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Abstract

The present paper reports the findings from a study of discursive representations of the future role of technology in the work of the U.S. National Intelligence Council (NIC). Specifically, it investigates the interplay of 'techno-optimism' (a form of ideological bias) and propositional certainty in the NIC's 'Future Global Trends Reports'. In doing so, it answers the following questions: to what extent was techno-optimism present in the discourse; what level of propositional certainty was expressed in the discourse; and, how did the discourse deal with the inherent uncertainty of the future. Overall, the discourse was pronouncedly techno-optimist in its stance towards the future role of technology: high-technological solutions were portrayed as solving a host of problems, despite the readily available presence of low-technology or no-technology solutions. 75.1% of the representations were presented as future categorical certainties meaning the future was predominantly presented as a known and closed inevitability. The discourse dealt with the inherent uncertainty of the subject matter, i.e. the future, by projecting the past and present into the future. This was particularly the case in relation to the idea of technological military dominance as a guarantee of global peace, and the role of technology as an inevitable force free from societal censorship.

Keywords

Futurological Discourse; Technology; Ideological Bias; Techno-Optimism; Categorical Certainties; Objective Epistemic Modality; Relative Certainties; Probabilities; Possibilities.

A corpus based investigation of techno-optimism and propositional certainty in the National Intelligence Council's 'Future Global Trends Reports' (2010-2035)

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Introduction

The present paper reports the findings from a study of discursive representations of the future role of technology. It uses data taken from the U.S. National Intelligence Council's (NIC) 'Future Global Trends Reports'. Specifically, it focuses on three issues: the presence of a form of ideological bias, i.e. techno-optimism, in discourse concerned with the future role of technology; the level of certainty expressed in such discourse; and, the ways in which the discourse conveys a sense of certainty about something which is inherently uncertain (i.e. the future). In doing so, it contributes to the fields of critical discourse analysis (CDA), the critical study of futurological discourse, as well as the wider field of discourse analysis. In the following section, I will briefly outline the rationale behind the present study.

Representations concerned with the future are particularly susceptible to ideological distortion (Dunmire, 2011: 1). By 'controlling public discourses concerning what the future can and will be, modern institutions are able to shape the future in their own image' (Dunmire, 2011: 36). Furthermore, discourse about the future influences 'policies and actions…for the more immediate present' (Dunmire, 2011: 37). Despite the incredible influence that can be yielded through the control of futurological discourse, critical analysis of such material remains a relatively under-

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researched area. The present paper, therefore, contributes to the growing body of critical literature concerned with future focused discourse (as encouraged by Scollon and Scollon, 2000). In the spirit of critical discourse analysis, it draws attention to the dominance of certain discursive representations as well as the existence of alternative possibilities (Chouliaraki and Fairclough, 1999: 4; Dunmire, 2011; 19). It achieves this by interrogating the NIC's 'Future Global Trends Reports' for the presence of a particular ideology, i.e. techno-optimism.

Schwab (2016: 2) makes a clarion call for 'all stakeholders of global society' to spend greater effort in understanding the role of technology in shaping the future. The present paper contributes to such an understanding by investigating a specific form of ideological bias in discourse concerned with the future role of technology. In a time of fundamental social change, it is perhaps unsurprising that futurologists frequently portray technology as providing solutions to the problems that increasingly bedevil the global community (such as, environmental degradation, food production, resource depletion, etc.). Such discourse is subject to a range of biases such as an overly simplistic understanding of the historical role of technology (Wright, 2005: 47); a status quo bias in which technological developments are projected as preserving present social arrangements (thus stifling the potential for change); and a presentation of the future as a closed inevitability (Huesemann and Huesemann, 2011). Given that techonologised futures are susceptible to the influence of individual agency and thus an open site of potentiality (Pellegrino, 2015: 224), this latter form of bias is particularly concerning. The examination of techno-optimism and propositional certainty exposes how open or closed technologised futures were presented in the work of the NIC.

