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Chapter 17 – UK AND US POLICIES FOR COMMUNICATING PROBABILITY IN INTELLIGENCE ANALYSIS: A REVIEW

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17.1 INTRODUCTION

Intelligence analysts are required to assess both current and future states of the world. For instance, what is North Korea's ballistic missile capability at the present time? How is its capability expected to develop over the next 5 years? And what is the strategic intent of these plans and actions? These assessments are typically made under conditions of uncertainty because relevant information may be missing or even unknowable (such as a foreign leader's intentions), information collection may be biased, and information may be unreliable as well as purposefully misleading. Therefore, most analytic assessments are essentially subjective probability judgements. Not only are analysts expected to accurately judge the probabilities, they are also expected to communicate these probabilities and their confidence in them in a veridical way to intelligence consumers. These consumers include other analysts who rely on prior intelligence reporting as well as policymakers and other decision makers (e.g., military commanders) who make critical decisions about defence and security.

The unambiguous communication of probability in intelligence assessments is important because miscommunication can lead to 'knock-on' errors in intelligence reporting that may, in turn, prompt erroneous and biased decision making. These consequences were acutely evident in the 2003 US-led coalition invasion of Iraq that aimed to find Weapons of Mass Destruction (WMD) which, in fact, did not exist. Post-mortem analyses of this major intelligence failure criticized intelligence organizations for understating the 'uncertainty' in their assessments and suggesting greater certainty than was warranted by the available information [1]; [2]; [3], p.173. The Butler report [4] further questioned whether intelligence products were "drafted and presented in a way which best helps readers to pick up the range of uncertainty attaching to intelligence assessments". The issue of knock-on errors in reporting was highlighted in the 2004 US Congressional report which stated that building on prior intelligence "without carrying forward the uncertainty from the first layer,... gave the impression of greater certainty about its judgments than was warranted" [3], p. 144. The deleterious effects of this intelligence on decision making was emphasized in the Chilcot inquiry which quoted UK Prime Minister Tony Blair's belief that intelligence organizations were "sure" about Iraq possessing WMD [5].

As the aforementioned quotes suggest, discussions of uncertainty in intelligence assessments sometimes conflate the concepts of probability and confidence. However, both analysts and intelligence organizations appear to find it difficult to grapple with these two concepts. For instance, Friedman and Zeckhauser [6] found that analysts confounded probability judgements with judgements of confidence. Similarly, the US Joint Chiefs of Staff Joint Publication (JP) 2-0 Joint Intelligence [7], which is used for joint and multinational intelligence in military operations, states that confidence should be expressed in three levels using a variety of linguistic probabilities (e.g., low confidence may be expressed by 'possible', moderate confidence may be expressed by terms such as 'likely' and 'unlikely', and high confidence may be expressed by terms such as 'almost certainly' and 'remote'). In

the present chapter, we focus on the Intelligence Community's (IC's) communication of probability.

Some in the IC may believe that the problems associated with the miscommunication of probability can be resolved by simply avoiding it altogether. This can be done either by suggesting complete certainty or by neglecting to communicate probability. Kesselman [8] searched the contents of National Intelligence Estimates (NIEs) (otherwise called intelligence reports or products) written between the 1950s and 2000s, and Mandel and Barnes [9] analyzed the language used in 2,013 Canadian strategic intelligence forecasts produced over roughly a six-year period [10]. These researchers found that 'will', which represents certainty, was the most commonly used word by analysts. Friedman and Zeckhauser [6] found that a notable proportion (i.e., 18%) of NIEs written between 1964 and 1994 did not provide any assessment of the probability associated with the outcome being forecast. However, neglecting probability is no panacea for the problems of miscommunicating it. For example, post-mortem analyses of the failed US invasion of the Bay of Pigs in 1961, which aimed to overthrow Castro's communist regime in Cuba, pointed to, amongst other things, the neglect to communicate to decision makers the chances of success without overt support from the US military in what was meant to be a clandestine operation [11], [12]. Probability should neither be avoided nor neglected, as acknowledged in the 2004 US Congressional report which states that "As much as they hate to do it, analysts must be comfortable facing up to uncertainty and being explicit about it in their assessments" [3], p. 408.

