1991; Ryle, 1949). This is what, within the philosophy of mind; is called monism. Is it possible to discuss Cartesian dualism without including religion? Well, this was my best effort.

[Some scientists that advocate monism, including Gilbert Ryle, who will be discussed next, tend to diminish Descartes when they disagree with him. I quote Ryle writing about what he refers to as *Cartesian dualism*: “Such in outline is the official theory. I shall often speak of it, with deliberate abusiveness...” (Ryle, 1949, p. 6). To Ryle’s defense I must admit that his criticism of Descartes generally includes cognitivists also, as being the official theory. Descartes theories are more recently cited by neuro scientists, claiming to find a unitary model of mind and body as; *Descartes error* (Damasio, 2008). These critics forget that Descartes wrote his books in context with his own time. He simply avoided confrontation with the ecclesiastical authority. The problem with Descartes is not his theories, but the lasting impact they made on philosophical thinking, and ended up, in Ryle’s words as; *official theory*. He gave rise to what I will refer to as *the Cartesian heritage* and it’s seemingly permanence.]

The Cartesian Heritage

Within the field of mathematics and methodology we owe a lot to Descartes. He is presumably the most read philosopher of all times. A search I did on amazon.com in the title field on “Descartes” gave 9 600 hits, and you have to add some 350 years of books that are not present on Amazon. As a result of this, Descartes, his philosophy and his logic and methods of deduction have been extremely influential upon essentially all of science since the days he walked this earth. Lessons learned from Descartes are that we find answers to our questions and

dilemmas by pursuing logic deduction. We start with the fundamental, if we cannot prove it false we assume it true. Upon this foundation we put the next element of our theory, if (when) this is true also, we have two true elements. We pursue the “true” until we find the answer that can: “...exclude all ground of doubt,” as Descartes wrote in his “*Discourse on methods*”. This makes perfect reason, but recognizing Descartes’ influence we can assume the following. This is how reason “is”. Reason is sequential and following a straight line towards the answer to our questions. Reason is rationality. A conjunction of true elements is always true. Cogito ergo sum. Not the other way around. Four hundred years in a more or less Cartesian world have made this the assimilated truth. I suddenly realized that I put the word “reason” on the bonfire, but a further assumption can be that this is generalized into how the mind- and finally how the brain works also. We sense the world with our neurons, electrical signals are transmitted through our nerves and the sensations (data) are processed according to some master program in our cerebral cortex and other parts of our brain, and eventually some kind of output is provided and decisions are made, we engage in action or do nothing. This is called the classical view of how the brain works. Again, this makes perfect *reason*. It was considered so simple that scientists started to write computer programs that should replace human thinking and provide for artificial intelligence (AI). When this turned out to be an error, scientist came up with the idea of neural networks and schema theory. The connectionist view of how the brain works was born, and AI scientists and programmers started rewriting their programs. This will fail also (Hubert L. Dreyfus, 1972, 1992; Haugeland, 1997). It is not that simple. The world is simply not Cartesian. If we look back again I find this a bit amusing, remembering what Descartes started from. He rejected perception as being too unreliable to be the foundation for science, and as so, that makes sense. Perception is how we represent and understand the world; we have no other input of the world as it is. Perception provides context. Thus all our thoughts, decisions and actions are based on perception. Can perception be separate from the human mind and thus intelligence? One who tried to answer this question was Gilbert Ryle.

Gilbert Ryle

When Gilbert Ryle (1900-1976) was not studying Plato or tinkering with his own philosophy he was teaching students. He was famous for making absolutely brilliant analogies. Scientifically Ryle was a proponent of ordinary language philosophy. He had very much in

common with Ludwig Wittgenstein (1889-1951) in his approach to philosophy. [For a comprehensive, but not entirely justified, critic of some of Ryle's ideas see Richard Rorty in (Christensen & Turner, 2013).] In 1949 he published "The Concept of Mind." In the beginning of the book he tells the following story:

"A visitor to Oxford or Cambridge for the first time is shown a number of colleges, libraries, playing fields, museums, scientific departments and administrative offices. He then asks 'But where is the University?' He was mistakenly allocating the University to the same category as that to which the other institutions belong." (Ryle, 1949, p. 6)

The visitor was mistaking the categories and believed the university belonged to the same class as its departments and expected a specific building. We all know that a university is the sum of its departments. Departments again are made of buildings, staff, students etc. which again belongs to other categories. Ryle continues by explaining the visitor's error as what he coined as a *category mistake*. Another example of a category mistake is a person watching a cricket match for the first time. Another person is explained who does the bowling, the batting and the wicket-keeping. After this the newcomer asks: "But who is doing the team-spirit?" It is quite obvious that persons who do not understand what is going on are prone to make *category mistakes*.

Ryle explains that Descartes makes a category mistake. In my view Descartes was a genius who seldom made mistakes, but in order to solve what was a dilemma to Descartes, he came up with what Ryle coins as *the dogma of the ghost in the machine*. On one hand Descartes studied and understood much of the physical world. Galileo Galilei (1564-1642) and his work was well known to him and his own knowledge on the science of nature was profound. On the other hand it was impossible for Descartes to deny the existence of God. He knew all too well what had happened to Galilei. Most studies even consider Descartes as being a good Christian, but this remains debatable (Cottingham, 1991, 1992). On the same hand he had the challenge of originating the non-physical things in the world. This is what leads to Descartes' category mistake: That body and soul were both substance. Descartes actually invents a whole new kind of substance to satisfy this condition: nonmaterial substance. Ryle categorizes this as philosophical nonsense, which is hard to argue.

Ryle's Regress

In the words of Ryle the most fundamental error with Cartesian dualism is infinite regress:

“Let us consider some salient points at which this regress would arise. According to the legend, whenever an agent does anything intelligently, his act is preceded and steered by another internal act of considering a regulative proposition appropriate to his practical problem. But what makes him consider the one maxim which is appropriate rather than any of the thousands which are not?” (Ryle, 1949, p. 19).

We leave Ryle's eloquent prose and revert to the well-known analogy of the “brain-computer” and the ghost. If a man (agent) does something smart (intelligently) the brain-computer must run the best (maxim) program using the optimum algorithms. Not any odd program out of the thousands of different ones you have got in your head, [quote ends here] but the best, otherwise you will not appear especially intelligent. Who picks that program? The answer to this is the ghost in the machine. And here is the case of infinite regress. There must be another ghost telling the first ghost to pick the best program, and another one to tell that one.... ad infinitum . I will leave Ryle here for a while; I get back to him later. Infinite regress does not need to be a problem. The work done by the ghost is the sum of the infinite geometric series expressing the iterations of “ghosting”. If the successive term is a fraction on the last the sum of the series will still be finite and the series converges. I am afraid that the successive term will equal the last making the sum infinite. If we return to Ryle again he states that it will be impossible to start such a loop of infinite regression: *“But if, for any operation to be intelligently executed, a prior theoretical operation had first to be performed and performed intelligently, it would be a logical impossibility for anyone ever to break into the circle.”* (Ryle, 1949, p. 19). In Descartes defense I have to admit, and Ryle keeps forgetting this, the ghost is not following the rules of nature. It is out of this world. However there is an experiment within physics that deals with what happens when a ghost (in this case named a demon) controls a machine.

Maxwell's Demon

Remembering Frank Zappa, who made sheets of music virtually “black” with notes (The Black page #1), I quote Zappa: “This is a hard one to play.” However, the implications are so profound that I cannot resist. The following is a classical thought-experiment that disproves

mind-matter dualism, verified by a Japanese team of scientists; I start with a small physics lesson:

[Increased entropy → more disorder → less energy available]

[Decreased entropy → more order → more energy available]

Imagine two fully isolated boxes separated by a frictionless shutter door. The boxes are filled with a gas. The gas molecules will pop and bounce around inside the boxes much like the balls with numbers on inside a Plexiglas container during a lottery draw on TV. According to Ludwig Boltzmann (1844-1906) the temperature, hence the speed, of the gas molecules will follow a normal distribution curve. Most of them will move according to the actual temperature in the gas (σ), but some will move slower (lower tail) and some will move faster (upper tail). Following the second law of thermodynamics the entropy of a closed system must remain constant. This system can be observed and it is in this world. Into this system we place a demon. He is “all mind” and out of this world, but with the ability to observe the gas molecules and control the frictionless shutter. When the demon observes a high speed molecule from the left box heading for the door he opens the shutter, lets it through and closes the shutter. Next; as soon as he observes a low speed molecule in the right box heading for the door, he opens the shutter, lets it through and closes the shutter again. And so he continues until he ends up with a box with a higher temperature on the right side and a box with lower temperature on the left side. The entropy of the boxes is lowered. The second law of thermodynamics is apparently violated. This is actually quite brilliant, and it was presented by one of the greatest minds of all time; Scottish physicist James Clerk Maxwell (1831-1871).

The puzzle was solved by Hungarian – American physicist Leo Szilard (1898-1964) in 1929 (He did the mathematics correct, but with a flaw in the deduction corrected by Rolf Landauer a. o. Szilard’s proof reached common census I the 1980’s)

In order to explain the system we must see the physical boxes and the mind – demon as a whole. What Szilard proved mathematically was; when you delete information you increase entropy. In essence he linked Shannon’s information entropy to Boltzmann’s thermodynamic entropy. While this mind-demon is observing the speed and direction of every molecule approaching, he is gaining ever more information, at some point he has to run out of storage space and start deleting information. He can do it when he rejects a molecule or any time later.

When he deletes information his entropy increases. The increase in entropy the demon is experiencing must come from the decrease in entropy within the two boxes. The second law of thermodynamics is not violated. The mind-demon makes an isolated thermodynamically system together with the physical boxes. There is a migration of entropy. The entropy in the whole system remains constant. To me this is at least circumstantial evidence that both the mind and the matter must be of the same world. The increase in entropy by deleting information is verified by a team led by Eric Lutz (Bérut et al., 2012). A few years before that Japanese scientists were able to replicate Maxwell's experiment and actually sort molecules according to their temperature (Toyabe, Sagawa, Ueda, Muneyuki, & Sano, 2010). [One important note on this to the uninitiated: This is pure applied physics.]

