How Uncertainty Influences Intelligence Analysis

- The Foundation of a New Theory

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Abstract

Uncertainty is a central concept to intelligence analysis (IA) but there is no theory that attempts to explain its role in IA and how it can be understood or managed. In this theory developing study, a definition of uncertainty and of intelligence analysis is presented. Four other fields are chosen for their similarity to IA and because they also must contend with uncertainty. The four fields are medicine, criminology, business, and political science.

A literature review of those four fields is performed for research into uncertainty. The findings are then summarized into a set of propositions that can form the basis of a new theory of uncertainty in IA, that is applicable to both the academic and professional sides of IA.

The findings demonstrate the need to reduce, and when not possible to manage uncertainty by structured analytical methods, improved communication, statistical assessment, risk assessment and insurance strategies.

Key words: uncertainty, ambiguity, intelligence analysis, ignorance, risk.
Words: 9188

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1 Introduction

"... as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns- the ones we don't know we don't know" (Former American Secretary of Defence Donald Rumsfeld 2002)

1.1 About Uncertainty

Uncertainty is a defining feature of intelligence analysis (IA). A large body of research is available about the concept and how it can be classified, handled, and communicated.[1] What is missing however, is a theoretical framework that attempts to prescribe how to reduce or manage uncertainty in IA. This theoretical framework can then also be used to understand uncertainty and act as a foundation to generate hypotheses from. Hypotheses that can be used to direct further research.

1.2 This Study

This essay will begin with a presentation and discussion on what uncertainty is and how it is defined. Focus will be on how the term is relevant to the field of IA. A short discussion will then follow on why a theory of uncertainty is needed and how it can be used to aid both further research and the professional intelligence practice.

A literature review on available research in the fields of medicine, criminology, business, and political science is then performed to identify what conclusions on uncertainty have been reached. Those fields have been chosen since they share similar aspects to IA and can offer valuable insights on uncertainty. The next step is then to assess which parts are relevant to IA and how it can used to further the understanding uncertainty in IA. Following on from this step, several propositions about uncertainty in IA are generated that can form hypotheses and thereby take the first steps towards a new theoretical basis. The study will end with a discussion on how the propositions can be applicable and what the limitations might be.

[1] For extensive discussions on how to communicate intelligence see Dhami et al. 2015, Mandel and Irwin 2020. A taxonomy of uncertainty can be found in Smithson 2010, p. 29. Also see Friedman and Zeckhauser 2012 for a presentation on how handling of uncertainty in IA can be done.

2 Background

2.1 What is Intelligence Analysis

We need to define exactly what IA is and which fields of practice it encompasses. A broad definition of the intelligence part is that it "is an operation for procuring and processing information about the external environment in which an organization wants to maximise the net achievement of its various goals".[2] The stage where information is processed can also be named analysis and the organisation is the consumer or the costumer of this process. Traditionally, the organisation has been a state and the intelligence service, is the subunit that is performing the task of intelligence analysis for its consumer. Non-state actors such as police organisations, criminal organisations and corporations also partake in intelligence.[3] Note here that these non-state organisations have intelligence capabilities, but intelligence analysis is not their main function. Intelligence is instead an auxiliary function, so for example a corporation is focused on maximising its profits and intelligence is a tool towards that goal. In this essay the focus will be on intelligence analysis as a process and what effect uncertainty has on it, irrelevant to which field it is occurring within. We expect uncertainty to act and have the same effect on IA, whether it is military intelligence or a police organisation.

The end goal of the IA process is to produces a report that offers a prediction or a forecast of what might happen with a probability estimate attached.[4] Uncertainty is therefore part and parcel of the process since no predictions can be made with complete certainty. Fragment of information, gained from adversaries actively trying to deny and deceive, further increase the level of uncertainty in IA.[5]

2.2 The Concept of Uncertainty

Before uncertainty can be defined it needs to be understood on how it relates to IA. The relationship between IA and uncertainty can be described in various terms so an explanation is needed so a definition can be offered. Uncertainty can be seen as inherent to the very nature of intelligence analysis.[6] As in, everything an analyst have to assess and decide upon is marred with uncertainty. The true intentions and capabilities of another actor can never be fully known. The function of an intelligence agency is to try and reduce this uncertainty, by gaining knowledge that

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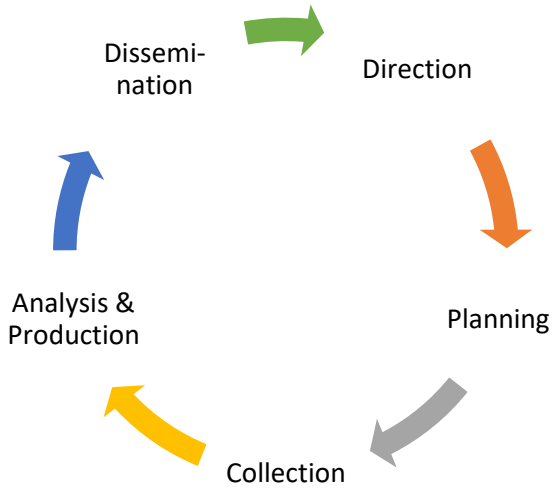
[2] Knorr 1964, p. 1.
[3] Breakspear 2013
[4] Dhami 2018
[5] Zegart and Morell 2019
[6] Friedman and Zeckhauser 2012, Mandel and Irwin 2020.

is not apparent or readily available through open sources.[7] In a sense, uncertainty is always prevalent whenever there is an opponent trying to hide something, such as in foreign policy. This warrants a process of information collection which is in itself unreliable and leads to further uncertainty. Collection can take place through intermediaries, such as spies that might have their own reason for withholding information.[8] Collecting information through technical means also suffers from unreliability such as bad weather obstructing the view of orbiting satellites or encryption limiting collection of SigInt.