In an effort to encourage analysts to communicate the probabilities in their assessments in an unambiguous way, intelligence organizations have, in recent years, implemented formal policies for such communications. Virtually all of these policies advise analysts to use linguistic probabilities (e.g., terms such as 'very likely'). In this chapter, we critically review these policies in the US and UK – nations that share their intelligence products with one another and nations that produce joint intelligence. We point to their commitment to communicating probabilities using what are essentially vague linguistic probabilities, in spite of the well-documented pitfalls in doing so. We also point to a seeming reluctance to effectively exploit relevant scientific evidence when developing and refining methods for communicating probability, which we argue has resulted in less than optimal methods for communicating uncertainties.

17.2 EXISTING POLICIES FOR COMMUNICATING PROBABILITY IN INTELLIGENCE ANALYSIS

The US and UK introduced policies for communicating probability in intelligence assessments in the mid-2000s following recommendations made by inquiries into the Iraq WMD intelligence failure. In the UK, the 2004 Butler review stated, "While not arguing for a particular approach to [expressing]...uncertainty, ...we recommend that the intelligence community review their conventions again to see if there would be advantage in refreshing them" [4]. In the US, the 2004 Congressional report stated, "Whatever device is used to signal the degree of certainty – mathematical percentages, graphic representations, or key phrases – all analysts in the Community should have a common understanding of what the indicators mean and how to use them" [3], p. 419.

Policies were developed in the US by the Office of the Director of National Intelligence (ODNI), and in the UK by Defence Intelligence (DI) originally and the Professional Head of Intelligence Analysis (PHIA) more recently. Both ODNI and PHIA are responsible for overseeing the IC in their respective countries. Despite the various options for communicating probability available to them, both the US and UK chose to convey probabilities in intelligence assessments using linguistic probabilities. Specifically, analysts in both countries (as in many others that follow a comparable approach) are required to use a standardized lexicon – namely, a list of selected terms or phrases that are ordered from the lowest to the highest degree of probability. In some cases, the phrases are combined with

numeric values, which could be point estimates (e.g., 80%; see Ref. [13]), but are typically ranges (e.g., 55% – 80%). Sherman Kent, who played a key role in founding the Central Intelligence Agency's (CIA's) Office of National Estimates (the predecessor of today's US National Intelligence Council), was the first to advocate this type of standardized lexicon, although it was not formally implemented in the CIA at the time [14].

The lexicons in the US and UK have undergone several revisions over the years. Table 17-1 and Table 17-2 show the most recent versions of the US and UK lexicons [17], [16]. As can be seen in Table 17-1, the US lexicon comprises seven categories containing a total of 14 phrases that represent numeric values from 1% to 99%. Table 17-2 shows that the UK lexicon comprises seven categories containing a total of eight phrases which are mapped onto approximate numeric ranges in two formats; namely, percentages and fractions. The two formats are only approximately synonymous. For instance, 35% is close to the fractional “equivalent” of 1/3, but not exact. However, this slight disparity is usually made salient in visual displays of the UK standard.

Table 17-1: Standardized Lexicon Developed by ODNl. Used since January 2015.

Phrase	Numeric Value (%)
Almost no chance / remote	1 – 5
Very unlikely / highly improbable	5 – 20
Unlikely / improbable (improbably)	20 – 45
Roughly even chance / roughly even odds	45 – 55
Likely / probable (probably)	55 – 80
Very likely / highly probable	80 – 95
Almost certain(ly) / nearly certain	95 – 99

Table 17-2: Standardized Lexicon Developed by PHIA. Also called the ‘probability yardstick’. Used since March 2018.

Phrase	Percentage Value (%)	Fraction Value
Remote chance	□ § 5	□ § 1/20
Highly unlikely	§– §20	§– §
Unlikely	§– §	§– §
Realistic possibility	§– < 50	§– < 1/2
Likely/probably	§– §	§– §
Highly likely	§– §	§– §0
Almost certain	□ §	□ § 19/20

Note: The symbol § means “approximately equal to”.