Ryle's Demon

If we assume the following; (1) The ghost in the machine obeys the laws of physics and mathematics, after all these are universal throughout the universe, and: (2) The ghost and the machine are parts of the same thermodynamic system, things get really interesting. Ryle's Regress and Maxwell's Demon (the increase in entropy from deleting information) combined shows that the entropy within a closed system will maximize when some sort of deliberate conscious action occurs. A human being is not a closed system; if "your system" close you will die due to asphyxiation, dehydration, starvation, constipation etc., but for a few seconds the body (machine) and the mind (the ghost) can be considered a closed thermodynamic system. Imagine you decide to close your eyes: The ghost will tell the ghost will tell...ad infinitum. Within a split second the entropy of the body will be maximized. All that is left are some randomly distributed molecules with the lowest possible energy state. Dear I suggest: Less than ash scattered on the ground?

Mind as Disposition to Heed

Having spent quite some time arguing that the mind is not some sort of thing of immaterial substance located in our amygdala, I can begin the process of finding out what it actually is. One way of finding out is to simply review the ontology of mind and go top-down (Dennett, 1981; Haugeland, 1997). [For an actual review of the ontology of mind see also: (Steward, 1997)] Ryle starts in the other end, and one of his most central ideas is to view the

mind as a disposition to heed. Weick reading Ryle elaborates: “*The word ‘heed’ captures an important set of qualities of mind that eludes the more stark vocabulary of cognition.*” (Weick & Roberts, 1993, p. 361). Another way of finding the meaning of something is to look in a dictionary. I am quite sure that this is no surprise to the reader, but it is possible to look a bit further than the actual process of finding out. Dictionaries tend to use the common understanding, synonyms or *meaning*, as opposed to the encyclopedic or academic *definition* of words. Webster gives the following explanation of the noun mind: “*The intellectual power of man; the understanding; purpose [...]; to attend to; to fix the thoughts on; to heed; to notice*” and further mindful: “*heedful*” and mindless: “*heedless*” (1985). My dictionary is a rather old dictionary, and the meaning and use of the word heed may have escaped current generations, but when reading Ryle’s prose, I do believe that it was a word he used in his common language also. Anyway, it was not necessary for him to look far to see the connection between heed and mind. If you wonder what “heed” means, you can more or less use the same words as for “mind”, but you may want to add the word “care”. This again; adds some beauty to it all:

Mind ↔ Heed ↔ Care

Mindful ↔ Heedful ↔ Careful

Mindless ↔ Heedless ↔ Careless

Ryle elaborates the difference of “knowing that” and “knowing how”. In this he shares much with Husserl and eventually Heidegger. Not surprisingly, this leads all the way back to Aristotle. But the principle is shortly described whether we act (*exercises*) by rules of canon or applications of criteria: [Episteme or techne if I go back to Aristotle.]

We can make a decision on how to act: Heedless or heedful, this decision can be proactive.

Ryle is focused on the mind of the individual, but Weick extend Ryle’s ideas to groups of actors (1993). By combining the ideas of Ryle and social psychology pioneer Solomon Asch (1907-1976) he establish and coin the term ”heedful interrelating”. Using Ryle and Ash as a foundation, he makes the following conclusion: “*The insights of Ryle and Ash can be combined into a concept of collective mind if we argue that dispositions toward heed are expressed in actions that construct interrelating.*” (1993, p.364) Weick makes this construct in an article that investigates why: “*Organizations concerned with reliability enact aggregate mental processes that are more fully developed than those found in organizations concerned with efficiency.*” (1992, p.357)

Ryle and the Cartesian Heritage.

After the release of “*The Concept of Mind*” Ryle continued his work on Plato and philosophical psychology, but his theories were not widely accepted. Within organizational theory (OT) he was essentially ignored until he was revitalized with a paper by Weick in (1993). Within psychology his theories gained little influence. The reason for both was the advent of cognitivism which became very influential upon OT and cognitive psychology. Cognitivism is a theoretical framework that came to be as a response to behaviorism, criticized for not considering cognition as a part of mind. In cognitivist view the mind has discrete mental states and the thought process is viewed like manipulation of data following rules, much like programs within computers do. In particular cognitive psychologist Herbert Simon (1916-2001) proved to be very influential within decision making theory (G. A. Klein, 1999; March, 1991). Cognitivists are considered neo-Cartesian and “*The Concept of Mind*” is very much a critic of cognitivism and a defense of certain aspects of behaviorism. Influential Cognitivist Noam Chomsky published a book that certainly connects Descartes and cognitivism called “*Cartesian Linguistics: A Chapter in the History of Rational Thought*”, defending mental states advocated by Descartes (Chomsky, 2009). Hence we have the rule of *the Cartesian heritage*.

Husserl

The remainder of this part of the thesis is an attempt to understand whatever it is; what we call the mind. This is still not obvious? We started with Aristotle who said that perception is the key to all understanding. We studied Descartes who said that reason is the key, perception cannot be trusted. Cogita ergo sum. Descartes was a rationalist. Ryle made quite an effort to prove him wrong: The mind is just an inseparable part of our bodies. I think in many ways he did disprove him. Ryle was not a rationalist. He loathed “the official theory”, discarding it as neo-Cartesian, so he was certainly not a cognitivist (Ryle, 1949). So what was he? Well, in some ways he is to be considered a behaviorist. This is not to be confused by radical behaviorism as advocated by B.F. Skinner, more like a sort of intelligent behaviorism directed at some goal, action, observable. There is a reason for this: If we return to his book “the concept of Mind,” he refers to it as a study in phenomenology. The book contains a few references to Edmund Husserl (1859-1938), the father of phenomenology. Husserl was a German philosopher who claimed *phenomena* (plural of phenomenon; any observable occurrence) distinct from *being*.

Consciousness is intentional, meaning that it is always intended (directed) toward something, and is always about something. To gain a better understanding of Husserl: Let us take one step back:

Within any science phenomenology is (was) initially the study of phenomena, appearance instead of reality. Meaning we study objects and action by the way they appear, not by what they actually are. In other words: Plato (ca. 428 -348 BC) and his theory of forms (or idea). Ryle was one of Europe's most prominent researchers on Plato. In many ways he was deeply influenced by Plato in his philosophy. This may seem like a step back in history, but imagine you are going to learn to become a master builder: There is no sense in studying a carpenter, a board of wood, a hammer and a nail. The only way to gain understanding is to study the idea of cladding a wall. The lesson learned is that the phenomena is what we perceive, what we try to understand and understanding provides us with comprehension.

If we return to Husserl again the key element was distinct directedness, this meaning that we experience towards (intent) something through the given context. [I challenge the reader to compare this to Weick's concept of Sensemaking or to Endsley's Concept of situation awareness.] Consider the following example:

I see that frightened girl running away while an angry gorilla pounds his chest.

Table 1

Phenomenological analysis

Sentence	Phenomenological description
<i>I</i>	First person structure, gives directedness
<i>see</i>	The verb, Type of perception
<i>that frightened girl</i>	Modus, Direct object expression, <i>Noema</i>
<i>running away while</i>	Given context
<i>an angry gorilla pounds his chest</i>	Defining context

Note: Adapted from example by: (D. W. Smith, 2013)

This may seem a bit elaborate, but if we take a look at *Table 1*, I have deconstructed one of the sentences to illustrate the phenomenological understanding of an event in space and time. Husserl was concerned about the expressive powers of language, so he used the term *noema*;

describing the meaning of the experience (remember Plato: form, idea), one influential paper describes noema as the mediating component of the act (here: of perception) (Føllesdal, 1969).

A few thoughts on Endsley and Husserl

If I follow professor Foellessdal's line of thought: Our consciousness is directed at the mediating component of our perception. This is essentially what situation awareness (SA) is all about. If the ontology of SA is to be explained, as it is understood through the positivist research of Endsley, I believe parts of it are with Husserl. I think that this is a sound approach given Endsley's approach to provide a practical solution to an imminent problem. A positivist approach to social sciences seldom allows room for meaning to be a part of any given model. This is what I experienced when I tried to make SA a part of OT whose foundation is largely based on interpretive groundings. OT is all about meaning and processes that are largely social. The derivative theories of Endsley's research however, got stuck somewhere along the way and adapted itself to be influenced by the Cartesian heritage. DSA, currently based on the processes of gaining genotype and phenotype schemata, being the most prominent one (Endsley, 1995, 2000; Føllesdal, 1969; Neville A. Stanton et al., 2009). In an influential paper Weick quotes Dreyfus saying that: "*Connectionism is a shaky basis on which to erect any theory of organizational mind [...] Connectionists have difficulty simulating emotion and motivation, as well as everyday thought and reasoning.*" (Weick & Roberts, 1993). In a way, this very much ends my journey through the history of philosophy together with situation awareness, and to an extent sensemaking also. The concept of situation awareness must continue to prosper and evolve into a theory that encompasses emotion and motivation. I will continue my endeavor to research the concept of mind by looking a step further than cognitivism.

No Mind?

The most obvious line of thought to follow if you want to fix the mind-body problem is to simply eliminate the concept of mind. Human beings have no mind. This is a very old idea. Within Zen Buddhism wu-hsin (No-mind) wu (Nothingness) were key points of focus within the Tang- and Sung Dynasties respectively. More recent approaches also exist; I guess there is no need to mention B.F. Skinner in this context? This is in stark contrast to the beliefs of many aboriginal or native cultures who believe the mind (soul) is in everything. In a strange way it is

possible to combine these two views of the world. Many philosophers probably have. It may seem like it, but this in by no means what Martin Heidegger (1889-1976) did, he was a student of Husserl, so in essence he just took hold of Husserl's theories and moved forward (Hubert L. Dreyfus, 1991). The result however has a striking similarity.

Heidegger

My one big deviation from life as I knew it, when studying for this thesis, was to start reading Heidegger. Not about him, I went to the source, reading English translations. This proved to be problematic.