Figure 1: A graphic representation of the intelligence cycle.



If uncertainty is an all-encompassing concept in IA, then an academic investigation of it would also mean an investigation into the whole field of IA, which would make it a non-viable topic for this essay. A narrower understanding and a more limited definition is therefore needed. To achieve this, we can refer to the intelligence cycle (*figure 1*), the old workhorse of intelligence studies and the crutch that can be called upon to visualize and simplify the complex process that IA is.[9] Every stage in the cycle can be argued, is built upon uncertainty since the whole process of IA as mentioned is defined by uncertainty. The initial stages of direction and planning can give rise to uncertainty if the policy makers intentions are for example based on electoral strategy instead of national security needs.[10] During the collection stage where information is gathered, there will always be doubt if a source is giving accurate information. Uncertainty during the dissemination stage can also stem from unclear communication to the consumer of

[7] Fingar 2011, p. 2.
[8] Perhaps the most famous example since the end of the Cold War is the case of "Curveball" and the faulty intel he provided in the lead up to the 2003 Iraq war as told in Fingar 2011, p. 98.
[9] See Manjikian 2013 and the first chapter of Phythian 2013 for further presentation of the intelligence cycle with its usefulness and limitations.
[10] Wilkinson 2010, p. 18.

intelligence on what the risks and benefits of certain actions are.[11] Since we are interested in intelligence analysis, the logical approach is to focus on the analysis stage of the intelligence cycle. This helps narrow the scope of this essay and allows for a discussion of sufficient depth and breadth.

2.3 Definition of Uncertainty

With the scope of IA and uncertainty established we can now turn to defining uncertainty within that scope. The problem here is that no agreed upon definition of uncertainty within IA can be found. It is a term that is often used as mentioned previously, to describe the natural state of the field but it is seldom explained. Authors are far more interested in explaining how managing it is essential to conducting foreign policy.[12] Or how it pervades national security and has far reaching consequences on decision making.[13] What they all seem to agree upon however, is that the main purpose of intelligence is to reduce uncertainty.[14]

For a definition of uncertainty, we are therefore forced to seek beyond what has been published in the field of IA. In general terms, uncertainty can be defined as ambiguous or unknown.[15] By not knowing then one suffers from ignorance, but the concept of uncertainty is broader than the negative value judgement communicated by the term ignorance. Ignorance or uncertainty can remain despite one's best efforts to alleviate that. Uncertainty can therefore be seen as the subjective perception of ignorance that the subject may or may not be aware of. A structured definition is needed to better understand the whole concept of uncertainty and perhaps the best attempt at this is Smithson's "taxonomy of ignorance" from the field of knowledge theory (*figure 2*).[16] According to this, uncertainty is a form of ignorance that falls under having erroneous views due to incompleteness of knowledge of a certain event. Incompleteness is the key word here. Uncertainty arises when one is missing sufficient knowledge about one or more factors, either due to not enough facts, facts that are vague or due to the presence of probability. Consider the challenges facing the intelligence analyst tasked with predicting how threatening an enemy tank unit is to one's own forces. In this scenario, uncertainty can arise from not knowing how many tanks are deployed in a specific area of operations or knowing how many tanks there are but not their state of readiness, and also having to account for the probability of what type of weather will be in effect during a certain time period that might affect the performance of said tank unit.

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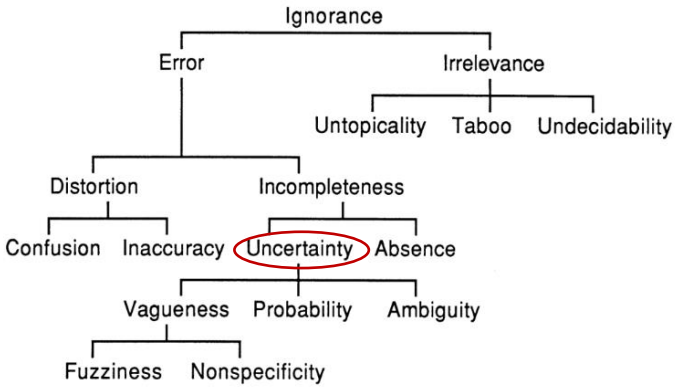
[11] See Dhami 2018, Mandel and Irwin 2020 for more on the risks inherent in unclear or confusing communication from analyst to decision makers.
[12] Friedman and Zeckhauser 2012.
[13] Mandel and Irwin 2020.
[14] This seems to be the what Friedman and Zeckhauser 2012, Dhami 2018, Mandel and Irwin 2020 in addition to Fingar 2011, p. 6 all agree on.
[15] For discussions on suitable synonyms for uncertainty see Smithson 2010, p. 28 and Marrin and Clemente 2005.
[16] More info on the Taxonomy of Ignorance can be found in both Han et al. 2011 and in Smithson 2010.

Figure 2: Taxonomy of ignorance. [17]



2.3.1 Biases and Heuristics

It is important to note that another cognitive level is also at play here that affects how the analyst interprets facts presented, which also acts as a source of uncertainty. When processing information into decisions, subjective biases of the person performing the task will affect the outcome. Psychological research has identified different biases. Of note are confirmation bias where information contradictory to established expectations is discounted for information that is more consistent, and hindsight bias which overestimates or oversimplifies what the correct action would have been needed for a successful result.[18]

A form of bias are the mental shortcuts that are often used to handle information overload that can occur when too little time is available to sort through the information adequately.[19] Known as heuristics they can be representative, where conclusions can be drawn from unclear information by repeating the actions taken from previous similar cases. It offers the advantage of applying lessons learned from previous cases to the new situation, but it becomes a liability if the new situation differs too much and false assumptions are made. Availability heuristics means that information that is most readily available has more prominence when reaching conclusions or making decision. For example, the most recently acquired information tends also to be easiest to remember and therefore is more readily available, but information acquired earlier might be more relevant even if less easily recalled.