For many great thinkers, the future is something that remains eternally unknowable (Poincaré, 1902; Hayek, 1945; Popper, 1957). The very nature of metaphysical reality is stacked against success in the kind of soothsaying frequently conducted by social institutions such as the NIC. Such a view may

help explain why humans often prove woefully poor in predicting future developments (Tetlock, 1999; Gilbert and Wilson, 2007; Taleb, 2007: 135). From an epistemological perspective, producers can only ever express beliefs (as opposed to knowledge) about the future (Lyons, 1977: 815; Fleischman, 1982: 20). However, linguistic distortion is possible regarding the level of certainty with which producers can talk about the future. Indeed, Lyons recognises the fact that English allows speakers to present themselves as having the ability to talk about the future with varying degrees of objective certainty (1977: 811). He further recognises speakers as even being able to talk about the future as known despite not being 'epistemologically justified in doing so' (Lyons, 1977: 815). Dunmire (2005) further notes that the way in which producers speak of the future in terms of propositional certainty can 'undermine the concept of the future as potentiality and, consequently, to interfere with our ability –even desire- to imagine, articulate, and realize futures that challenge those prescribed by dominant discourses' (2005: 483). As already stated, the present paper, therefore, investigates the level of propositional certainty assigned to representations of the future by the producers of the NIC reports. It also considers how such discourse promotes a sense of certainty about something inherently uncertain.

In short, the present paper specifically investigates the interplay of techno-optimism and propositional certainty in the work of the U.S National Intelligence Council. Using a broad based discourse-semantic approach (van Dijk, 1995) the present study achieves its objective through the following research questions:

(1) To what extent was 'techno-optimism' present in discourse concerned with the future and technology?

(2) What level of propositional certainty was expressed in such discourse?

(3) How was a sense of certainty conveyed about an inherently uncertain subject matter?

The following two sections will consider the core analytical components: techno-optimism, and propositional certainty.

Techno-optimism

The central thesis of Huesemann and Huesemann (2011) is that social institutions have seduced themselves with ideological notions of technological salvation: high-technology solutions have come to be unquestioningly regarded as holding the ability to resolve the problems faced by humankind. Broadly speaking, techno-optimism (or more precisely, 'techno-over-optimism') covers two domains: environmental and social. Environmental techno-optimism principally points to counter technologies (i.e. technologies which attempt to fix problems created by previous technologies) and, efficiency improvements as a remedy to emergent environmental problems (e.g. pollution). It comprises three subcategories: economic, food, and resource techno-optimism. Economic techno-optimism alludes to a number of ideas discussed in Huesemann and Huesemann: unlimited economic growth is environmentally sustainable; and, in defiance of thermodynamic constraints (Greening et al., 2000), efficiency gains will outpace the demand for scarce resources. Food and resource techno-optimism are both predicated on the notion that scarcity will be overcome through innovation such as through the development of genetically modified crops; greater use of biofuels; and the development of more efficient water desalination techniques.

Social techno-optimism involves the use of technology to provide temporary fixes to social problems (e.g. global security) often as a way of avoiding controversial or inconvenient solutions. Social techno-optimism also comprises three subcategories: security, medical, and the technological imperative. Security techno-optimism is predicated on the idea that military might is the primary mechanism for ensuring peace amongst nations. Proliferation can be counterbalanced through constant innovation (i.e. the development of ever deadlier weapons), as well as the doctrine of

mutually assured destruction (MAD). Medical techno-optimism proposes the idea that high-tech solutions and medicinal super-drugs will abolish disease and increase longevity. The concept of the technological imperative promotes the idea that technology is an autonomous, inevitable, and independent force. It can be neither stopped nor subjected to societal censor: 'in accordance with the technological imperative, whatever can be done technically, will be and should be done' (Huesemann and Huesemann, 2011: 253).