Although these standards are national in breadth of applicability, they are implemented with slight variations across organizations that use the relevant standard. For instance, the National Crime Agency in the UK uses a visual representation of the yardstick in which the verbal probability terms are shown along a horizontal line ranging from 0% to 100% [17]. The boundaries of each term are stated as percentage chances but not as fractions. Probabilities below 50% are depicted in shades of blue, whereas probabilities above 50% are depicted in shades of purple.

Although we believe that the IC should develop clear guidelines for communicating aspects of uncertainty such as probabilities and confidence levels, we are concerned by the solutions they have adopted. In the remainder of this section, we summarize many of these concerns as they pertain to specific features of the current US and UK lexicons. Although the two lexicons exhibit differences, they share the same general approach, which entails selecting a circumscribed set of verbal probability terms and then attempting to set bounds on the meaning of those terms by aligning them with numeric probability intervals. Specifically, both lexicons provide seven categories of probability from which analysts may select. This has the effect of coarsening the 0 – 1 probability scale and can artificially inflate the expressed likelihood of rare events, tail risk, or what has otherwise been described as black swans – namely, events that have extremely low probabilities but also extremely high consequence severities [18]. Indeed, while phrases such as ‘remote chance’ and ‘almost no chance’ are the lowest probability categories in the lexicons, these do not convey exceedingly small chances that would be required to accurately characterize tail risks. In fact, they are likely to be orders of magnitude off. For instance, a study of the interpretability of such terms found that the peak interpretation of ‘remote chance’ by a sample of intelligence analysts in the UK was about 23% and it was about 17% in a sample of Canadian analysts [19]. Clearly, an analyst could not effectively communicate a 1% chance using this term, let alone a 1/10,000th chance, which is still large in the realm of black swans. We believe IC standards for communicating probabilities to decision makers should enable analysts to be as granular in their assessment as they may need to be.

Another concern we have with communication methods that rely on verbal probabilities is that such terms do not only convey probability, they also convey “direction” to recipients. Directionality refers to whether the phrase itself is positive or negative. For instance, strengthening a positive term, such as likely, for instance, by using “very” or “highly”, will raise the probability conveyed, whereas doing the same to a negative term will lower the probability. This in itself is not problematic. However, research has shown that phrases with negative directionality are interpreted with greater variability than positively worded phrases [20]. This is supported by evidence from research on intelligence analysts [19], [21], [22].

All categories in the US lexicon and one category in the UK lexicon contain more than one phrase and so are intended to be fully substitutable. It has been argued that providing synonyms allows for stylistic expression in intelligence reports [13]. However, some evidence suggests that synonyms in the lexicons may not be interchangeable in the minds of analysts [10], [21], [22]. Conversely, recipients of communications might treat terms that are differentiated in the lexicons as near synonymous. Ho *et al.* [19], for instance, found that intelligence analysts treated remote chance and very unlikely as nearly synonymous. However, we see that in both the US and UK lexicons these terms occupy adjacent ordinal positions in their respective scales.

The verbal terms in both lexicons are associated with numeric ranges. This is intended to provide boundaries on the inherent fuzziness of the probability terms’ meanings. However, Budescu Por, Broomell, and Smithson [23] found that recipients of verbal probability phrases in lexicons often do not keep the standards in mind and default to their personal interpretation of these phrases, thus defeating their purpose. These authors also showed that variability in the understanding of linguistic

probabilities could be reduced somewhat by presenting the numeric range a phrase is intended to represent alongside the linguistic expression of probability in the statement itself. However, if numeric ranges had to be included in intelligence estimates in order to give the verbal terms clear enough meaning, then it begs the question why use the terms at all? Why not simply present the ranges, which presumably could then be specifically tailored to the assessment? In addition, there are currently some categories that have sizeable numeric ranges (i.e., up to 25% points in the US lexicon and 20% points in the UK lexicon). Consequently, some phrases are much fuzzier than others. Wide latitude for interpretation increases opportunities for misunderstanding of probability. For instance, whereas a US analyst writing an intelligence report may intend 'likely' to mean 55% (i.e., bottom of the range), a reader of his/her report may understand it to mean 80% (top of the range).