2.4 Is a Theoretical Basis for Uncertainty needed?

A debate on whether IA is a science, or an art has been ongoing for decades. Proponents of the science side argue that by generating hypothesises and

[17] Copied from Smithson 2012, p. 9.
[18] For further information on biases refer to Karvetski et al. 2020 and Kebbell et al. 2010, p. 90-91.
[19] Kebbell et al. 2010, p. 89-90.

developing tests to test them a higher objective truth will eventually be reached. This is the school of positivism, and it dominated the field during most of the Cold War [20] A countermovement inspired by the subjective or relativistic schools of thought argued that truth is always subjective and changing according to the settings and so a true objective fact will never be reached.[21]

Irrespective the epistemological viewpoint, uncertainty as a concept remains a valid research objective. It is a concept that presents itself to formulating research questions, that can be investigated both as part of the scientific method or examined as part of the critical theory. It also has a direct relevance to the professional side of IA and how it affects the daily work of an analyst. In short, it fulfils the criteria for being an interesting concept.[22] On the professional aspect, rigorous intelligence analysis is structured similarly to academic analysis. Not surprising then that intelligence analysts tend to have an academic background where analytical tools and methods are taught.[23] Analysts are also expected to demonstrate their method and have their results scrutinised and be reproducible. [24]

So, uncertainty is an area suitable for research since it is a fundamental part of IA. Research is also needed since as mentioned previously, there is a distinct lack of scholarship on uncertainty in IA. Despite repeated statements how essential it is, little has been published on uncertainty and most of it investigated how it can be communicated in reports. These studies concluded that using estimative words to communicate degree of uncertainty leads to more confusion than when numeric values are instead used.[25] How uncertainty affects decision making has also been investigated. For example, handling uncertainty through usage of structured analytical methods to consider all possible hypotheses. Probability distributions and analysis of competing hypotheses are two such examples.[26]

If applying positivistic viewpoint that IA is a research field worthy of scientific enquiry, then we need a theoretical framework that can anchor the subject and allow a jumping point towards further research. Since it is established that uncertainty is an essential part of IA and that there is a dearth of knowledge about the topic, then a theory of uncertainty is needed. From that theoretical framework, new hypotheses can be generated that can also have a positive effect on professional side of IA. Intelligence organisations tend to be resource intensive and have a direct impact on national security and decisions of war and peace.[27] A solid theoretical foundation already underpins other fields handling the same questions such in war studies and in international relations. A similar foundation in IA is missing and needed.

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[20] Pioneers in the field of intelligence studies came from the school of realism and applied the same lessons that dominated the field of political science to the new discipline. See Kent 1964, Knorr 1964, p. 11 and Lillbacka 2013

[21] See Manjikian 2013 and Bean 2018 for two representative arguments from this side.

[22] Adcock 2005 provides a discussion on what a concept is and Davis 1971 adds to what would make a concept interesting and worthy of further study.

[23] Fingar 2011, p. 4.

[24] Ibid 2011, p 110.

[25] Dhami 2018, Mandel and Irwin 2020

[26] Friedman and Zeckhauser 2012

[27] Wilkinson 2010, p. 18

2.5 IA Compared to Medicine

The previous section demonstrated how uncertainty is inherent to IA since it entails making decisions based on inadequate information, and often under time pressure. IA shares this issue of decision-making under uncertainty with several other professions.[28] Many of those professions and disciplines which include criminology, business, and medicine have also investigated the issue of uncertainty as it relates to their field.[29] Since the academic and professional sides of IA are comparable to those fields then there is a need to assess this research on how it can be applied to IA.

Curiously enough, the field or profession most often compared to IA is medicine, with the intelligence analyst being compared to the physician. Medicine and the art of diagnosis has been held up as a normative example for IA to strive towards.[30] The first stage of treating a patient is for the physician to ascertain what the cause of the symptoms in the patient are. This is known as diagnosis and the physician will have to try and identify the correct diagnosis to implement the correct treatment. By asking the patient detailed questions and examining for signs of a disease, the physician hopes to reach a conclusion on what the diagnosis might be. An analogy for the intelligence analyst could be the question from a policymaker on how high the risk of an enemy nation deploying a new weapon is. The analyst would start here by referring to the knowledge they already have on this enemy state and technical details of this new weapon. Often there is a need to progress to the stage of investigations where diagnostic tests such as blood analysis or radiological imaging are carried out to either confirm or exclude a suspected diagnosis. To refer to our hypothetical intelligence case, the analyst would have to assess what the risk and consequences are if the enemy state deployed this weapon depending on the extent of that deployment and during which time frame. The analyst would then need to plan for collection of new data to refute or confirm a hypothesis whether from technical or human sources.

Marrin and Clemente see this diagnostic process as objective and therefore it should remain objective and scientific also when transplanted to IA. Criticism has however been raised against this notion by pointing out that the process is beset by subjective biases and structural factors.[31] The assessment of the physician can vary depending on their background, age, and gender. The patient will also report their symptoms in a multitude of ways depending on their own preconceived notions and backgrounds. So, several subjective factors will influence the process and the outcome. This subjective relativistic process can be argued, is not different from the process of intelligence analysis either. A whole host of structural and personal

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[28] Kent 1964
[29] Smithson 2010, p. 27
[30] In Marrin and Clemente 2005 it is made clear that a scientific method is at work in the diagnostic stage in medicine and IA should try and emulate this process.
[31] A very thorough account on the limitations of considering the process of diagnosis as purely objective intellectual exercise is presented in Manjikian 2013.

conditions will also affect the process of IA so the analogy with medicine holds regardless of epistemology.

2.6 IA Compared to other Fields

Published works comparing IA to other fields or disciplines other than medicine is sadly lacking. Shortage of comparisons to criminology for example is unexpected since areas of criminology such as organised crime and terrorism studies can also be argued to fall under IA.[32] Perhaps this closeness to IA makes a comparison less interesting.