Propositional certainty in representations of the future

Epistemic modality is one of the principal means through which certainty is expressed in English. It has been considered by numerous fields including philosophy, logic, and grammar (Morante and Sporleder, 2012: 225). The present paper utilises a distinction, often neglected by analysts (Nuyts, 2001a: 384), between categorical statements, subjectively modalised statements, and objectively modalised statements. The distinction allows for discrimination between statements that are explicitly presented as beliefs, and those that are presented as categorical certainties, and objective epistemic possibilities (see below). The origin of such a distinction lies in the work of Lyons (1977). Based on earlier work by Hare (1970), Lyons (1977: 793) tentatively proposes the idea that statements can be categorised into three basic types: categorical, subjectively modalised, and objectively modalised statements. The first type involves an utterance that is presented as an unqualified, straightforward, statement of fact (as in example 1, taken from the 2025 future global trends report).

(1)

The pace of technological innovation **will** be key to outcomes during this period.

It should be noted that 'will' was regarded as expressing categorical certainty in the present paper. Two reasons informed this decision: the auxiliary verb does not explicitly refer to the evidential basis

of the utterance (as in subjective epistemically modalised statements); and, it does not explicitly 'express uncertainty as such, but situates the state of affairs on the time axis (i.e. futurity is its primary meaning)' (Nuyts, 2001: 173). Categorical statements express the highest epistemic warrant (Lyons, 1977: 809; van Dijk, 2011: 31; Abdi et al., 2010: 1675). In making such statements, senders are committed to the factuality of such propositions. Furthermore, presenting the future in terms of 'absolute modality' (Dunmire, 2011: 112) compresses the space to imagine alternative futures as well as agentive roles (Grosz, 1999:3). In other words, the future is presented as a closed inevitability.

According to Lyons, propositions can be epistemically qualified in two ways: producers can qualify the neustic component of an utterance (i.e. 'I-say-so'), or, the tropic component (i.e. 'it-is-so'). The subjective/objective divide (in Lyons) can be understood as resting on the quality of the evidence used in the modalisation of a statement. The former involves subjective guesswork as to the likelihood of an event, whereas the latter involves a (supposedly) objective measurable chance (Nyuts, 2001: 33); van Dijk succinctly summarises the distinction:

> One way of accounting for the difference between these modalities is to define subjective modality in terms of the personal state of mind, namely (un)certainty of language users, and objective modality as (degrees) of probability, independently of the speaker, and based on external evidence, such as statistical probabilities, scientific research and so on (van Dijk; 2011: 277).

Again, subjectively modalised statements qualify the 'I-say-so' component, and work to indicate the speaker's reservations about expressing a categorical 'I-say-so' to the factuality of the proposition embedded within the utterance. Take the following example from the 2025 global trends report.

(2)

We believe India will scramble to ensure access to energy by making overtures to Burma, Iran, and Central Asia.

The clausal expression 'We believe' in example 2 qualified the neustic (i.e. 'I-say-so') component of the utterance. According to Lyons, any qualification of the neustic component decreases the epistemic warrant of propositions and converts them into 'statements of opinions, or hearsay, or tentative inference' (1977: 799). Speakers are not committed to the factuality of such statements. Such statements, as in the one above, present an open conception of the future that is subject to challenge. Nuyts (2001a: 386) makes the point that the markers are primarily an evidential qualification and do not necessarily invest a proposition with a possibility value. Again, the underlying epistemological reality is one in which all statements regarding the future are subjective. Nevertheless, English allows producers to mask such a reality (as when they use the objective modality).

Objectively modalised statements have an unqualified 'I say so' component, and an 'it is so' component that is qualified by a degree of possibility. The speaker is committed to the factuality of such a proposition by presenting it as a relative certainty, probability, or possibility. Take the following example from the 2035 global trends report.

(3)

Continued North Korean provocations, including additional nuclear and missile tests, **might** worsen stability in the region and prompt neighboring countries to take actions, sometimes unilaterally, to protect their security interests.