Heidegger and Language

The understanding of words and narratives is detrimental to understand Heidegger's philosophy, and there are many opportunities for misconceptions. Heidegger is aware of this, and key elements in his writing are the construction and combination of words which he did in German. I have encountered this problem before. Most notably when reading Martin Buber (1878-1965), even the title of his famous essay on existence remains a puzzle to English speaking people without knowledge of German: "*Ich und Du.*" The word "*Du*" simply does not exist in English. The rarely used word thou is simply put not the same. This is not a problem in the English speaking world as these "problems" never arise. The way we give meaning, by using words and constructing sentences, is inherently different in English and German. But, every time one has to translate something, or when you are speaking in an acquired language, it is. I will discuss this in more depth later when I address the problems of acquiring SA through verbal communication and narratives. Being German speaking, I solved this issue by picking up German- and Norwegian issues of Heidegger's writings. [And a good German dictionary.] It is much simpler than reading someone's translation with hordes of footnotes to and from the translation's shortcomings. Back here in the English speaking world again the problem recoils.

Heidegger and the mind problem

Husserl's intent was a problem for Heidegger. Personally I think Husserl in many ways is right. Humans are basically aware beings and this awareness triggers our attention and thus intent. Husserl thought somehow that intent was directed, but in order for this to work you more

or less end up in a mind- body problem. [The puzzles of internalism and externalism are often discussed concerning both philosophers to no common consensus.] Who was to direct this but the mind? This was not a problem to Husserl. But Heidegger had to solve this. His philosophy is essentially based on the one simple axiom that our existence is (not in) our being (noun). However this is not any odd being. This is actually very simple but fundamentally very hard to grasp. [I have strived to come up with a comprehensive model: Most have heard about the big bang theory, not the TV show, but the theory that models the birth of the universe as an initial singularity with infinite density containing all space-time and matter. In the big bang the singularity rapidly expands then inflates creating the universe as we know it. The universe is not static, but ever changing and expanding. It is also important to notice that there is a limit to our *observable* universe. This is a simple model of our being of course, but it makes sense. Please notice that you are the expanding universe, not the singularity. The singularity makes your center – your point in time.]

In 1927 Heidegger publish a book that turned out to be his magnum opus. It was called “*Sein und Zeit*” and the title is the conjunction of two nouns; being and time. This title makes the only two “things” we actually know. Descartes based his entire philosophy on these two entities also (and added a few more). Our closest sensation of our being is actually cognition, so Descartes stated: I think, therefore I am. This may seem like a chicken – egg paradox, but we have already proved that it is the other way around. I think because I am. Heidegger took this a bit further. He basically stated that: I think because I am *being here*. [I realize that this is an awkward sentence; Heidegger did not say this, but just to prove the analogy to Descartes]. Heidegger used a word that is notoriously difficult to translate into English. It is also a bit difficult to grasp the meaning of it. Let us start with the literal translation: “*Dasein*” is actually a concatenation of the two words “*Da*”; meaning both *here* and *there*, and “*Sein*”; meaning *being*. I have made a few sentences that imply the use of the word “*Da*”: “*Da bin ich.*” – Here I am. “*Wer da?*” – Who is there? “*Es ist nichts mehr da*” – There is nothing more left. The translation *dasein*; being there or there-being, as many tend to use is wrong, because *dasein* also means; being here. Existence is also wrong because Heidegger did not use the German word “*Existenz*,” that was used in another context. The only good translation of *Dasein* in English is the sentence Heidegger uses as modes of *dasein*: [Modes of] Being in the world (Hubert L. Dreyfus, 1991). This is actually the core phenomena of Heidegger’s philosophy: Human is: Being in the world.

The novelty to it all is that it actually fits everything. In-the-world is by no means restricted to tangible items or what is: *ready-at-hand* in Heidegger's own words. Heidegger writes that Dasein is closest to our understanding, not the abstract or sensations we perceive (Heidegger, 1996).

Heidegger and the dogma of directedness

Despite being a philosopher Heidegger started his professional career as a carpenter. [Among other crafts] As a result of this, a hammer is quite often used in his discussions. Heidegger experienced that when he was using a hammer, he was not aware of the actual process of hammering. The hammer as a tool was invisible to him and the only sensation he was experiencing was the act of hammering, nothing else. Not until someone gave him a hammer that was too heavy or otherwise uncomfortable did he have awareness of the hammer again (Heidegger, 1996). The use of a pencil is another good example. When writing you are not aware of the pencil, it becomes invisible; you gain only the sensation of writing. There were no subject and no object, just the act (idea), the whole idea of directedness and intent disappeared. Heidegger calls this *circumspection*. With this insight we leave Heidegger for now. He is notoriously difficult to read. In my view he adds layers upon layers of complicatedness to his theories without gaining complexity or clarification. For further understanding of mind and thought I will turn to John Haugeland (1945-2010).

Haugeland on Heidegger by Dreyfus

In the post WW2 years engineers were able to build more and more sophisticated computers. It became an area of much research and the resources of mathematicians Alan Turing (1912-1954) and Johann von Neumann (1903-1957) became available as both the Manhattan project and the codebreaking project at Bletchley Park ended. This was the dawn of artificial intelligence (AI). Many prominent cognitivists or cognitive psychologists were also mathematicians and they recognized the opportunities in AI quite early on. The architecture and processing power of early computers were literally speaking not much, but early AI devotees thought it possible to build and program a machine that could be proven intelligent. The proof of the pudding would be the famous Turing test. That did not work of course, and still do not work, and in many scientists' opinion never will. The rise and fall of AI caused two things to

happen. One good thing and one bad thin. Let us start with the bad: The idea that cognition worked like a computer program set a new light to the ever glowing fire of the Cartesian heritage. Models of human cognition started to pop up in the form of flowcharts, Boolean algebra was applied to discrete mental states and some even had ideas of brains doing binary processing. Much of this was actually applied research; a good deal of this was scientific nonsense (Ryle, 1949). The good part is that the interest in AI also triggered much good scholarly work on human intelligence, mainly the philosophical side of it. This was to a large degree done by AI opponents. The most well-known of these is Hubert Dreyfus. [In the new 2014 cinematic version of the 1987 Robocop movie starring Joel Kinnaman, a senator upholding a law to ban non-human android policemen is named Hubert Dreyfus in his honor. The law is named The Dreyfus Act.]

In his review of the 1992 Dreyfus' book; "*What computers still can't do*" Haugeland returns to Dreyfus' initial 1972 book called "...*What Computers Can't do.*" From the last part of this book Haugeland extracts the following model (Haugeland, 1996):

- (1) *Human intelligence is essentially embodied*
- (2) *Intelligent bodies are essentially situated (embedded in the world)*
- (3) *The relevant situation (world) is essentially human*

Haugeland continues his review of Dreyfus' 1972 model:

"This I would like to argue, all come to the same thing: namely, to understand the possibility of intelligence is not to understand a property of some possibly isolable system, such as an "intellect", or a "mind" (- intellect +affect), or even an "agent" (-intellect +affect +body). Rather, it is to understand a larger whole comprising a number of cultured, embodied individuals living together in an already meaningful world." (Haugeland, 1996)

Haugeland further writes that Dreyfus' book was published in 1970. This should bring some sort of Déjà vu to (us) more recent proponents of situated learning and embeddedness: Jean Lave's book "Situated Learning: Legitimate Peripheral Participation" (with E. Wenger) was published in 1993 and "Cognition in Practice came in 1988" These books left a deep impact on pedagogy as a whole. In a few sentences Haugeland (on Dreyfus (on Heidegger)) more or less sums up Heidegger's elaborate prose. Dreyfus on Heidegger preceded situated learning and

distributed cognition with nearly fifteen years. [And of course Vygotsky preceded both.] Before I leave existentialism, I will take a look at a few cases to illustrate the concepts of SA, sensemaking and mind. To summarize the theories discussed we must remember Dreyfus' inseparable system:

(1) *Intellect*

(2) *Intellect + Affect = Mind*

(3) *Intellect + Affect + Body = Agent = Intelligence*

Adapted from: (Hubert L. Dreyfus, 1972)

This teaches us that all parts of our body are embedded in the world as parts of our existence. The last important lesson from investigating the concepts of mind in general and existentialism in particular is to make the one statement that is fundamental to our further discussion. :

Human exists at a point in time and it is impossible for human to disprove this statement.

Two Cases of Poor Decisions?

In this section I will tell two stories of decision making. I will leave it to the reader to decide if they can be considered poor decision. What is important in these two stories are the means to the decisions, not the decisions themselves. In "Sources of Power" Gary Klein states: *"Poor outcomes are different from poor decisions. The best decision possible given the knowledge available can still turn out unhappily. I am interested only in the cases where we regret the way we made the decision, not the outcome. I define a poor decision-where we regret the process we used [...] Knowing what you failed to consider would matter."* (G. A. Klein, 1999) I find these two cases interesting because they form a dichotomy based on what we fail to consider. I believe both cases exemplify the need for both situation awareness and sensemaking in organizations and show their interdependence.

The Salvage at Utvika

The July 22nd (2011) Oslo bombing and Utoeya massacre are well known internationally as a national tragedy claiming 77 lives, mostly youth. The sole assassin was a 32 year old Norwegian right wing extremist. After detonating a bomb made from explosive slurry near the governmental quarters in central Oslo, he went on a spree armed with a semi-automatic rifle using high velocity hollow point ammunition and a semi-automatic pistol for backup. The

destination for this spree was the Utoeya AUF (National Labor Party's Youth Group) summer camp attended by some 600 youngsters. Utoeya is an island in Lake Tyrifjorden four miles north-west of Oslo. The killer went on the island posing as a police officer aboard a small ferry. Arriving at Utoeya he starts the spree by killing the camp hostess and an unarmed security guard. Soon after this he starts killing youth, still pretending to be a PO. At gunpoint the campers tried to hide or escape the island, mostly by swimming ashore, often severely injured. The massacre went on for an hour and a half killing 69 and injuring 66. The police arrived at the island at 1825 hours. The assassin surrendered as soon as he saw the police, having already telephoned the police twice on their emergency dispatch number willing to surrender.