There is also an absence of examination on how the world of business relates to IA. The situation is also curious considering there is a whole subfield of business termed "business intelligence".[33] An endless array of business organisations of all sizes, are in a constant state of competition which requires intelligence capabilities. The economic nature of this field and the large amounts of data that is collected leads to a statistically based approach.[34] Since competition forms the basis of business, the concept of "competitive intelligence" is also in use which is closer to the more traditional viewpoint of IA. Competitive intelligence is different from business intelligence in that the analysis of data is the most important stage. Both strategic and tactical forecasting, and in-depth analysis of the competitors' strength and weaknesses form an essential part of competitive intelligence process.[35] In business intelligence the focus is instead on collecting data about the company's internal capabilities and not as much on the external conditions.

[32] See Mobley and Ray 2019 for an example of study covering criminology, counterinsurgency studies and IA.
[33] Watson and Wixom 2007.
[34] Ranjan 2009.
[35] Bose 2008.

3 Methodology

3.1 Developing the Theory

The aim of this study is to develop a theory of uncertainty in IA. Theory in this setting is meant as a prescriptive framework on what uncertainty is and how it can be handled. In other words, an instrumentalist, or a problem-solving approach.[36] A problem solving theory is by nature positivist since it sets out to solve a problem and accepts that there is normatively correct approach. The ambition is that the theory can be used in professional setting of IA. So, the theory needs to be specific enough for this purpose, but it also needs to be generic enough to account for the various settings and contexts that IA takes place within. Furthermore, a good theory needs to act as a starting ground for generating new hypotheses that can be tested in a scholarly setting.[37] The ambition with this study is to develop a theory that can fulfil both these conditions and is also able to explain and predict in as simple terms as possible.

As stated in the previous chapter, no such theory for uncertainty exists for IA but other disciplines have made headway towards explaining uncertainty as it relates to their fields. Our method is to review available literature on uncertainty in these other fields and summarise those findings into a theory that is applicable to IA. So the main objective is not to present and test a hypothesis, but instead provide the foundation from which new hypotheses can be generated. The scope of the essay does not allow for any applications to cases from IA but a short discussion on how it can be applied it offered at the end.

3.2 Research strategy

First step is to identify which other fields or disciplines to review for studies on uncertainty (*Figure 3*). The first field identified is medicine since it has already been compared to IA previously.[38] The fields of criminology and business where also included since they already overlap with IA as outlined in chapter 2. Political science and international relations have also previously presented viewpoints on uncertainty and are therefore included in the literature review. IA is considered a subject of political science but the published works on uncertainty is not directly related to IA, as will be demonstrated in chapter 4. Other fields or disciplines could also have been included, such as engineering but the study was limited to these four fields since they appeared to lie closest to IA and the essay leaves little room for any more comparisons.

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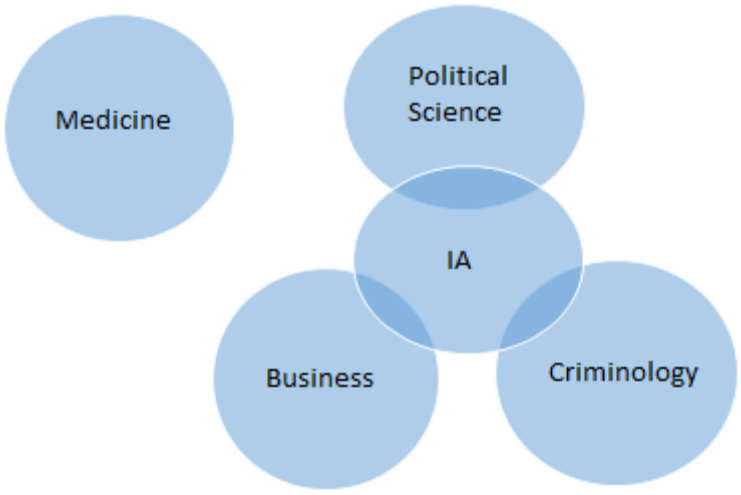
[36] An exegesis of what constitutes an intelligence theory is found in Bean 2018.
[37] Sims 2009.
[38] Refer to Manjikian 2013 and Marrin and Clemente 2005.

Figure 3: The relationship in regards to IA.



With the fields identified a search was performed for the "uncertainty" in the subject areas of "medicine", "political science", "criminology" and "business". This search was first performed in EBSCOhost with access provided by Lund University. To widen the search further, uncertainty was also replaced with ambiguity. The whole process was also repeated in Google Scholar. Top results in each search were then reviewed and relevant references used there were also included in the review as a form of snowball sampling.

3.3 Applying the Theory

The final stage of the analysis will present propositions. Each proposition is discussed and when applicable illustrated by examples of known cases from the field of IA. Suggestions on how the propositions can be applied is also provided with a short discussion on what the obstruction and limitations might be.

4 Findings

4.1 Uncertainty in Medicine

It is striking how uncertainty is described and assessed in medicine in identical terms to how it is in IA.[39] Every activity and aspect of healthcare is dominated by uncertainty.[40] To better understand how and why this occurs then it helps to consider what the medical profession considers is the ideal process of medical practice that every physician should strive towards.[41] The goal is to maximise the benefit for the patient and minimise the harm by following this ideal model.

4.1.1 The Ideal Process

Similarly to IA, the role of the physician is to try and analyse and make an assessment based on often uncertain information. The physician must rely on their knowledge and experience gained from their education and practice. This forms the first line of tools in trying to solve the question of what is wrong with the patient and what the correct course of action should be. The next step is then for the physician to list the most likely potential causes of the illness by making a list of differential diagnoses. A good list of differential diagnoses should also include less likely but potentially disastrous if missed diseases. A mental risk assessment is thereby created where likelihood of a disease (improbable to frequent) and its consequences (negligible to catastrophic) are listed.[42] So a severe and relatively common disease should come at the top of the differential list while a rare disease with negligible consequences would probably not even make the list. The analyst should also follow a similar process by making a list of hypotheses on potential outcomes and account for the potential severity of each hypothesis.