The absence of a mental state predicate (e.g. we believe) meant that the I-say-so component was left unqualified. Had the utterance contained such a clause then it would not have been considered in

the present paper. Again, such clauses scope over entire utterances and explicitly present propositions as mere beliefs. In the example above, the it-is-so component was qualified by the embedded modal 'might'. According to Lyons, producers are committed to the factuality of the possibility expressed in such statements (1977: 799). Given that the concept of possibility allows room for alternatives, such statements promote a more open conception of the future than categorical statements. However, given that they are supposedly based on objective factual information (as opposed to simple inferences) and are presumably true under certain conditions such statements present a more closed conception of the future than that presented in subjectively modalised statements.

According to Lyons, categorical statements and objectively modalised statements have an illocutionary force similar to an act of telling (1977: 799), e.g. X is a categorical certainty; or, X is an objective possibility e.t.c. In a data set concerned with future possibilities, categorical statements and objective epistemically modalised statements were felt to be particularly worthy of investigation for two principal reasons: firstly, they allowed for examination of what was unreservedly committed to (even if it was a qualified with a certain degree of possibility) in the discourse; secondly, both kinds of statements provide insight into the way in which producers attempt to achieve the epistemological impossible, i.e. talking about the future with certainty or objective possibility.

Data and approach

Established in 1979 the National Intelligence Council (NIC) is a collection of leading academics and subject matter experts. It convenes every four years to project how 'key trends might develop over the next decade and a half to influence world events' (NIC, 2020). The projections of the NIC are compiled as a key policy document for each newly incumbent U.S. president. Since 1997 the 'non-sensitive' aspects of the NIC reports have been made publically available (6 in total). The reports

were used to build a specialised corpus (approximately 207,000 words). The automated annotation functionality of the Wmatrix system, developed by Paul Rayson2, was used to extract all concordance lines that fell within the semantic domain of technology.

In total, 1528 concordance lines were extracted from the corpus of six reports, 61% of which were found to be relevant to the focus of the present study, i.e. contained a proposition in which something was referenced or predicated about the role of technology in the future. A further 34% of the concordance lines were excluded as irrelevant (e.g. headings and phoric marker constructions) as well as constructions in which in which nothing was predicated about the future. Finally, a number of the lines (n =5%) were found to be semantically irrelevant, e.g. many lines that contained the node word 'system' actually referenced a non-technological entity such as 'welfare system'.

Once identified, the relevant concordance lines were manually coded according to the key technological issue (see Table 1) and propositional certainty value (see Table 2). All concordance lines were then read, and re-read, in order to explore the extent to which the lines expressed an ideological position consistent with techno-optimism. The lines were finally gathered into consistent discourse themes that emerged from the analysis (reported below).

Table 1 summarises the schema used to annotate the concordance lines according to the broad issues contained in the discussion of techno-optimism above. A miscellaneous category was created for lines that resisted neat classification.

Table 1. Key issues regarding the future and technology

Key Issue	Essential techno-optimist position	Example

[2] Available at: http://ucrel.lancs.ac.uk/wmatrix/

	Economic	Technology will enable continued economic growth	Over the next 15 years the pressures on the environment as a result of economic growth will decrease as a result of less energy-intensive economic development and technological advances. (2015)
Environmental	Food	Innovation will achieve food security	Genetic modification will improve the engineering of organisms to increase food production and quality. (2015)
	Resources	Innovation will overcome scarcity of resources	Service companies are developing new super fracking technologies that could dramatically increase recovery rates still further. (2030)
	Security	Military dominance ensures global security and influence	The United States, with its decisive edge in both information and weapons technology, will remain the dominant military power during the next 15 years. (2015)
	Medical	Medical discoveries will reduce illness and increase quality of life	Biotechnologies that extend life may also be made available to enhance the comfort of living, reduce pain, and extend basic human functions in ways that promote individual independence and reduce caregiver burdens. (2035)
Social	Technological Imperative	Technology is an inevitable, independent, irrevocable force	Some states will seek to control the Internet and its contents, but they will face increasing challenges. (2020)
	Miscellaneous	Miscellaneous	Ideas about gender roles and masculinity are also likely to influence counterterrorism as information technology and the sharing of ideas broaden

	perceptions of acceptable 'masculine' behaviors. (2035)