Soon after July 22nd public opinion questioned the inefficiency and the long dispatch and response time. Lives might have been lost because practice and routines was apparently below a required level of quality (NOU, 2012; Sollid et al., 2012).

In the aftermath of the tragedy the Norwegian Secretary of Justice and the Norwegian police commissioner resigned their posts. The Norwegian Government ordered an independent commission to investigate the incident and provide an official publicly available report. The mandate of the commission was to assess and learn from the July 22nd tragedy. The Gjoerv Commission provided their report as an official governmental document on August 13th 2012. One section of the report is of special interest because it is about situation awareness and sensemaking. The PSAP and the dispatchers decided not to send in paramedics to aid civilians doing first aid and transporting the injured victims. The civilians decided to carry on helping the victims despite the response from the PSAP (Public Service Answering Point, responsible for dispatching). The following quote is a translation I have made of the report from the Gjoerv-commission, as there is no official English version of this document available:

From around 1800 hours civilians from the leisure camp at Utvika and nearby places, despite putting their own lives at risk, went to sea in small boats to salvage youths from the water and the shores of Utoeya. The youths were brought ashore at private residences alongside Utvikstranda and at the campsite. Civilians from these sites transported injured and hypothermic youths to the rescue site at Sundvollen. From 1814 hours several calls from the campsite at Utvika were recorded at the emergency dispatch center (PSAP). The callers asked for ambulances to rescue the injured gathered at the campsite. The callers were told that the area was not secured yet, because of this the dispatchers were not able to send in ambulances and

paramedics. Not until 1903 hours the dispatchers released the ambulances and dispatched them to the camp at Utvika (NOU, 2012, pp. 177–178). See Figure 1.

As a result of these circumstances the Gjoerv Commission criticized the decision made at the PSAP and honored the civilians for continuing to help and give first aid:

“It seems like a paradox to the commission that PSAP considered the area by Utvika campsite unsafe for paramedics, while volunteers confronted the danger and saved youths. Volunteers showed by doing this great compassion and great bravery.” (NOU, 2012, p. 178)

The world is not deterministic; any given situation can always have a different outcome given a different set of circumstances. This is why Gay Klein wrote about a poor decision. In his view and in my view also; it is never possible to categorize any decision as perfectly wrong. The concept of right or wrong is not what I am going to investigate. In this case I will try to find the connection between SA, sensemaking and the mind and what the commission called a paradox: *“...PSAP considered the area by Utvika campsite unsafe for paramedics, while volunteers confronted the danger...”(NOU, 2012).*

Method

In the following two cases I have constructed the story from written narratives. Katherine Eisenhardt published a paper regarding case study that proved to be very influential. I have essentially followed her guidelines (Eisenhardt, 1989, 1991; Ravenswood, 2011). Her approach is to make a construct, or model, and iterate until it fits. However, I have no concern making any kind of hypothesis or research question, I am only interested in making connections and finding patterns. Connections make common grounding for discussing theories. My approach is therefore based in grounded theory, not actually knowing what I look for (Corbin & Strauss, 1990; Glaser & Strauss, 1967). At some points during the discussion of the findings I have used my own qualified experience as a guide to seek for more data and re-initiate the whole process (Flyvbjerg, 2006).

The Gjoerv Commission Report is very thorough and substantial, covering 482 pages. The transcribed communication between the PSAP and the callers is also available. Audio recordings from PSAP are available, most of these on the Internet. In sum there is much data available for reconstructing the events of July 22nd. The commission had free access to all data and ample

mandate, resources and the time available. It is fair to state that the reconstruction of events and the assessment of the events on July 22nd made by the commission are true and well justified. The civilians were heralded for their decision and achievements. The dispatchers were to some extent criticized (seems like a paradox) for their decision to do nothing. I went back to the transcribed communication between PSAP and the civilians at Utvika to investigate sensemaking at both sites. Many of the civilians also shared their insight in the press and were interviewed in newspaper articles. The data on this is collected from the internet and may be biased. Since this investigation is not about what is right and what is wrong, but rather to gain insight into the processes of sensemaking and situation awareness, both are processes of a biased experience, bias is of less concern regarding the data integrity.

Results

I see two clusters of elements that constitute this case, these being the civilians at Utvika and the dispatchers at the PSAP. I will list the findings with respect to organization, situation awareness, sensemaking and mind:

PSAP.

The organization can be considered a complex “tight coupled” technological organization (Orton & Weick, 1990; Weick & Roberts, 1993): The PSAP was ruled by procedures, norms, standards, regulatory and statutory requirements and normative training and learning. Training is often simulator based. There are generally 7-8 different computer programs or web-sites to relate to (generally referred to as systems). Operators were closely connected to computer systems and communication equipment. Out of loop situations occur seldom. The outfits are well organized with a clear chain of command (Hansen & Meldalen, 2011; “KoKom - Centre of Competence,” 2015; Sollid et al., 2012). The most prominent reason for the denial of service was one of the HSE requirements of the paramedics: Personal safety above all: Do not engage until object is cleared by the police (Sollid et al., 2012).

The **Situation awareness** of the dispatchers was for obvious reasons not the same as that of the civilians at Utvika. The dispatchers were trained to gain SA through verbal communication and interaction with technology, so it is plausible to assume that their SA was to some extent compatible with the civilians’. Another interesting aspect regarding their SA is at which goal it is aimed. There are many possibilities (Endsley, 2011).

Sensemaking within PSAP is hard to reconstruct but findings give conclusive evidence that the PSAP was in a situation of information overload. Dispatchers were constantly responding to incoming telephone calls experiencing out of loop performance. Workload effects SA, Weick also state that agents make decisions instead of making sense when time is limited (Maitlis & Christianson, 2014; Weick, 2009; Wickens et al., 2013). Sensemaking would be the strongest tool to bring the organization back in loop, but this did not happen. One possible cause for this is what Weick describes as collapse of sensemaking, put under pressure people tend to regress to habitual performance. If you are chased by a woodland forest fire you tend to run away from it, not realizing that it will outrun you (Weick, 1993). Another important finding was when I examined the (to me) available communication logs between PSAP and callers. The dispatchers did not ask questions to the callers in order to shed more light on what was going on. They mostly argued that they could not dispatch any paramedics, one dispatcher once heralded the civilians as “being admirable” (Hansen & Meldalen, 2011). This strongly indicates that sensemaking is limited if not absent (Maitlis, 2005; Weick, 1993).

The **Mind** of the PSAP was very much at habitual performance due to time limitations. They made decisions, not sense. Creativity was at a low point. It is also very important to stress that their sense of being in the world, as a part of what is going on, was compromised. Their technology did not provide the view into the world they very much needed. This was because of work overload. The day to day work at the PSAP was very much about assisting people without the intervention or need of other. I cannot see any indications whatsoever that the dispatchers in any way lacked the disposition to care. They did what they were supposed to. They responded according to their procedures (“KoKom - Centre of Competence,” 2015, *NOU*, 2012).

The Civilians at Utvika Camping

The **organization** of the civilians at Utvika constitutes a simple organization structure. They shared a common goal of salvaging the victims and different actors performed different tasks, being rescue, transport, first aid and general care (*NOU*, 2012; Weick, 1993). Some said, being interviewed by local newspapers afterwards; they did what they had to do. After all survivors were on shore some helped the police rescue the dead at sea. They had no significant form of leadership, any regulations or restrictions of any kind or any kind of hierarchy (“This is the stories of the heroes from Utvika,” 2011). This is a loose coupled system, meaning they are

highly adaptable, resilient to internal fluctuations and allow for self-determination by its actors (Orton & Weick, 1990; Weick, 1976). Strong signs also show that sensemaking constituted their organization (“This is the stories of the heroes from Utvika,” 2011).

Situation awareness seemed to be well developed within the group of civilians at Utvika Camp. They perceived the situation – comprehended it – and projected the solution after which they did something about it. Their goal was to help. To add some corrective measures to this statement: The situation was a very simple one and the civilians stated that they never were in any real doubt about what to do.

The **sensemaking** within the civilians made them enact on the salient cues of the distressed youth, connected these to a frame of aid and caretaking and committed to interact together and aid the youth as an action of demand. They organized into a simple organization and gave aid with great passion and care.

Mind is a disposition to heed and care. The interviews with civilians at Utvika revealed great care for the injured and hurt. “We did what we had to do” (“This is the stories of the heroes from Utvika,” 2011). Another important finding is that the action the civilians engaged in was altruistic behavior. It is also plausible that some if not all civilians showed heroic behavior or “heroism” (Becker & Eagly, 2004; Hochschild, 2011).

Discussion

March state in one of his most recent book that experience is a poor teacher, which is why we have procedures (March, 2011). Procedures are made to suppress unwanted behavior and promote wanted behavior. They also serve other purposes, for example as a reference, but this is not going to be discussed now. Requirements, on the other hand, are essentially made to define the shape and quality of the outcome of a process. The difference is in short how to make or do and what to make or do. To Use Endsley’s terminology: Requirements are goal oriented. Procedures are not. They are more or less static in order to comply with almost any given context. Through my survey of SA, sensemaking and mind I have gained the insight that all we do is a result of the actual context of being in the world. In short, procedures will be too general to catch the actual situation, and too many unnecessary restrictions are applied. This will be restrictions on our SA also. In short the dispatchers performed below their capabilities. Within organization theory there has been a discussion about the capabilities to handle dynamic

environments and the need of adaptation to perform at a desired level. These capabilities are called dynamic capabilities, and procedures will restrict these also (Eisenhardt & Martin, 2000; Teece & Pisano, 1994). Prominent procedures and tight couplings, much technology in which the PSAP had little or no control hindered sensemaking. Workload can have stopped the little that was going on. Sensemaking enables the dispatcher to make good decisions (Weick, 2009). Sensemaking enables us to create a collective mind, and Weick elaborates about what he names a shared field. This is about heed, and aiming for the higher goal. And thus mediates SA also:

“[...] technological tight coupling is dangerous [here Weick writes about prone to error] in the presence of interactive complexity unless it is mediated by a mutually shared field that is well developed” (Weick & Roberts, 1993, pp. 377–378).