With the list complete, the next step is to decide on investigations that can rule in or rule out the various diagnoses on the list. If for example the suspected cause of chest pain is a myocardial infarction (heart attack), then ECG and a blood test for markers of infarction would be the prudent first step. This is especially important since heart attacks are both common and can cause an imminent death.

With these steps completed, the physician has now identified the likely cause of illness or at least ruled out the most severe or common causes and now treatment can be started. The analogy with IA here fails since the final step for an analyst is to report back on their findings and sometimes offer recommendations on the prudent next step, but the analyst is usually not involved any potential actions.[43]

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[39] In Han et al. 2011 for example uncertainty is described as a "pervasive and important problem".
[40] Babrow et al. 1998.
[41] Marrin and Clemente 2005.
[42] For an example of a risk matrix and further presentation of the subject refer to Jarret and Westcott 2010, p. 72.
[43] Marrin and Clemente 2005.

4.1.2 Limitations with the Ideal Process

The process outlined is the ideal one but there are several challenges that can and will hinder it and in practice make it difficult to follow. Firstly, the assumption is that the physician is an emotionless automaton who is not affected by stress, tiredness, or prejudice.[44] Secondly, this model assumes that the patient is always easily understood by the physician. It ignores that patients can have their own difficulties in communicating their illnesses, or they might have their own agenda that is not in agreement with the physicians. This has been identified primarily as a problem of communication.[45] Physicians in training might also not have enough knowledge or experience and will therefore struggle with how to handle uncertainty.[46] Another limitation is that his model assumes a near infinite availability of time and resources. In emergency medicine for example, there will not always be enough time to methodically work through a list of differential diagnoses since the patient might have expired by then. In austere conditions such as in less developed countries, there might not even be the option of performing certain blood tests or radiological investigations. These limitations take the process closer to IA which share similar challenges. A patient not offering an adequate description of their symptoms for example can be compared to an informant reporting deceptive intel, or the enemy possessing good communication security limiting signals intelligence.

All these issues lead to increasing uncertainty and causes problems for physician and patients alike. By identifying these sources of uncertainty, strategies can be developed to limit them. Biases and heuristic as discussed in section 2.3.1 are a common source of uncertainty and this also applies to medicine.[47] Doctors link commonly seen clusters of factors to certain illnesses, but this becomes an attribution error if a less common disease can also be linked to the same factors. Chest pain in middle aged men who are overweight, and smoke are all factors that point to Myocardial infarctions as the cause. But the very same factors can also signal a bleeding from the aorta which is a much rarer condition but even more lethal with a completely different treatment.[48]

4.1.3 How to handle Uncertainty

A consorted effort to improve methods in reducing or at least managing uncertainty within the medical field is ongoing.[49] Since communication between physician and patient can lead to misunderstanding and errors in diagnosis, education in communication skills has been improved which reduces uncertainty.[50] Another

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[44] A thorough critique of this positivist view can be found in Manjikian 2013.
[45] Babrow et al. 1998
[46] Han et al. 2011
[47] Kebbell et al. 2010, p. 89.
[48] Lee and Goldman 2000.
[49] Han et al. 2011.
[50] Babrow et al. 1998, Wray and Loo 2015.

solution is the use of evidence-based medicine, which is aimed at reducing uncertainty by ensuring that medical practice is guided by scientific evidence, and not by the physician's personal experience, instinct or other subjective factors.[51]

A more structured method of classifying and dealing with uncertainty has also been proposed as "the theory of uncertainty in illness".[52] This theory defines uncertainty as a psychological manifestation in illness and managing it is needed for successful coping. The theory looks at uncertainty from the perspective of the patient. Lack of knowledge about the illness such as its current state, complexity of treatment, seriousness of illness and unpredictability of the course of the disease all contribute to uncertainty. The patient´s ability to manage uncertainty is thereby improved by offering information specially targeting those factors. To achieve that, information must be clear, accurate, consistent, from a believable source and with a reasonable probability estimate.

4.2 Criminology

Considering how a significant part of IA covers the intelligence aspects of criminology, it is surprising how little the practice of intelligence and of policing have been compared. Criminology does offer insights into uncertainty making a comparison needed. Investigating crime, hearing witnesses and arresting criminals always leads to uncertainty. The whole process from crime prevention to trial and conviction is expensive and time consuming, necessitating the need for adequate strategies in handling and reducing uncertainty.[53]

4.2.1 Reducing Uncertainty

It has been proposed that uncertainty within criminology can be understood through the prism of proportionality. Since the cost of investigating crime is so high in terms of time and resources, all crime cannot be investigated equally.[54] The limited resources must be weighed up against the severity of the crime and the likelihood that a crime can be solved. A risk matrix as explained in section 4.1.1 can be used here, where how much attention a crime warrants is based on severity of crime, cost of investigating it and likelihood of solving it. The same process can also be applied to whole specific neighbourhoods or certain types of crime. This is the theory behind initiatives such as Compstat which used geospatial tools to map crimes to time and place to identify crime hotspots.[55] Extra policing resources could then be targeted specifically at those hotspots. The large amount of data that can be

[51] Manjikian 2013, Wray and Loo 2015
[52] Babrow et al. 1998.
[53] Wilkinson 2010, p.18.
[54] Wilkinson 2010, p. 22-23.
[55] See Attewell 2010, p 58 for more info on Compstat. Refer also to de Maillard 2018 for a more critical and nuanced perspective on Compstat.

generated in just one neighbourhood leads to a whole host of statistical methods than can be used to measure uncertainty, which can then be reduced by better targeting of resources. Criminology also has a chronic problem of underreporting of crime.[56] This hidden crime can be assessed with indirect measures such as analysing wastewater for traces of illicit drugs to estimate their prevalence in the community.