As shown in Table 2, four value groups were used to classify the data, i.e. categorical certainty and three discrete value groups for objective epistemic modality (as in Lyons: 1977: 800). In terms of the polysemous nature of many modal items, an inclusive approach to interpretation was taken in the present paper, such that modals were given an epistemic reading unless they were unambiguously deontic or dynamic. Table 2 displays the typical markers found in the data with relevant examples.

Table 2. Typical propositional certainty markers in the NIC reports (2010-2035)

Epistemic Value	**Description**	**Typical Marker**	**Example**
Categorical certainty	Unqualified declarative expressions, used to convey categorical certainty (e.g. X will happen)	Items of simple futurity: 'will'	Communications technology **will** become so inexpensive that most countries **will** be able to pay the cost of connecting to the global information infrastructure. (2010)
Relative certainty	Declarative expressions in which the basic propositional nucleus was given epistemic meaning by a linguistic device indicating relative certainty. In such cases whilst the level of certainty was high, categorical certainty was not quite justified (e.g. it is the case that X is almost certain).	Adverbs of certainty	Enabled by communications technologies, power **almost certainly** will shift toward multifaceted and amorphous networks. (2030)
Probability	Declarative expressions in which the basic propositional nucleus	Epistemic phrases	Activist groups like Anonymous **are likely** to employ increasingly

	was given epistemic meaning by a linguistic device indicating a degree of probability (e.g. it is the case that X is a probability)		disruptive cyber attacks. (2035)
Possibility	Declarative expressions in which the basic propositional nucleus was given epistemic meaning by a linguistic device indicating mere possibility (e.g. it is the case that X is a possibility)	Modal verbs:, 'may', 'might', 'could'	Finally, enough countries **might** decide to seek nuclear weapons capabilities in reaction to an Iranian capability. (2025)

Findings

The following section will discuss the findings from the annotation exercise. I will first present the percentage distribution of the key technological issues in the data examined. I will then present the overall percentage distribution of the propositional certainty values. Finally, I will present the distribution of propositional certainty across the technological issues. Table 3 below shows the overall distribution of the thematic categories in the corpus.

Table 3. Percentage distribution of thematic categories in the NIC data (2010-2035)

Category	**Percentage**
Economic	27.3
Food	3.8
Resources	5.9
Security	38.0
Medical	5.6

Technological Imperative	14.1
Miscellaneous	5.3
total	100

Overall, security issues contained the largest amount of propositions in the corpus (n = 38%); economic issues accounted for the second biggest percentage share of the data (n = 27.3%). Given that the economic and military realms are key sites of neoliberal activity (Fairclough, 2003) it is perhaps not surprising that a futurist agency like the NIC focused on such issues. As one would expect, the miscellaneous category contained a diverse number of themes including: the role of technology in the spread of various ideologies (such as pluralism, anti-Americanism, and religious extremism); and, the empowerment of women and excluded groups through internet connectivity. Due to constraints on space, the miscellaneous category will not be given any further significant attention. Table 4 below shows the overall distribution of propositional certainty in the data examined in the present paper.