Harold Leavitt wrote about the balance of the internal elements of an organization. Complex organizations have a more delicate balance than simple small ones. This does not allow for much dynamics before it performs poorly. Meaning you cannot start producing shoes in an ice-cream factory overnight. They look quite similar on the outside, the same amount of staff, similar location and so on, but they have a too delicate balance to be able to change dramatically. They are neither able to improve their capacity dramatically. It is easy to make these organizations collapse just by introducing the need for a slightly different goal. The PSAP had an interruption in this balance and few means to regain it. The construction of an organization is always a best guess (Atkinson, 1999; Leavitt & Whisler, 1958).

The civilians at Utvika made their organization on the fly by using sensemaking, they improved their SA through sensemaking and this eventually provided a clear task and a clear goal. This was all a result of being in the world (dasein):

They gained a balance between experience (sensemaking) and what to do (SA).

This works, and their actual doing reverts very much to behavior and they used tools ready-at-hand. These were small boats, cars, cell phones and items they were very much in control of. Their simple organization proved to be organic and not mechanistic. This facilitated learning and adaptation to chance and allowed sensemaking (Jacobsen & Thorsvik, 2013).

Conclusion – The Salvage at Utvika

The PSAP decided to withhold the rescue teams despite the civilians being on site giving aid to the youth. The Gjoerv Commission Report stated that this seemed like a paradox.

The behavior and the decisions made at the PSAP were caused by their complex “tight coupled” organization, training, procedures, requirements and work. This proved to be a hindrance for the disposition of mind to act with heed and care and their SA proved low visibility of the actual world. This hindered altruistic behavior and the dispatchers simply continued with habitual behavior and followed the procedures to the point.

The civilians were loose coupled, simply organized and in command of their technology. In a very short time they developed a group mind of heed and care. This allowed for altruistic human behavior to dominate fear and the urge to regress to habitual behavior and escape the danger. They were able to pursue the goal of their SA and help people.

I see no signs of a paradox, only a clear cause and its effect.

The Bridge Collapse at Rotvollhaugen

Master Solutions AS was founded in the autumn of 2009 by ex-employees of the former construction department of Aker Solutions in Vaerdal in the midst part of Norway. Key founders were regarded as some of the best people within the scaffolding industry. The company had key focus on innovation and on knowledge management: Both being properties rarely seen within the construction industry in general and scaffolding in particular. The foreman was one of the first in Norway to receive a master builder’s certificate. He was one of three owners of the company. In the spring of 2013 the foreman together with other employees worked on assembling the falsework of a bridge over the E6 at Rotvollhaugen just outside Trondheim.

Even though the construction industry was experiencing recession right now, the company had experienced a nice increase in revenue since they started. It was considered an easy job. The falsework was made up from a few central raisers with bedding on top. The main contractor was supposed to use the bedding with added formwork to mold the reinforced concrete to make the span. The pillars were already finished. The foreman and his crew had just finished two very similar jobs on other bridges for the same contractor so this was considered to be an easy task involving little or few challenges. On May the 8th 2013 Reinertsen AS, being the main contractor, starts the process of filling the formwork with concrete. All parties involved were confident that the work would proceed according to plans. This was the reason for allowing ordinary traffic passing under the falsework and scaffolding while they filled the formwork. This practice continued all through the day during the molding process. At 1400 hours the foreman

takes out some scaffolding parts and is observed on his way towards the falsework near the raisers. He has already sent one of his crew members in a pickup back to the base to get more parts. At 1430 hours the raisers collapse and the road below and area nearby is buried in reinforced concrete and scaffolding parts. The foreman and a woman passing by in a car are killed instantaneously. Ten other workers are injured. On the 10th of May Master Solutions are charged by the Norwegian police, but because they went bankrupt soon after these charges were dropped. The case ends when Reinertsen AS, holding the legal responsibility as main contractor, is convicted for violations of Norwegian HSE legislation (Adresseavisa, 2013; Meland & Vikan, 2013; Reinertsen AS, 2013b, 2013). See Figure 2.

The cause of this failure is, as the verdict shows, a systemic one. Reinertsen did not follow their own HSE procedures and assured that the raisers could take the pressure from the bedding as built. They relied on Master Solutions, and took it for granted that Master Solutions did their job according to their contract and that the raisers were strong enough. Master Solution made an error. They did not follow the assembly manual; issued by the producer of the tube and clamp scaffolding parts making up the raisers. They had used too few diagonal trusses. As a simple result of Hooke's law the raisers bent under too much pressure and collapsed.

The reason for the collapse of The Rotvollhaugen Bridge is of lesser interest to this case, the decision the foreman made to enter the scaffolding under the bridge is. This must in some way be connected to his acquired SA (Endsley, 2011). Why did he engage in this unfortunate action?

Method

My method for finding the results in this case is the same as in the case of the civilians at Utvika. There is a wealth of data available in this case, but some sources stand out. Some scholarly work was done on Master Solutions AS prior to the incident. This was mostly to reveal their Business model, organizational identity and hence their commitment to knowledge management (Irgens, 2011). Reinertsen AS ordered an independent surveillance; this was done by a board of experts at NTNU [The Norwegian University of Science and Technology]. This report can be considered unbiased (Reinertsen AS, 2013). Through the Internet Archive I had access to their website which was taken down some time after the incident. Some interviews with employees and the foreman are available in various newspapers and magazines, and these are

used partly to construct the SA and sensemaking of the foreman in the context leading up to the accident. This must be considered somewhat unreliable, but considering this case is used only to reconstruct the foreman's SA and sensemaking, this is of lesser concern.

Results

The scaffolding workers foreman was known to be a thorough and well respected man of his craft. He had many years of work experience, and a proven track record, so he must be considered an expert at scaffolding and building falsework (Alustar AS, 2008; S. E. Dreyfus, 2004; S. E. Dreyfus & Dreyfus, 1980; Irgens, 2011). He was present on the construction site to aid the team working with the formworks and molding. Some important signs indicate that he was looking after the falsework. All findings show that he was the first to see the impairment of the raiser that finally broke and collapsed. The company the foreman worked for was well known for innovative solutions, doing jobs other refused and always coming up with a solution. Their reference list was a showcase of smaller special projects more than large ordinary ones. This marks the organization's identity as one of innovation and solutions not found in the textbook. Innovation is very much about going for the unknown, while traditional construction is all about proven solutions. Cost issues are also prominent within the construction industry. I saw few examples of traditional scaffolding in Master Solutions' portfolio. However, this does not mean that they did not take on these jobs. Another finding was that almost the entire staff was highly educated, and they made a point of it on their website (Master Solutions AS, 2013). This in sum can be seen as signs of an open rather than a conscientious organization. The inclination towards innovation also categorize them as an explorative organization (March, 2008). The foreman and his crew had no formal practice or training with regard to SA.

The prominent findings in this case is that of a normal initial workload, the foreman did not feel he had "very" limited time, otherwise he would not send another worker back to base to get more scaffolding parts.

The **SA** of the foreman was gained in a situation of normal workload and moderate stress. The **Sensemaking** process the foreman was experiencing, probably together with the other worker, can be assumed to enable him to reach a committed interpretation. This enables decisions to be made. It is also important to consider that the particular job at Rotvollhaugen was

mainly done because of a recess in the market following the 2008 global economic crisis (Adresseavisa, 2013; Meland & Vikan, 2013; NTB, 20071023, 20130601).

The Mind is closely related to identity if we consider self-awareness as “in the mind” (Giddens, 1991; Graaff, 1987). Their identity as innovative was a vital part of Master Solutions, a consequence of this can be a group mind of dare and audacity.

Discussion

The deformation of the central raisers at the construction site occurs at some moment before 1400 when the foreman is observed with additional scaffolding equipment on his way towards the raiser. We must assume that the foreman comprehended the situation and projected possible solutions and their outcome. I see three possibilities: (1) Do nothing, which for the foreman was unthinkable. (2) Warn others, close the road and evacuate all the workers on the site. (3) Do a quick fix by reinforcing the existing construction with more scaffolding parts. At this point in time, the bridge was not going to collapse for another thirty minutes. I can assume he felt the adrenaline, experiencing stress, but he was not in a situation affected by workload. Assuming he had time to make sense also, we must assume that he did what was most plausible and most coherent given his overall identity (Weick, 1987, 2009; Weick et al., 2008). This was to apply the quick fix. To understand this decision we can imagine the following: Assume the foreman did not have the capability to make sense. He was all-behavior. I will put my two cent on the following scenario: The foreman perceives the deformation of the raiser - comprehends this and project imminent danger. The response to danger is to move to a safe location. Because of altruistic behavior he warns the other workers and evacuates them. The latter is almost certainly a part of the company’s HSE procedures too. If I apply sensemaking, these suggestions are apart from the identity part just speculations, this will suppress behavior and we will have another outcome. *Retrospect*: Like all adults he has applied fixes, probably professionally in less dire circumstances. *Identity*: He was a part of an organization which solved the most difficult challenges. To evacuate would be the easy solution? *Social Context*: To escape would be to admit to failure. If he fixes the deformation this will not happen. *Plausibility*: An applied fix is a plausible solution. To evacuate - Stop adding more concrete until the concrete already applied has hardened - Reinforce the falsework – Then start adding concrete, again would be possibly be the accurate solution [Adapted from: (Weick, 1995a)].

Conclusion – The Bridge Collapse at Rotvollhaugen

Lessons learned from this case are prominently that sensemaking can outperform SA. If we examine this the other way around: This is what sensemaking is all about. We justify, seek coherence, makes sense in order to commit to enact. Sensemaking fail to consider the goal and almost any outcome satisfies. A “well-developed” group mind of caution could moderate (mediate) the process of sensemaking giving a more well-developed decision (Weick, 1987; Weick & Roberts, 1993; Weick et al., 2008).