The current standards, while adopting the same general approach, differ in terms of many specific aspects that can undermine bilateral interoperability and cause communication errors. For instance, the US lexicon contains 14 phrases organized into two sets, whereas the UK lexicon has a single set of eight phrases. Only five phrases are shared between the lexicons and, notably, the UK lexicon contains the phrase 'realistic possibility'. Barnes [13] "banned" the use of the phrase 'realistic possibility' in his Canadian probability lexicon because of his belief that it lacked precision (see also Kent's 1964 discussion of weasel words [14]). Indeed, studies reveal that US and UK analysts do not normally use this phrase to express probability [21], [22].

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Finally, the US lexicon does not cover the end-points of the probability interval (i.e., 0% and 1%), and whereas the UK lexicon does, it has gaps between categories (e.g., 6% – 9%). Complete certainty therefore, cannot be expressed linguistically using the US lexicon, and specific points along the probability scale cannot be expressed using the UK lexicon. Similarly, omission of the end-points precludes all orders of magnitude between .99 and 1, and .01 and 0. In the US lexicon, each category slightly overlaps the next, whereas in the UK lexicon, as mentioned, there are gaps between categories. Analysts using the US lexicon may find it difficult to select specific phrases when communicating probability at the top or bottom ends of a category. This is particularly problematic given the wide category ranges. For example, an analyst wishing to express a numeric value of 55% could use 'roughly even odds' which has a bottom range of 45% or 'probable,' which has a top range of 80%. Clearly, a decision maker may respond differently if he/she believes the likelihood being expressed is 45% or 55% versus 80%. Finally, whereas categories in the US lexicon are associated with numeric ranges, in the UK lexicon they are associated with both numeric and fraction ranges. The denominators in these fractions differ both within and across categories (e.g., the second category represents $\frac{1}{2}$ – $\frac{2}{3}$ and the third category represents $\frac{1}{3}$ – $\frac{1}{2}$). There is a total of seven different denominators used in the UK lexicon. The lack of a common denominator means that information cannot be easily aggregated (summed) and effort has to be made to find a common denominator.

17.3 THE IC'S COMMITMENT TO LINGUISTIC PROBABILITIES

Intelligence organizations strongly prefer to communicate probability linguistically rather than numerically. In their analysis of NIEs, Friedman and Zeckhauser found that only four percent contained numeric expressions of probability (e.g., percentages, odds) [6]. Thus, the lexicons introduced in the UK and US in mid-2000s merely institutionalize the IC's longstanding bias against precision and quantification of probability. The IC is not alone in the preference for using linguistic probabilities. Indeed, research has demonstrated that people generally prefer to communicate probability linguistically rather than numerically [24], [25], [26]. This is particularly so when

judgements are made under conditions characteristic of the intelligence analysis domain, namely, where people sense that relevant information is unreliable or unknown [27].

People may prefer to express probability linguistically rather than numerically for several reasons. Wallsten *et al.* found that some people said it was easier and more natural to use language rather than numbers [25]. For some, this preference was particularly so when the issue was deemed to be unimportant and/or the information was unreliable. In the IC, Barnes observed that analysts initially perceived it to be too difficult to estimate a numeric value [13]. Analysts were also concerned that numeric estimates would mislead by providing a false sense of precision, which might cause policymakers to put too much confidence in intelligence assessments. Finally, analysts were anxious about numeric values being used to evaluate their analytic performance because these can be easily tested (e.g., by the use of Brier scores [28]). The sentiments of individual analysts are shared by organizations overseeing the IC. For instance, ODNI stated, “Assigning precise numerical ratings to such [analytic] judgments would imply more rigor than we intend.” [29].