Table 4. Overall percentage of propositional certainty statements in the NIC reports (2010-2035)

Category	**Percentage**
Categorical certainty	75.1
Relative certainty	5.4
Probability	4.3
Possibility	15.2
total	100

As is apparent from the results above, the producers of the NIC overwhelmingly expressed categorical certainty when making representations about the future and technology. In other words,

the producers predominantly presented the future as a closed inevitability. This would suggest that the producers held a modernist conception of the future. According to such a conception, the future is something that can be predicted with a high level of certainty (Adam, 1995: 169; Bell, 1997: 4; Heller, 1999: 3). Indeed, futurists are charged with the task of allaying fears with regards to the uncertainties of the future by providing a sense of certainty; mastery over the future has become part of the western ethos (Lal, 1999: 213). Interestingly, when the producers chose to qualify a statement objectively, they were more likely to express mere possibility. If representations of the future are conceived as existing on a cline of inevitability/potentiality, then the overall results would suggest that the producers essentially gravitated towards the two extremes, i.e. categorical certainty and mere possibility. In other words, the producers did not display a propensity to express shades of meaning with regards to propositional certainty. As can be seen in Table 6 below, this was true of all the individual categories. Such a trend may accord with a general aversion to nuanced calibration involved in episodes of prediction (Taleb, 2007: 140). Table 5 shows the distribution of propositional markers across the key technology issues.

Table 5. Percentage distribution of propositional certainty statements across key technology issues

	Economic	Food	Resources	Security	Medical	Technological Imperative	Miscellaneous
Categorical certainty	75.1	74.3	67.2	68.5	75.0	88.5	75.5
Relative certainty	5.4	5.7	9.1	7.7	1.9	1.5	4.1
Probability	4.3	5.7	7.3	5.4	5.8	0	6.1
Possibility	15.2	14.3	16.4	18.4	17.3	10.0	14.3

Total Percentage	100	100	100	100	100	100	100
Total Frequency	253	35	55	352	52	130	49

Discourse concerned with the economy, food production, health, and the technological imperative, was more likely to express categorical certainty, i.e. promote a closed version of the future. The economy and the technological imperative will be discussed in further detail below. In terms of food production, the producers expressed a high degree of certainty about the benefits promised by genetically modified crops and emergent agricultural technologies. Discourse concerned with resources and security was more likely to contain modals that indicated future potentiality, and thus projected a version of the future more open to negotiation. Security will be discussed in greater detail below. In terms of resources, the producers predominantly focused on energy issues. They expressed a relatively high degree of uncertainty in regards to the potential of new energies to replace the current energy architecture. Interestingly, the producers expressed a high degree of certainty about the potential benefits to be gained from hydraulic fracking technologies. In doing so, they expressed a preference for the continuation of the fossil fuel era.

The following section will discuss in greater detail the interplay of propositional certainty and techno-optimism in relation to the three biggest issues (accounting for 79.4% of the data): i.e. the economy, security, and the technological imperative.

Discussion: techno-optimism and propositional certainty in the work of the NIC

The three main themes shall be considered in the order of their relative size within the data set. I shall comment on the presence of techno-optimism within each category, the level of propositional certainty expressed and the discursive means by which such certainty was conveyed.

Security issues

As already stated above, security issues accounted for the largest percentage share of the data used in the present paper (n =38.0%). Again, the category contained the second least amount of concordance lines which expressed categorical certainty (n = 68.5%). In accordance with the general trend in the data, possibility accounted for the second largest amount of concordance lines (n = 18.4%). As will be seen, this was largely driven by a focus on emerging security threats which involved the discussion of a range of possibilities. Two dominant themes emerged from the data: technological military dominance as a guarantee of global security; and, the technological domain as a novel source of instability.

The producers of the NIC reports consistently legitimised the notion that technological military dominance was both desirable and crucial in terms of the achievement of global peace (as also discussed by Dunmire, 2015: 306). For example:

(4)

In 2025, the US **will** still retain unique military capabilities, especially its ability to project military power globally, that other nations **will** continue to envy and rely on to secure a safer world…The US also **will** continue to be viewed as the security partner of choice by many states confronted with the rise of potential hostile nuclear powers (2025).