Results

The rationale for the remainder of the thesis is to further discuss some of the theoretical shortcomings of current popular SA models with respect to the mind in general and heed in particular. Sensemaking has seen relatively little empiricism (Maitlis & Christianson, 2014), but SA has, at least on the operational aspects of SA. Quite a large amount of research has gone into measuring it, but little research has focused on understanding it or finding key theoretical underpinnings. SA can be viewed as a bottom-up model, key focus is on building blocks, not on how they work internally (Hoffman, 2015; Matheus et al., 2003; Wickens, 2015). This is a theoretical thesis and I have used the results from investigating the three cases as support for the discussion and eventually a new theory.

Discussion

In this third part I will discuss the fundamentals of SA with respect to sensemaking, mind and organization. I will do this with respect to relevant theory, data from the two/three cases and illustrative cases, mental experiments and additional data from scholarly studies.

What is situation Awareness?

I will begin my discussion by addressing the rather rhetoric question: What is walking? The obvious answer is of course: Moving one foot in front of the other, and then the fist and so on. We all know that is the wrong answer too. That is just a vague description of what you do. This description fits tripping, running or even crawling, those are certainly not walking. The description is wrong for a dog with four legs. What about a caterpillar? Even a caterpillar

“Walks.” If we go all the way back to Plato, there is a way to find the answer: What is the idea? (What is the form?) Aha! It is an animal moving from one location to another. It is animal locomotion, and so on. The answer is to be found in ethology, the study of animal behavior. Walking is a form (Plato) of animal behavior. This makes sense.

Then, what is SA? A good *description* of SA is obviously: The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Endsley, 1995). Evidently, SA is some sort of behavior. In most contexts it is possible to observe its idea (form). Consider a pack of meerkats. (*Suricata suricatta*): They are social animals living in maternal clans of about 20 individuals. When they are outside their burrows, one of them always stands sentry. On the highest point, usually on two legs, it eagerly looks out for predators. If a danger is spotted, the sentry barfs out, whistles or uses any of the 10 different calls meerkats know. Hearing the call, the meerkats seeks hide in the nearest entry to their burrow. The meerkats alongside primates are well known for their altruistic behavior.

In Endsley’s strictest description of SA, the sentry satisfies all the criteria, he even makes decisions on which call to use. The observed *idea* is SA. Is this SA then, just pure behavior? B.F. Skinner and radical behaviorists probably would say yes, but I say no. There are some serious shortcomings to the meerkat’s model [their implementation of one] of SA. This is a quite interesting case actually (YouTube) because we can observe two different behaviors simultaneously. Let us start by observing the difference between human and animal behavior: The one we know best is: *Altruistic behavior*.

Meerkat Altruistic Behavior

Basically the only reason for their behavior is to secure survival of as many individuals as possible. Females take care of other female’s offspring, but males will kill and eat offspring from older males. Altruistic behavior cannot suppress other modes of behavior. If they are scared, they will hide. Behavior is not adaptable and the only context dependence is in or out of burrow.

Human Altruistic Behavior

The human being can suppress almost anything else than the need for air and water to care for others. They endure fear, toil, sweat, bloodshed, starvation, fatigue, terror, poverty and degradation. Human beings can travel halfway around the globe to give aid and help to the needed. Some stay year after year by the bed of a sick relative. They give charity to poor beggars. Behavior is highly adaptable and is very much context dependent.

This is obvious, of course, but there are two points to it. (1) It is easy for us to see the differences between animal and human altruism, because we know the idea of altruism and it being in the world, so well. (2) If we study altruism it is much harder to state that this is purely behavior, learned or innate. There is much more, and this is very much because of our *dasein*. Being in the world. The meerkats are not. They are in *untergang*. They are in between, in the environment [*Untergang* meaning going down, being between up and down, think of the sun in the process of going down.] (Heidegger, 1996; D. W. Smith, 2013).

When we shift object of study from altruism to SA things are not that obvious. This again is because SA is described but remains ill-defined and it lacks a proper ontology [May be functionalism, cartesianism or cognitivism (Winsen & Dekker, 2015)]. When we go from studying altruism to studying SA, let us focus on what meerkat SA is not if we compare it to human SA:

Meerkat vs Human Situation Awareness.

The idea of this exercise is to “trick” the meerkat to make the wrong decision. This will reveal shortcomings in SA. The task for the meerkat is to perceive, comprehend and project in order to facilitate the optimal decision. He is only allowed to go into the burrow if a real predator is approaching. If he makes the right decision he is spared the excess energy needed to run down into the burrow and up again. This is actually what meerkats do all the time:

Hyena approaching – ok. Photograph of hyena – Tricked. Boeing 747 flyby – Tricked. Thunderstorm – tricked. Recorded lions roar with low fidelity – Tricked. Poster of Justin Bieber – Tricked. Justin Bieber approaching – Tricked.

I could go on for hours, but I guess the point is taken. A human would not be tricked by any of these. We are intelligent, able to adapt, we discriminate, make sense and essentially

always provide for good decisions. This is what humans do. I believe SA is with the human, not the system.

The Meerkat Paradox

As the reader notice there is an ongoing controversy about the location of SA. Endsley state that it is with the human, other argue that it is in the system, much like cognition is distributed according to Edwin Hutchins' theories (Endsley, 1995; Neville A. Stanton et al., 2015). If we stay with the meerkats there is one simple way to "prove" [this is not a proof being a paradox] Endsley right. Consider the following:

The meerkats and their sentry is one of the simplest systems in existence that acquires some sort of SA. Imagine that I help the meerkats in their day to day life by giving them a robot, let us call it GOFAI. The robot is super smart, its sight and hearing is superior, it has an infinite supply of power, whistles and barfs the right calls and will never predict the wrong outcome. The meerkats are happy with GOFAI. Actually they prosper because they save energy because every time they hide in their burrow there is a reason for it. Even for the not so initiated, this system is easy to understand, hence easy to analyze.

The question remains: Where is the SA? With the meerkats, the robot or distributed in the system? The obvious answer is of course neither. It is with the humans, because only humans are able to fix the computer when it breaks down. According to the second law of thermodynamics it will. [An even simpler answer is that only humans are able to maintain the robot.]

The keen reader noticed that I named it a paradox. This is because this is to prove that "meerkat SA" is not SA, and that makes it a paradox. However the only way to disprove this paradox is to state that you need a human with "cognition", not a meerkat in this system for it to be a "real" SA system. This statement is the same as the statement "meerkat SA" is not SA. Hence: SA is only human and "is" nowhere else. SA is all about our being in the world.

Situation awareness is property of dasein.

A theory of Unification

The human Tenet – Dasein (1)

Human existence is one prism with many facets. Most of which are primordial and what we call *behavior* and essential to our survival. During the evolution this existence has become more and more many-faceted since we developed the capability to think and reason. This is what we call the concept of *cognition*. We achieved *intellect* and somewhere along the way human beings gained the ability to reflect its own thoughts¹. Much like we can experience our physical being when we look in a mirror, we can experience our own thinking. Because of evolution our experience of being in the world has changed. Our sensation of our thinking and reasoning became one of detachment and independence. These facilitated sensations of *affect*² and the concept of mind had evolved. This gave rise to what we now name *mental* processes. Considering this line of evolution human existence is still being in the world: *Dasein*. Dasein means that we are beings of behavior, cognition, intelligence and affect. There is no affect without intellect, no intellect without cognition, no cognition without behavior and no behavior without a physical body. The makes up the circumference of a circle as there is no human body without dasein. This idea (form) is perfect sense to me, but unfortunately disturbing to some. To a few this is heretic and in some places in the world this idea is downright blasphemy. To Descartes it was unthinkable.

From the dawn of humanity many facets of our existence have been added. Some of these have been discovered, many are unknown and a few have been researched. This research has mostly been beneficial, but a few times we have been led astray. One of these is what Gilbert Ryle coined a category mistake (Ryle, 1949). We are still making this mistake, in my view this is in essence because the social sciences sometimes fail to recognize Darwin's work.

The Social Tenet – The Organization (2)

Individuals and organizations are essentially one and the same. An organization is made of several mostly heedful individuals that work together towards a common goal. [The opposite of an organization is anarchy.] We strive together through our socializing and mutual sensemaking and this constitutes a coherent existence in the ever changing world. This is in accordance with Weick's research, he constitutes this to an ongoing process (Hernes & Maitlis,

2010; Weick, 2009). The socio-cultural view on how we learn and develop also supports this assumption (Vygotsky, 1980, 2012). Research on ergonomics and distributed cognition show that within an organization cognition is in the system [all individuals, technology and organization] rather than with individuals (Hutchins, 1995; Neville A. Stanton et al., 2015). The OT cognitivists also support this assumption to some degree, but some will state that your behavior will be a result of discrete states: Give these circumstances “most people” will do this or that, this will to some degree imply that an individual would do this when “unattached”- and that when “attached” to the organization, and this does actually very much prove my point, there is always a situation, and our behavior is a result of this (March, 1991; March & Olsen, 2004; Simon, 1979, 1991). Finally I will also add that a; “being in the world view” of the organization is also supported by theories of situated learning (Lave & Wenger, 1991). In sum there is much data supporting an “in the world view of the human” within OT, pedagogy and ergonomics. However, this is a far cry from stating there is any evidence or will to supports existentialism as appropriate founding ontology for any of these. And there probably never will by any either, until someone claims there is a connection.

The Mind Tenet– Organizational Mind (3)

Is a thought “real”? There is only one possible answer to this question, it must be. There is no such “thing” as an unreal thing. It is not tangible, but it is real. All one’s thoughts, desires, wishes and many more are very much in this world, as there is no place else for them to be. Sometimes you can observe them, if not the thoughts per se, but symptoms of thoughts, you can acknowledge that other persons have them too. The rise of fury in a face, the beginning bursts of laughter or the adoring face of a lover. Many of these are evidently just behavior, but not all. There is a limit to how much and how subtle expression behavior can cause (“Consciousness without a cerebral cortex,” 2014). And there is an absolute beauty to this: Humans are accountable for their doings in the world, and that includes their thoughts. Thoughts represent break points and opportunities. They can make you heedful or heedless. Having thought is a part of our existential commitment (Haugeland, 1998).