However, the benefit of communicating probabilities with words is questionable given the significant, well-documented pitfalls of doing so. Research has repeatedly demonstrated considerable variability in how people understand linguistic probabilities in both laboratory settings and applied domains [30], [31], [32], [33], [25], [34], [35], [36]. This variability is evident across people as well as within an individual person. Specifically, individuals may have broad or fuzzy interpretations of particular phrases. In addition, different people may use different phrases to refer to the same probability value(s) and/or may use the same phrase to refer to different values.

Research also shows that the interpretation of linguistic probabilities may be affected by the context in which they are used [10], [20], [37], [38], [39], [40], [41], [42], [43]. These contexts can be externally provided (e.g., the base rate of an event or the severity of an outcome) or internal to the person (e.g., one’s attitude to the subject matter). In the intelligence analysis context, Mandel [10] reported that a combined sample of intelligence analysts and university students had significantly less discriminating numeric interpretations of linguistic probabilities when they were used to describe an action that was described as failing than when the same action was described as succeeding.

Finally, it is unclear how effectively linguistic probabilities can be combined. This is of particular concern in the IC where analysts are often required to express how the probability of a number of (independent as well as interacting) events may combine to lead to an outcome or set of outcomes. Imagine, for example, a chain of four independent events that must occur in order for a particular threat scenario to manifest. In one case, the probabilities of the events are estimated to be .75, .10, .70, and .01. In another case, they are given the US standard equivalents, ‘likely’, ‘very unlikely’, ‘probable’, and ‘almost no chance’. If asked, what the probability of the four events occurring was, it would be easy for the analyst using numeric probabilities to calculate the probability of the conjunction, which is simply the product of the four terms, equalling $5\frac{1}{4}$ out of 10,000. We strongly suspect that the analyst using the linguistic probabilities instead would be led astray, not only because the verbal terms cannot convey such a small probability but also because words do not lend themselves to arithmetic operations.

The similar approaches to communicating probability adopted in the UK and US intelligence communities suggests that the IC believes that the pitfalls of using linguistic probabilities can be mitigated by adopting standardized lexicons that attempt to establish the intended meaning of the selected phrases. However, research shows that people find it difficult to suppress their normal meanings of linguistic probabilities even when lexical standards are provided for them to consult [23], [38]. In the IC, the ineffectiveness of this approach is no doubt further compounded by the use of

multiple lexicons currently in use in organizations that share intelligence (e.g., the UK and US). These situations require analysts (and other intelligence consumers) to rapidly shift their use and understanding of phrases and to mentally juggle different lexicons. If the research indicates that even a single lexicon is not adhered to well, what is the likelihood that individuals receiving intelligence will make these additional adjustments? A glance at Table 17-1 and Table 17-2 illustrates the juggling act required due to organizational differences in lexicons. For instance, whereas the UK lexicon uses ‘unlikely’ to represent 25% – 35%, the US lexicon uses it to represent a broader range of probabilities (i.e., 20% – 45%), and so consumers of intelligence products from both countries would need to speculate whether these products intend to communicate the same or different probability. To illustrate the mental juggling act required due to within-organizational revisions of lexicons, we can refer to the UK where DI’s version of the yardstick was replaced by PHIA’s version on March 5th 2018. Analysts and their customers would therefore be expected to update their understanding of nearly all of the phrases in the previous lexicon, and to use both lexicons when referring to reports produced before March 5th and those produced after this date.

In short, the IC wants to allow analysts to use linguistic terms for conveying probabilities that are familiar to them, but it does not want to allow analysts to determine the meaning of those terms. In so doing, we believe the IC has overestimated its ability to institutionally mandate meaning, change it at will through successive revisions, and to achieve corresponding compliance from its analytic partners and collaborators.

17.4 THE IC SHOULD DEVELOP EVIDENCE-BASED POLICIES

Policy development in the IC has historically occurred without consideration of relevant evidential bases beyond the anecdotal ‘lessons learned’ following intelligence failures [44], [45]. This is also largely true of the development and refinement of policies for communicating probability in intelligence assessments. While we cannot rule out that ODNI and PHIA considered relevant research findings in the process of formulating their policies, the incongruity between where we believe the scientific findings point and the IC’s adopted solutions indicates that the exploitation of relevant research findings was ineffective. We also see no evidence that the adopted methods were tested for their effectiveness prior or subsequent to their full adoption. Thus, neither ODNI nor PHIA knows if their lexicons are effective methods for communicating probability.