In the example above, through the use of categorical certainty markers, a future in which the U.S. would continue to act as military guarantor was essentially presented as a fait accompli. As will be seen, the producers frequently created a sense of certainty through the representation of an 'extended present' (Nowotny, 1994: 51). In the excerpt above, the producers used the auxiliary verb 'will' in conjunction with verbs of continuation to essentially state that what is militarily true of the world today will be true of the world in the future (Alessandrini, 2003: 213). Interestingly, the discourse also frequently considered the prospect of an inevitable decline in U.S. military prowess. In the face of such a decline, the contingencies that could contribute to continued domination were discussed. For instance, the 2030 report contained the following statement:

(5)

The West **may** need to extend the nuclear umbrella to those countries feeling threatened by proliferation (2030).

Example 5 makes for an interesting contrast with example 4. The reader may notice that that the subject of the proposition referenced the 'West' as opposed to the U.S. as a unilateral agent. Nevertheless, the discourse still privileged a future based on technological military dominance. In doing so, such discourse effectively stymied discussion of a future based on a shift from a reliance on ever deadlier deterrents to one based on alternative approaches to global peace, like a pronounced role for legally binding global institutions, or diplomacy (Seib, 2016). In other words, there was no criticism of present arrangements in the projected vision of the future. Again, this meant that there was little scope for the discussion of alternative arrangements or change (Polak, 1973: 142). Unlike most modalised statements examined, the explicit thinking behind example 5 did not occur in the immediate co-text. Nevertheless, I would argue that the presentation of the proposition as a possibility in itself constituted a recognition of the inherent uncertainty of the

future. Through the use of the modal auxiliary (i.e. 'may') the discursive position was opened to greater debate (Tse and Hyland, 2008: 1238).

As already stated the second major theme within the category of security concerned the technological domain as a novel source of instability. The discourse concerned with this theme contained a greater degree of uncertainty. It also exposed the moribund effectiveness of munitions and standing armies in the achievement of global security, e.g. nuclear warheads will not prevent a cyber attack. Particular attention was given to the certain and likely use of lethal technologies by terrorist organisations. For example:

(6)

While vehicle-borne improvised explosive devices **will** remain popular as asymmetric weapons, terrorists **are likely** to move up the technology ladder to employ advanced explosives and unmanned aerial vehicles (2020).

In the excerpt above, the producers presented the information in the opening modifying phrase as a categorical certainty. Again, such certainty was achieved through the projection of a present trend into the future (i.e. 'will remain'). The proposition in the base clause was presented as an objective probability. I would argue that the categorical certainty of the modifying clause (i.e. 'improvised explosives will remain') allowed the subsequent epistemic evaluation in the base clause (i.e. 'terrorists are likely…to employ advanced explosives') to be presented as a logical, common-sense, extension. A certainty about vehicle-borne explosives licensed speculation about the future use of advanced explosives. In other words, the producers can be taken as having said: given that X will be the case (as a categorical certainty); it is simultaneously likely that X will also be the case. A similar case can be observed in the following example (albeit over a longer stretch of discourse).

(7)

> Over the next 15 years, a growing range of actors, including terrorists, **may** acquire and develop capabilities to conduct both physical and cyber attacks against nodes of the world's information infrastructure, including the Internet, telecommunications networks, and computer systems that control critical industrial processes such as electricity grids, refineries, and flood control mechanisms. Terrorists **already have** specified the US information infrastructure as a target and **currently are** capable of physical attacks that would cause at least brief, isolated disruptions (2020).

The possibility presented in the first line (i.e. 'terrorists, may acquire') was anaphorically supported by the second sentence. The use of the present perfect (i.e. 'Terrorists already have specified') in the first proposition of the second sentence rendered the event detailed as relevant to the present/projected future (Dunmire, 2011: 75). The second proposition compounded the impact of the utterance by highlighting present day capabilities (i.e. 'currently are capable of'). Again, the future was presented as knowable (even if it was only a possibility) through past and present trends (Adam, 1995: 169). Elsewhere, in typical techno-optimist fashion, the producers pointed to the technological domain as providing a possible solution to emergent threats. For instance:

(8)

> Technology **will** be a double-edged sword. On the one hand, it **will** facilitate terrorist communications, recruitment, logistics, and lethality. On the other, it **will** provide authorities with more sophisticated techniques to identify and characterize threats (2035).