The Perception Tenet (4)

Human perception is a consequence of being in the world. In Husserl's phenomenology perception is the mean by which we acquire noemata. Perception can have different types; seeing, hearing, smelling and feeling and also non-tangible like recalling memories or sudden understanding of meaning in the environment. Perception provides triggers for both sensemaking and SA. In Heidegger's existentialism perception is essentially *dasein*.

The Temporal Tenet – Existence of Time (5)

Human temporality is a physical property. Temporal awareness was essential to Husserl's phenomenology. Heidegger built his philosophy of time by combining Kierkegaard (Heidegger's authentic temporality) and Husserl (Heidegger's inauthentic temporality) and his notion of temporality is the most sophisticated ever in the history of philosophy (H. L. Dreyfus, 1975; Heidegger, 1996). Soeren Kierkegaard wrote about temporality that life can only be understood backwards; but it must be lived forwards. This makes perfect sense on the individual level, and this is also coherent with Weick's framework of sensemaking in organizations. I believe the world is moving forward in physical time, but it is a matter of experience and choice whether a human or an organization is moving forward or moving backwards in experienced time. (Orlikowski & Yates, 2002; Strack, Schwarz, & Gschneidinger, 1985; Zimbardo & Boyd, 2008). This is also consistent with Heidegger's notion of inauthentic temporality (H. L. Dreyfus, 1975; Hubert L. Dreyfus, 1991). Stating that the time is a physical property, and hence must obey the laws of nature is not the same as stating that it is one-dimensional. Time can have any number of dimensions. A Cartesian (This is geometry not philosophy) two dimensional system with authentic time on the x-axis and inauthentic time at the y-axis is easy to imagine. [A parallel to space which can have any number of dimensions, it is just beyond the imagination of many to see more than three dimensions. For the keen reader: Imagine that you assign each point in physical space a color; four dimensions, a color and a sound; five dimensions and so on. The familiar term space-time is not the same as this is not Euclidean space]

Temporality depicts a crucial difference between the individual and the organization. While human existence follows a well-known pattern of life and finitude within a frame of generally speaking some 85 years, organizations can exist just for the sake of building a bridge, salvaging youths escaping or the seeming permanence of a PSAP.

The dichotomy of individual vs organizational temporality is a challenge with respect to the inclination towards heedful performance.

Each moment in time is a singularity.

Heidegger wrote that each moment in life constitutes a branch point where a person “chooses” a kind of life, a way of being (Heidegger, 1996). This constitutes also Endsley’s notion of projection; considering options before some sort of decision mechanism is triggered or an agent simply engages in action (Endsley, 2015b). One can consider this moment in time a temporal singularity as no agent is able to observe (or sense) more than one property of physical time. Any other property is in the World.

The Retrospective tenet – Sensemaking (6)

Sensemaking is essentially retrospectively human perception. The verb retrospect is literally looking back in time. The meaning of it is surveying the past. I have added the word essentially to give homage to John Haugeland, as all phenomena in the world have subsidiary meaning. Perception is that of noema, and noema can be perceived universally. The sensemaking process can start by almost any sensation or action. This can be tangible, observable or abstract. One hears a disturbing sentence, sees all your employees gather for lunch ten minutes before lunchtime or suddenly realizes that staff meetings are boring. Being a part of any organization is a continuous process of enacting on discrepancies, unfamiliar patterns and salient cues. Sensemaking is ever ongoing but always starts at *one moment in time*. This is often referred to as a trigger: *Sensemaking is triggered by cues—such as issues, events, or situations—for which the meaning is ambiguous and/or outcomes uncertain.*” (Maitlis & Christianson, 2014, p. 70).

Sensemaking as a framework is an evolving set of ideas, and Weick has done an impressive piece of work keeping this process on track. In a much longer sentence Weick gives the essence of sensemaking this way:

“Sensemaking unfolds as a sequence in which people concerned with identity in the social context of other actors engage ongoing circumstances from which they extract cues and make plausible sense retrospectively, while enacting more or less order into those ongoing circumstances.”, Karl Weick in (Sutcliffe, 2006, p. 409).

The Prospective Tenet – Situation Awareness (7)

Situation awareness is prospecting human perception. The verb prospect is literally looking out. The meaning of it is searching for something desirable. Looking out is the idea (form) of a sentry. A sentry must be able to discriminate perceived data and enact on *noemata* that is desirable. Noema is the mediating component of perception and it is not necessarily intended. [Heidegger does not repudiate Husserl's notion of noema. (Crowell, 2013)] The process is a part of our experience and sensation of being in the world. The extraction of relevant noemata is the process of perception and comprehension as expressed by the first two levels of SA (Endsley, 1995; D. W. Smith, 2013). Prospecting based on the essence relevant noemata is the projection level of Endsley's model. This process is improved by training and affect. Situation awareness is as all human existence a part of our existential commitment which is exclusive to human (Haugeland, 1998). Thus, SA cannot exist without the human and cannot be observed detached from existential commitment (Hubert L. Dreyfus, 1972, 1991).

The Decision Tenet (8)

Making decisions and enacting can only occur at a moment in time. This also is in short Heidegger's notion of a break-point (Heidegger, 1996). [As the point in time of projection was a break-point also.] These are always acts of more or less heedful prospects of the future and retrospection of the past given the relevant situation (in the world). Cognitive psychology has taught us that decisions are made as consequences of, or as acts of; heuristic biases, garbage cans, not deciding at all, appropriateness, behavior and even more rational sequencing of data (Cohen, March, & Olsen, 1972; Kahneman & Tversky, 1979; G. A. Klein, 1999; Olsen, 2007; Tversky & Kahneman, 1974). We make new decisions all the time while still trying to make sense of those already made. Decisions make break-points, we can follow them in retrospect, but we can as a result of sensemaking influence the making of the stories they tell.

Who needs Situation Awareness

Mica Endsley has mostly studied SA in dynamic environments or operation. She often adds the word dynamic to sentences describing SA (Endsley, 2011). Operations like control rooms, commercial and military flight and firefighting are obvious. This is where it all started. In short any organization/operation where wrong outcomes are dire must be exposed, scrutinized

and assembled to facilitate SA performance. Or more specific: To facilitate the optimal balance between sensemaking and SA. The three different case studies taught me that little sensemaking (PSAP) is not optimal, much sensemaking is not (Rotvollhaugen) but a balance between sensemaking and SA (Civilians at Utvika) provides for good performance and good decisions. [There is a fundamental issue when discussing this also, as one may state that anyone involved in a sensemaking process needs sufficient SA to keep control of the world and any goal desired. This is what Weick, at least in part, accounts to the “ongoing process” characteristic of sensemaking (Weick, 1995a).] The more or less obvious conclusion to this is always, but one must consider the consequence of the wrong outcome versus the cost of implementing SA-optimized training, assessment, operations, protocol and technology. I started this essay by discussing SA and mind, and if responsible parties act heedful, caring and commit to their existence they will know the totality of SA and seek to reach common goals. Needless to say, one may have the highest level of SA, a mature and well-developed sensemaking process, but unless you are committed to your existence, you end up, as a cruel example, smashing an Airbus A320 into a hillside killing 150 (Ashif, Willsher, & Kassan, 2015). Taking stock of this example as a case to learn from; one need SA to know what is going on; a pilot obviously more so than a long distance runner [Touring]. Endsley has taught that key features of SA are goals and outcomes. This implies that we need SA in order to keep focus on goals and outcomes. This has very much in common with the everyday insight of a positive attitude. This is the opposite of heedlessness, carelessness, mindlessness and the overall negative attitude.

What is situation awareness for

The fundamental level of Situation Awareness is: Perceiving those elements in the environment that needs to be attended to. This also implies to be able to know who these are and discriminate any other irrelevant element and the irrelevant parts of the environment itself.

From our findings discussing the Utvika case: The Civilians stated in hindsight: We did what we had to do. This is spot on: What I am trying to argue is that SA is about perceiving the elements that needs to be attended to. Imagine this: Three process technicians (PT) in a control room, all alone on the factory night shift. They are all busy monitoring the chemical processing plant in order to keep production in loop. Protocol is under no circumstance to leave the factory

unattended. Hitting the STOP button will invoke a need to restart the factory and that is a USD 50.000 setback. Suddenly, one of the PT's grabs his chest and falls unconscious to the floor. One of the remaining PT's starts CPR instantly while the third operator suddenly realizes that the defibrillator (AEDS) is a 5 minute fast run away. It is deep down below the control room on the main factory floor. He hits the STOP button and dials 911 on his way out to fetch the "defib."

Being an imaginary case it could have any number of different outcomes. One PT might decide it was best to leave the rescue to the PT already doing CPR and continue operations. The discussion of this case is not about a poor or a good decision [As usual], but about SA and sensemaking. Making too much sense of situations like these is can turn out to be unfortunate. When we discussed the bridge collapse, the foreman "made much sense" and did not follow his instinctive behavior, this might have led to the outcome of the accident. The civilians "made less sense" and followed their SA and saved some of the escaping youths. They did what they had to do. Situation awareness is for finding out what to do.

If one makes little sense and has a low level of SA one is most likely doing nothing.

That statement is by no means a surprise to anyone. But in order to solve a differential equation, you need an initial condition. This initial condition indicates the need for more sensemaking as the need for SA increases. This is interesting. One may have the inclination to think that highly complex dynamic operation requiring high levels of SA required less sensemaking. I have no findings that indicate this, and the most imminent explanation to this is that while workload increases so does the possibilities of making poor decisions and chances of erroneous performance increase. This is very much in line with the findings on a study of collective mind (Weick & Roberts, 1993).