Additional strategies to reduce uncertainty is by managing biases and heuristics (the mental shortcuts) explained in section 2.3.1. For example, just being aware of the existence of bias can reduce the impact of that bias.[57] This strategy is probably not enough, so more structured methods of analysis for criminologists have been proposed, such as analysis of competing hypotheses and visualisation tools like social network analysis that allow better overview of large amounts of information.[58]

4.2.2 Managing Uncertainty

Reducing uncertainty is often not a viable option, either due to lack of resources or simply due to some information being irreducible. The assumption is that uncertainty is always negative and that reducing it is always a positive step. Different strategies are therefore needed that instead of reducing uncertainty manage it and make it tolerable. The first step is to accept that some uncertainties are irreducible. Randomness is such an uncertainty, so when or what kind of crime is going to occur and what at what specific time can never be fully predicted.[59] Opportunity cost and trade-offs are another issue that needs consideration. Increasing resources for murder investigations for example overburdens the courts leading to more guilty defendants being acquitted.[60] More information generated can also increase uncertainty, since now more time is needed to process the information which in turn can generate additional alternatives. The additional alternatives themselves will increase uncertainty since there are now more choices to decide between.

Cognitive strategies can help as a starting point for managing uncertainty. In addition to accepting uncertainty, the focus should always be only on what can take the investigation further. This means that before allocating resources to for example interviewing a certain witness, a mental checklist should be made if this course of action will lead to useful new information. Better training and more experience lead to improved ability to ignore irrelevant information and thereby better management of uncertainty.[61]

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[56] Attewell 2010, p. 56.
[57] Kebbell et al. 2010, p. 91
[58] Refer to Karvetski et al. 2020 for an investigation of different structured analytical methods. More information on social networks analysis can be found in Leuprecht et al. 2017.
[59] Smithson 2010, p. 27
[60] Smithson 2010, p 38
[61] Ibid, p. 38 and 45.

4.3 Business

Due the nature of the field of business, it has fewer useful insights to offer on uncertainty as it relates to IA. Businesses act in a well-regulated environment and tries primarily to predict levels of demands and supply.[62] Statistical tools are the primary methods of meeting those demands which are not as easily transferred to IA. There are still useful lessons to be learned for an intelligence analyst for business is always acting in under uncertain conditions which can be applied to IA.

The statistical methods used in business means that a large part of the uncertainty can be quantified in numbers and risks assigned to them. A business can then maximise the chance of an investment paying off by following those risk estimates.[63] Uncertainty is therefore limited in definition to what a business enterprise simply cannot assign a probability or a risk to.[64] Three different adaptive options for managing this uncertainty are available. First is by trying to collect more information, but this ignores the fact that it will not always lead to reduced uncertainty or always be worthwhile. The second alternative is to accept the uncertainty and instead build up a tolerance for it. Forcing banks to undergo stress test after the financial crisis of 2008 is a great example of this alternative.[65] This ensures that if the financial crisis would repeat itself then the banks will have enough capital to withstand it. A third option is to control the uncertainty by for example spreading the risk on several parties. The insurance industry exists for this very reason. A company can insure against risks that it cannot plan for.

A further two maladaptive options can also be chosen. A business can deny the existence of uncertainty by for example making an erroneous assessment that an uncertainty is in fact certain.[66] An executive could for example decide based on their instinct and disregard the uncertainty. Finally, a business can banish the uncertainty and associated risk by for example ignoring it.[67] Business with environmentally damaging practices can ignore that and just hope that they will not suffer any direct consequences through a lawsuit.

When and if businesses choose to act can also be considered a management strategy of uncertainty.[68] A business is more willing to act and invest resources if they deem the future as safe but is more likely to defer any action if too much uncertainty exist. If the uncertainty is resolved, then it can be acted upon. The issue of "competitive intelligence" discussed in section 2.6 also comes into play here. By knowing more about the competition and the environment in effect, the business can fine tune their response to the uncertainty. A business lacking in intelligence might on the other hand be forced to behave even more cautiously and wait longer before acting.

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[62] Fargher 2010, p. 127.
[63] Wernerfelt and Karnani 1987.
[64] Fargher 2010, p. 127.
[65] Ibid, p. 130.
[66] Fargher 2010, p. 132
[67] Wernerfelt and Karnani 1987.
[68] Ibid.

4.4 Political Science

Research on uncertainty exists under the wide umbrella of political science. In electoral politics, studies have shown how uncertainty can be harnessed into fear by politicians to aid them in elections.[69] Feeling of uncertainty by the electorate, such as risk of being exposed to crime or terrorism, can quickly mutate into fear, even if the risk of it occurring is relatively low. Politicians pushing such policies thereby appeal to the voters' primal fears. This could be described as a form of securitization with unknown threats elevated to being the primary concern of the public and uncertainty thereby utilised into electoral success.[70]

Uncertainty in international relations has also been demonstrated to limit the degree of cooperation between states.[71] The anarchic international system is a source of uncertainty so states must reach agreements before cooperation can take place. When unexpected changes occur to the conditions of the state, be they internal or external, those same agreements can suddenly be a source of uncertainty. An agreement is by definition, a commitment to limit the states room for manoeuvre which is a risky choice with uncertainty present. A state can manage this uncertainty by preserving flexibility in those agreement which acts as a form of international insurance.