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One way to assess the effectiveness of a standardized lexicon is to compare similarities and differences between what the lexicon advocates and what analysts do. For instance, do analysts use phrases in the lexicons as intended? Do they consider phrases to be substitutable in the same way as advocated in the lexicons? Fortunately, there is a growing body of research on how probability is communicated in the IC. Some studies are based on a content analysis of actual intelligence reports [6], [8], [9]. While the external validity of this method is high, the method is limited because it does not enable researchers to determine what probability value(s) analysts had in mind when they used a specific phrase, unless they also provided numeric values in the reports (which may be relatively uncommon given the preference for communicating probability linguistically rather than numerically).

Partly in order to overcome this limitation, other studies have used quantitative methods [10], [19], [21], [22], that elicit people’s lexicons for communicating probability and measure how people numerically interpret linguistic probabilities (for details of some specific methods used, see Refs. [33], [46], [47]). Regardless of the method used, however, the extant body of research points to

discrepancies between policy (what the lexicons advocate) and practice (what analysts do). Below, we summarize the main findings from this research and their implications for the US and UK lexicons.

Kesselman counted the occurrence of a pre-selected list of 63 words and phrases, including those in the original lexicon produced by ODNI in the contents of NIEs written from the 1950s to mid-2000s [8]. Her analysis revealed trends in the language used across the decades. The use of ‘even chance’ waned and then increased from the 1950s to 1990s. Words such as ‘probably’ and ‘likely’ that were intended to be interchangeable in the ODNI’s lexicon differed in their popularity; i.e., the use of ‘likely’ increased from the 1950s to 1990s, whereas the use of ‘probably’ decreased. In fact, phrases in the ODNI’s lexicon were not equally popular, and in the early to mid-2000s, there was no occurrence of ‘remote’ and ‘even chance’ in the NIEs. Although Kesselman was unable to discern the probabilities that analysts were referring to when using specific phrases, it is clear that the ODNI’s efforts to reinstitute language that had naturally gone ‘out of fashion’ may face challenges to adoption.

Mandel [10] examined a standardized lexicon used by strategic analysts in a Canadian strategic intelligence unit, which for present purposes included some of the phrases in the ODNI’s and PHIA’s current lexicons. He asked a combined sample of military intelligence analysts (who did not use the lexicon on the job) and university students to provide the best numeric probability equivalent for each of the phrases. His findings indicate that interpretations of the phrases in the current ODNI and PHIA lexicons did not map directly onto the prescribed numeric ranges. In some cases, credible ranges based on the 95% confidence interval around participants’ median equivalency estimates were either below or above the category range. For instance, in PHIA’s lexicon, whereas ‘highly unlikely’ represents 10% – 20%, the corresponding 95% confidence interval on the median best estimate in Mandel’s study was 8% – 10%. Similarly, whereas ‘likely’ is intended to represent 55% – 75% in PHIA’s lexicon, the 95% confidence interval on the median estimate of this term was 75% – 80%. Finally, phrases such as ‘likely’ and ‘probably/probable’ that the lexicons intend to be substitutable were not perfectly so in participants’ minds [10]. Thus, Canadian analysts relying on reports produced by the US and UK may misunderstand the probabilities that their American and British counterparts intend to communicate. Of course, misunderstanding can also occur amongst other consumers of US and UK intelligence products.