What are the Characteristics of Situation Awareness

One way to twist the concept of SA is to state that if you have sufficient SA you will know which situations in the world to attend to and which to leave unattended. Haugeland referred to these as relevant situations. The civilians at Utvika stated that they knew what to do. The characteristics of SA should, following formal logic; have very much in common with the relevant situations. And how do we know which is which. The simple answer to this is, to no surprise; experience. Being experienced is in essence the same as having observed many different situations, their resolving and hence; their outcome. To overcome lack of- or to improve

experience we use training and assessment. In general situations requiring training and experience require SA:

- Complicatedness – Situations that impose many cues at once
- Complexity – Situations that impose different cues at different levels that are difficult to comprehend
- High velocity – Situations with short duration or multiple sequencing
- Out of loop – Situations that are not supposed to happen but never the less do.
- High stakes – Situations which can lead to “disasters”
- Prone to error – Performance of both system and operator are easily compromised

This is just to name the most significant characteristics of relevant situations, there are more, but in essence these are situations with significant outcomes if left unattended. In general, according to the second law of thermodynamics all elements within a system will fail at some point in time. Consider a STOP button. The function of the push-button is that the engine stops if one pushes this button. That was the theoretical approach to understand it [techne]. Within the scrutiny of experience [episteme]: This button does not exist, in reality will everything some time or another fail. In reality the STOP button comes with a tag that says: This push-button will work in 99.9999% of the times you push it and fail in 0.0001%. There is no such thing as a closed loop. There is always a boundary condition. Picking up these tags in any relevant situations is very much the characteristics of SA.

What are the Requirements of Situation Awareness

If we return to our discussion of the PSAP; findings indicate that they did not perform the way The Gjoerv Commission expected them to. For the sake of the discussion I can extrapolate this statement and give it the following meaning: The commission expected another outcome. [This can be entirely false, but it is a justified assumption.] Within the PSAP organization this should be an observed discrepancy between what was observed and an expected outcome. If the PSAP shall perform according to expectations this discrepancy shall be closed: A desired change of behavior “in” or “of” the organization. This is exactly what sensemaking is about, and the organization should be able to do this without intervention if their sensemaking had not collapsed (Weick, 1993). The conclusion to this is, based on our conclusion when discussing The Utvika case; is that the organization and the operations (idea) of the PSAP should be somewhat

different. Meaning: Facilitating both SA and sensemaking. This is not because of the outcome, but as a result of the process, more specific a review of the process. If we return to Endsley a key factor for successful performance when performing operations like dispatching is SA (Endsley, 2011). A discussion of SA performance is very much being able to differentiate about “knowing how” and “knowing what” to do. When training and assessing SA, procedures are important, because novices are unable to recognize how to do specific task. Expert does not need these procedures and as a result of this they are able to perform with insight and creativity. Experts are able to consider significant cues or data in the environment that novices fail to consider. They use other sets of rules (S. E. Dreyfus, 2004; S. E. Dreyfus & Dreyfus, 1980):

Using the procedures you train novices by as requirements for operations by experienced personnel is not wise. [Remember Aristotle] Simple military training programs usually accounts for this. For example; the required disassembly – assembly time for a handgun is much lower at boot camp than it is for personnel in service. By keeping requirements dynamic; performance will improve.

Bringing it all back home

There is a sudden beauty to most things in life: The beauty of this discourse is that Descartes was essentially right. The downside is: He was right for the wrong reasons [This is known as the Gettier Problem (Gettier, 1963).], and he made the wrong conclusion. We cannot know if there is a devil whispering in our ear and tricking us to believe everything we know. Remember the statement: *Human exists at a point in time and it is impossible for human to disprove this statement.* In our point in time there is no devil. Our retrospect and our prospect may contain as many devils as one wish, but this makes no possibility for one to enter our point in time. This is our human existence. Descartes mixed the mental and the physical. Our only known existence must be physical. There is no duality. The connection between Situation awareness, sensemaking, mind and organization is fundamental:

My proposed ontology:

- (1) Dasein¹ exists at an observed singular point in time in n-dimensional Euclidean space² and only as a property of one or several human beings.
- (2) Time exists in n-dimensional Euclidean space but can only be observed as a singular point.
- (3) Prospect³ exists as a property of dasein and can be observed in n-dimensional Euclidean space but only from a singular point in time.
- (4) Retrospect⁴ exists as a property of dasein and can be observed in n-dimensional Euclidean space but only from a singular point in time.

¹Meaning of dasein is essentially: Being (noun) in the world

² Or some may prefer as an *n-tuple*.

³Having thought about future events

⁴Having thought about narratives or memorized events

An easy explanation:

The meaning of these sentences can be difficult to comprehend, but it is actually quite simple. You can only observe your existence at one single moment in time. You do not know if there was a past, and you do not know if there is a future. It is only your sense that tells you there was and there will be. This was basically what Descartes initially said. If you sense stop telling you this, you are most likely *insane*. In the moment, time is also (not one dimensional, but) singular, as a result of what I just stated. This is also the consequence of the sad truth that physical time is one dimensional. [Time is a straight line.] Another consequence of this is that you cannot think in one moment in time. It is infinitesimally small. Human cognition is slow, and on this scale it is not possible to have any cognition of “now”. You can sense it, and sensing is observing. And, in case you still doubt, the physical world we observe is still 3D. This is quite easy, but then the problems begin; we eat, breath, walks and all the physical, but our thoughts, where are our thoughts? And here is the clever part: They exist, in us, and they are as we; a part of the physical world. As a result of the infinitesimally small “now”, cognition must either be prospective or retrospective, and as so they are always tagged with a temporal property. [The

research on human memory shows that memories are recalled according to time and context.] Our sense of the situation is gained through the successive approximation of our prospect and our retrospect. We get a sense of what is going on, but in essence we are always lagging a bit behind due to our relatively slow ability to react to changes in the environment. The dimensions I apply to our spatial and temporal existence is there because I want to apply as many axis of freedom as I like to them. The first sentence is in essence impossible to disprove as we cannot disprove our own existence. The assignment of space to dasein, and the last three sentences are axiomatic; stating the existence of thought and properties of it. They are also impossible to disprove (axioms) as these are consequences of our first statement which is true. This philosophy of mind is in essence a notion of Heidegger's existentialism, but applied by Hebert Dreyfus and John Haugeland. I have simplified it to quite some extent, but, I do not believe it has to be much more complicated either. I have made it a bit more extensive than Heidegger regarding his construct of two-dimensional time, as I see no possibility for a two-dimensional temporality can fit the quirkiness of human mind. This also greatly simplifies the construct of identity or stories that can be different for the same moment in past time.

Conclusion

Level 1 – Epistemology

My own case studies of the civilians at Utvika, the PSAP and the foreman indicate the interdependency between situation awareness and sensemaking. Mica Endsley relates SA and sensemaking at some level, but it is a bit difficult to point at how. Klein pinpoints it at the different ways we facilitate decision making by using his RPD and D/F model of sensemaking. I have also used Karl Weick's research to prove that a well-developed group mind mediates tight couplings in organizations. His and Roberts seminal work on US aircraft carriers is a qualitative study. Their conclusions have in later studies to some extent been confirmed. Weick also recognize SA as a process on the individual level. The dependencies between SA and sensemaking are the strongest evidence for proving SA to be a part of mind and thus an inclination to act with heed.

None of the philosophers I have used have done any significant empirical work on the actual idea. However much research has been done within the area of sociocultural learning and cognitive psychology to confirm the dependencies between cognition and "being in the world". Cognition is the main human feature to comprehend relevant situations. This links SA and the World on the epistemological level. Sensemaking and mind is well researched within the area of organizational theory and are very much products of each other.

Level 2 – Ontology

The one sole purpose of the exercise of the ontology was to investigate the interdependence of SA, sensemaking and the mind. Sensemaking is a process that starts when observed discrepancies trigger our retrospect to resolve problems. I cannot find any problems fitting sensemaking to the proposed ontology. Situation awareness is a fair bit more complicated because it is primarily the ability to perceive the elements in the environment. [We are actually unable to do this, but we have a sense of them being in the environment, our visual perception and thoughts are always a bit behind the environment.] Our being in the world will provide the perception and comprehension. Wickens states that this is the essence of SA. The projection is the fundamental of our prospect. To prospect is to think about future events. Fitting Endsley's model of SA on the ontological level is difficult as she refers to mental models, schemata and tries to explain how our mind is working while obtaining and using SA. If we disregard this, and

simply acknowledge the principle of the three levels of SA, the model and ontology is compatible. Endsley regards SA as an exclusive process of human mind. This ends my explanation: *Situation Awareness* and *sensemaking* are essentially fundamental properties of *mind*, the mind is essentially in the *body*, the body is essentially in the world and the world is essentially human. In case you forgot; the *organization* is essentially in the world and essentially human. It all makes sense.

Level 3 – A (Rather) Harsh Critique of Distributed Situation Awareness

Stanton's model of DSA is problematic. Both ontologically and epistemologically. He makes no effort to connect sensemaking and SA on the operational level, and relates "loose couplings" to SA within the system. My findings indicate the opposite. Sensemaking provides loose couplings and constitute organization identity, and tight coupling are very much present as a result of organizational structure. This is also very much in line with rather old well researched theory by Leavitt.

Fundamentally he is making an error when he states that SA is a property of non-human and human actors. He tries to explain this with Hutchins' theory of distributed cognition and two kinds of schemata passing around. I have given sufficient evidence that awareness and cognition are two different categories of human existence. The Whintec model of DSA, stating that it is knowledge that is passed on within a system, also confirms this. Artman and Garbis model of DSA likewise. Awareness is essentially human mind while cognition can be assigned many other entities. I have no problem assigning cognition to the whole system I am using right now, every now and then I ask my computer for a reference; it pops up. What did the Stanford Encyclopedia of Philosophy say about Husserl's intent? A few invisible [Heidegger], unconscious keystrokes and the answer is provided. Cognition is distributed between me and my computer, and together we think about a million times faster than I would have done alone. Not to mention the word processing and the spelling control. But this is a far cry from assigning any kind of awareness to my computer or the system. That is my mind alone. Any sign of trouble around here: I am out, leaving my mindless machine far behind. It is sacrificial, I am not. Together we are a mind and a machine. Not a mind in the machine. Remember Ryle.

Thesis ends here

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Footnotes

¹[One can only speculate if having two brain halves connected by the corpus callosum have anything to do with this.]

²[The notion of affect is from John Haugeland (1997).]

Figures



Figure 1: Ambulances awaiting dispatch near Utvika. Photo From the official report.



Figure 2: The collapsed falsework at Rotvollhaugen Photo: Jonas Bjoerkli, adressa.no