Another interesting insight comes from the field of game theory on credibility and threats.[72] Credibility is usually considered to be synonymous with believability since a threat must be perceived by the opponent to be believable. In the nuclear age however, this definition came into conflict with rationality since threats of nuclear war between two equal opponents will lead to mutual destruction. This whole argument is conditional on both sides having complete information about each other's capabilities and being rational i.e., seeking to avoid mutual destruction. In reality, states never have complete information which leads to uncertainty. A state can reduce the risk of annihilation due to misjudgement by the opponent of their intentions or capabilities by investing in defence, such as a missile shield or investing in devastating nuclear response capabilities. By ensuring that those capabilities are known by the opponent, both credibility and rationality are maintained while uncertainty is reduced.

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[69] Lawrence 2010, p 119.
[70] Lillbacka 2013.
[71] An elegant statistical study by on how agreements are reached by states to handle uncertainty can be found in Koremenos 2005.
[72] Kilgour and Zagare 1991.

5 Analysis

5.1 Summary of Findings

The reviewed fields of research have each offered their own insights into how to reduce or manage uncertainty. From medicine the focus is on how to address uncertainty by improving communication between physician and patient, and between the various members of the healthcare team. Good communication skills have been shown to reduce mistakes, improve outcomes and lessen the mental stress in patients and healthcare professionals alike. Good communication can be improved by ensuring that it is, clear, accurate, complete, trustworthy, and consistent. Uncertainty is also accepted as a constant factor, so physicians are advised to accept uncertainty and train in how to handle it. Basing practices on best available scientific evidence is also another strategy of reduction through standardisation.

From criminology we found research based on decision making being applied on identifying biases and heuristics in investigative work. The need for training in the cognitive handling of uncertainty is also apparent. Some uncertainties cannot be reduced which must be mentally accepted and some can be reduced but this incurs a cost that can lead to uncertainty in another area. Better training and experience can also lead to more efficient management of uncertainty by ignoring irrelevant data. More structured analytical tools and strategies can also be utilised. Geospatial analytical methods especially have proven useful in crime reduction. A risk matrix can also be utilised to decide on how to maximise limited resources.

Business' main contribution is in quantification of risk management to handle uncertainty. Uncertainty is also an accepted part of doing business, so tools have been developed to instead limit the potential consequences such as adequate due diligence and insurance practices. This minimises the risks by sharing it and spreading it out on multiple parties.

Finally, studies in political science have demonstrated that uncertainty also needs to be managed when irreducible. States can for example agree to international cooperation only if it minimise their exposure to risk or by maintaining enough flexibility. Game theory has also demonstrated that uncertainty can be mitigated by either strong defensive or offensive second-strike capabilities.

5.2 A Theory of Uncertainty

From this summary we can now take the first steps towards a theory of uncertainty in IA. This is presented below in the form of general propositions (P):

P1: Uncertainty is inherent to intelligence analysis since the goal is to obtain knowledge hidden by opponents or make predictions about future events which can never be fully known.

The very existence of intelligence agencies is to reduce uncertainty by collecting information and process it into intelligence that can be disseminated. Without uncertainty there likely would not be any need for IA and decision makers would not need intelligence report to make decisions.

P2: Reduction of uncertainty is usually desirable but only if the cost of achieving that does not outweigh the cost of not attempting to reduce said uncertainty. The cost can be in time, resources or that other parts of the process suffer with increased uncertainty.

Uncertainty is unavoidable but it can be reduced by collecting and processing information. Information gathering is only beneficial for as long as the analytical capacity is not overwhelmed. The analytical capacity must also be accurate enough to filter out the noise from the signals. If the capacity is saturated or not accurate, then collecting more information will instead start to cause more uncertainty. Modern intelligence agencies with sizable electronic collection capabilities will have this problem rather than not having enough data. Consider the amount of intercepted electronic mail that an organisation like the NSA can collect and it becomes easy to understand the extensive resources for analysis that are needed. The time it can take to process information containing a warning about an imminent attack might take such a long time, that it is too late for the information to be processed into actionable intelligence.

P3: Complete reduction of uncertainty can never be achieved so strategies for managing this uncertainty must be available.

P4: Communication at every stage must always be clear, accurate, consistent and with reasonable probability estimates.

P5: Training and supervision protocols must be established that stress the need to disregard irrelevant information that will only increase uncertainty and confusion, and to prioritise information that will help in reaching a valid conclusion. This is especially relevant in time sensitive scenarios.

These three propositions all concern strategies to manage uncertainty when it cannot be reduced further. A cost-effective way is to standardise all communication, so it follows the same format and uses the same language. This should apply to all internal and external communication occurring within an intelligence organisation. Using a standardised glossary in how estimates are classified is such an example of

improving communication. A consistent use of language in communication reduces the risk of error.

Since studies have shown information overload can lead to maladaptive responses, better training is needed to improve coping skills. This applies especially to new staff since experienced personnel tend to perform better. A useful skill is to learn how to focus on the relevant information and filter out the less useful or less prioritised parts. In addition to training, uncertainty can also be managed through updated internal guidelines that promote such practices. Close supervision of the newly hired can also yield desirable results.

P6: Statistical methods and structural analytical tools to estimate risk and uncertainty should be used when available.

Relying on personal instincts and hunches is, as demonstrated not a reliable solution for managing uncertainty. Good management entails objective and structural estimations of risk. Part of this process is considering different hypothesis and risk assessing them by likelihood and potential consequences. Suggested tools for such solutions involve analysis of competing hypotheses and risk assessment matrices. If the data set available allow for statistical analysis, then that should also be used for risk assessment.

P7: Plans on how to handle poor outcomes need to be established, such as spreading the risk and having insurance policies.

A perhaps more foreign concept for intelligence services is the concept of insurance, which is widely used in the business world. In many situations where uncertainty cannot be reduced or adequately managed in the tradition sense, then planning for the worst or having some form of a backup might be enough.

P8: intelligence practices should be based on scientific evidence when possible, instead of basing practices on tradition, instinct, or other subjective notions.