Wallsten *et al.* [22] examined the linguistic probability lexicons of 119 CIA analysts. They found that the average size of the lexicon (spanning the 0 to 1 probability interval) was approximately eight phrases. This is much less than the current ODNI lexicon and equivalent to the current PHIA lexicon. Wallsten *et al.* also found considerable variability in the phrases that appeared in analysts’ lexicons (i.e., there were 170 distinct phrases). ‘Unlikely’ and ‘likely’ were the most common phrases, appearing in around 70 analysts’ lexicons. For present purposes, we point to the fact that although there was a general correspondence between the rank order of phrases in analysts’ lexicons and ODNI’s and PHIA’s prescribed rank order, analysts’ numeric interpretations of phrases in these lexicons again differed from that intended, with some

phrases being interpreted outside the category ranges. The fact that US analysts may not interpret phrases as prescribed by ODNI suggests that expecting them to suppress their vernacular interpretation of linguistic probabilities may be unrealistic.

Most recently, Dhimi [21] found comparable results in a study of the linguistic probability lexicons of 26 UK intelligence analysts who are responsible for writing intelligence reports. Analysts' lexicons contained, on average, ten phrases, and a total of 145 unique phrases were used. 'Likely' and 'unlikely' were, again, some of the most commonly used phrases. In addition, although the rank order of phrases in analysts' lexicons generally corresponded to the rank order in the US and UK lexicons, analysts whose lexicons contained phrases that appeared in these lexicons did not use them as mandated. For example, while 'likely' was ranked before 'highly unlikely' in analysts' lexicons, they used the phrases to represent ranges with higher maximum probabilities than that mandated in the UK lexicon. Interpretations of some phrases were above or below the category ranges prescribed in PHIA's current lexicon, and analysts did not consider 'likely' and 'probably' to be interchangeable as intended.

Finally, Ho *et al.* [19] studied 61 Canadian and UK intelligence analysts' interpretations of phrases in the US and UK lexicons, in an effort to compare the effectiveness of an evidence-based lexicon versus the US and UK lexicons. The researchers used one group of analysts to derive different evidence-based lexicons that utilized the same probability phrases as those common to the US and UK lexicons. The evidence-based lexicons relied on different statistical methods to set the numeric ranges that corresponded to each probability phrase. Ho *et al.* then studied a distinct group of analysts and recorded the proportion of their numeric probability equivalency estimates that fell in the ranges stipulated by the various lexicons. The UK and best performing evidence-based lexicon outperformed the US lexicon at the extremes (i.e., for the lowest and highest probability phrases), whereas the US and evidence-based lexicon outperformed the UK lexicon for the mid-range probabilities. Overall, Ho *et al.* [19] showed that the evidence-based lexicon was superior to both the UK and US lexicons in capturing analysts' interpretations of the institutionally mandated terms.

17.5 CONCLUSION AND THE WAY FORWARD

In the present chapter, we highlighted a number of significant pitfalls associated with using linguistic probabilities to communicate probability. These are due to the variability in the interpretation of phrases, the effect of contextual factors on interpretation of phrases, and the difficulties of aggregating the meaning of phrases. Requiring analysts to suppress their normal meanings of phrases when using standardized lexicons such as those advocated by ODNI and PHIA is deeply problematic and virtually untenable. An alternative approach to communicating probability is warranted that draws on scientific theory and evidence and which would overcome the pitfalls associated with using linguistic probabilities. The fact that the miscommunication of probability in intelligence products can have devastating consequences underscores the need to improve current policies and practices.

Perhaps the default policy ought to be to require analysts to use their own selection of numeric ranges (and precise numeric probabilities where appropriate). Intelligence organizations should not only encourage and permit analysts to be more precise and clearer in their communication of probabilities, but they should also incentivize analysts to perform analysis in a way that helps them to generate more precise probabilities. Recall that ODNI eschewed the use of numeric probabilities in the US because they believed this may imply greater rigor than intended [29]. We argue that analysis ought to be rigorous even when the bases for assessment are subjective probability judgements. It remains a deep misconception in the IC that only frequentistic probabilities (or relative frequencies) can be quantified. This flies in the face of Bayesianism and the very foundations of rational choice theory [48]. We recommend that, at minimum, the IC invest in research that examines the relative effectiveness of

current methods and alternatives that involve the use of numeric probabilities. We believe that the results of such a relatively low-cost research program would be highly useful.

17.6 REFERENCES

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