Another method of moving away from subjective assessments is by constant evaluation and improvement of methods used. All routine practices that form part of the analytical process can and should be evaluated if they actually work and a new evaluation should take place after every adjustment to those practices. The aim is to apply the scientific process of constant improvement and finetuning.

6 Discussion & Conclusions

6.1 Theory

This essay has demonstrated that uncertainty can be assessed and managed in a consistent and structured approach. Other fields have developed concepts on the topic and can therefore offer blueprints for how those concepts can be integrated into the IA process.

6.1.1 Application

Intelligence failures as described and evaluated in the literature point to failures in collection, failures in analysis, failures in communication or failures in imagination.[73] The first failure is not relevant to our discussion since we restricted this study to analysis. It can also be argued in that these failures are also failures in minimising uncertainty or at least accounting for it. Communication failures for example in the set up for the 9/11 attacks meant that important intelligence was not shared between the various agencies and the whole picture was missed. Missing critical information leads to higher uncertainty in anticipating future attacks. Established and efficient lines of communication using a standardised language decrease uncertainty and increases the chance of reaching the correct conclusion. The same argument can also be made to the other forms of failures.

As found in studies of uncertainty in the other fields, objective and structured measures are perhaps the best solution to managing and reducing uncertainty. The need to train doctors in communication skills has been demonstrated to have a positive impact on clinical outcome for patients. The applied to both internal communication within the profession and external to patients. Copying this process to IA should be viable, with training in how to write reports and how to report uncertainty. It should also be applied to the internal process within the intelligence agency and externally to consumers and allied agencies.

Developing tools and protocols to break away from haphazard analysis methods, that might differ from department to department and even analyst to analyst should also be a priority. Standardised solutions that minimise the impact of personal biases have been demonstrated from both medicine and criminology to also improve outcomes. Various methods of analysis have been proposed or are indeed already in use in the IA community.[74] Using risk assessment matrix is also highly recommended. What seems to be missing however is the constant evaluation and improvement of such tools. Medicine has for example introduced the concept

[73] For examples of failures in analysis see the classical assessment of how the Office of Naval Intelligence missed the signals indicating the imminent attack on Pearl Harbour in Wohlstetter 1962. For well-known examples of the failures in communication and imagination see Kean and Hamilton 2004 about the 9/11 attacks.
[74] Karvetski et al. 2020.

of evidence-based medicine which means that every practice regardless of how ingrained should be scientifically evaluated and improved when needed. Such systemic efforts at improving analytical methods are needed in IA. These efforts could also increase the cooperation between the academic and professional sides of IA and thereby further strengthen the links.

A more novel idea found in the literature is the concept of insurance as used in the business community. Insurance is used to spread the risk so potential fallout is reduced by sharing it with other organisations. The fallout in business is obviously economic but a similar concept can be introduced in IA even if the fallout here is loss of lives or loss of territory. Perhaps co-operation among states or among different intelligence agencies fulfils a similar function. Making allies through co-operation can offer a form of insurance policy against attacks by opponents. An insurance policy does run the risk of binding the hands of a state but as demonstrated by uncertainty research in international relations, cooperation agreements are only accepted by states if they offer enough flexibility. Smaller states joined NATO as insurance policy against a perceived threat from the Soviet Union and deemed the consequences of an attack worse than binding themselves to an agreement which reduced autonomy. The argument remains valid even when replacing states with intelligence agencies.

6.1.2 Issues of Application

The unique features of IA, such as its hidden and secretive nature raise several obstructions for introducing above mentioned suggestions. A proper evaluation of methods usually demands certain volumes of data to be analysed. Volumes that are hard to reach in IA since methods and results are usually closely guarded secrets. The problems especially affect academic research.

Another issue is that IA is closely dependant on its relation to its consumers who usually also provide the funding and exert political influence. Influence that can impede the actual IA process.[75] The relationship between analyst and consumer has a power imbalance that is different from similar relationship between physician and patient. In the second relationship, the power is tilted towards the physician since the patient, in most healthcare systems is not the one directly funding the health services. In IA it often the state that is the consumer and is in control. The state can therefore exert political influence on the intelligence work that can be damaging. This becomes a factor of uncertainty since changing political fortunes can overnight change funding, control, or mission of the intelligence services. Intelligence services therefore have limited autonomy to implement strategies that can better manage uncertainty since they often are at the mercy of the state and its demands.

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[75] Betts 1978

6.2 The Next Step

Producing a theory-developing study based on a literature review is challenging due the abstract nature and difficulty in presenting a valid analysis. This study is also more of an overview of the subject, which leads to the risk that important findings in other fields can be missed. It is also entirely possible that all the recommendations presented here are already tested and implemented in IA but no documentation is openly available for review due to the secrecy of the field. Other fields and disciplines are ruled by the spirit of open collaboration and their research is freely available. This was part of the reason why data was collected from those fields and thereby bypassing the secrecy of IA. Choice of an indirect solution such as this does run the risk of offering insights that are not as valid to IA though. Developing a theory based on those arguments and applying it to IA is therefore problematic. The ambition is however that this indirect method is just a first step towards developing a theory of uncertainty applicable to IA. The next step would be to test and refine each proposition in section 5.2 in the IA setting. The next step towards a theory of uncertainty is by formulating hypotheses based on those propositions and testing them. The endpoint is the formation of a coherent theory that can be of use in both the academic and professional environment.

6.3 Conclusions

We have demonstrated how uncertainty relates to IA and how there is an absence of a comprehensive theoretical framework. Through a literature review we have also identified what other fields with similar attributes to IA have found in research on uncertainty. The main findings are that uncertainty dominates IA and that it can be reduced but that is not always desirable. Often it is irreducible and therefore strategies to manage this uncertainty are needed. Strategies that include objective and structural analytical methods, standardised and improved communication, and when applicable using statistical risk assessments, and developing methods of insurance against unwanted consequences.

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