Such discourse arguably encourages the development of policies that treat the symptoms of terrorism rather than the underlying causes. Whilst all efforts must be made to ensure the future protection of innocent lives, surely technological discourse should not be relied on for the purpose of 'providing illusory solutions to our problems...even if these problems are fundamentally social, psychological or spiritual in nature' (Huesemann and Huesemann, 2011: 221).

Economic issues

As already stated, economic issues accounted for the second largest thematic category (n =27.3%) in the data. Excluding the miscellaneous category, economic issues contained the second highest amount of concordance lines that expressed categorical certainty. Possibility accounted for 15.2% of the concordance lines concerned with economic issues. As will be seen, possibility was often used to express (dis)preference for certain futures. The discourse contained two main themes: economic advantage precipitated by technological innovation; and, the economic impact of failing to keep pace with technological trends.

In the discussion of efficiency gains, the discourse predominantly reflected the neo-classical link between technological innovation and the advantages gained by commerce (Solow, 1956). Such representations were largely expressed in terms of categorical certainties, as in the following example:

(9)

The pervasive incorporation of information technologies **will** continue to produce significant efficiency gains in the US economy (2015).

Once again it is possible to see how the construction in the example above conveyed a sense of certainty by projecting the present into the future (i.e. 'will continue to'). When the producers discussed efficiency gains as objectively qualified likelihoods, this usually involved a hyperbolic inflation of the benefits accrued (although as can be seen in example 9 this was sometimes true of categorical statements). For instance, in relation to new information technologies the producers claimed:

(10)

Early and significant adoption of these technologies **could** provide considerable economic advantage (2025).

In relation to human augmentation technologies the producers claimed:

(11)

Early and robust adopters **could** see significant benefits, while nations and societies hesitant to employ the technologies **may** find themselves disadvantaged (2025).

Cap (2008: 18) discusses the role of alluring promises as a rhetorical device intended to sell a particular vision. In the previous two examples, technological complicity was presented as promising at least the possibility of great gain, and presumably the certainty of more humble benefits. Interestingly, the producers displayed a propensity to talk in terms of possibilities, rather than certainties, when making representations about the economic impact of non-adoption. For example, in the 2020 report, the producers claimed:

(12)

The gulf between "haves" and "have-nots" **may** widen as the greatest benefits of globalization accrue to countries and groups that can access and adopt new technologies (2020).

Such discourse approved of proactive adoption of technological innovation for commercial gain; failure to do so was represented as precipitating the possibility of economic wretchedness. Such discourse stifled the credible discussion of a future based on alternative economic arrangements and naturalised current models of economic management. In terms of conveying a sense of certainty, an aspect of the present was once again projected into the future, i.e. the reference of the proposition (current economic inequality amongst nations) was represented as possibly worsening. In both examples 11 and 12, the producers used the same discourse strategy to promote their preferred

version of the future (i.e. one in which technological adoption was preferential). Jaworski and Fitzgerald (2008) identify a powerful discourse strategy in the rhetoric of UK political parties. Typically, one party projects a calamitous vision of the future that would arise from the victory of their opponent. Both examples 11 and 12 involved a similar discourse strategy in that the producers presented an undesirable future arising out of non-adoption.

Overall, discourse concerned with the future role of technology in relation to the economy privileged particular concerns of the future above others. Firstly, the health of the economy was privileged over that of the environment. Indeed, the reports largely neglected the standard techno-optimist rhetoric, i.e. efficiency gains will mitigate the deleterious impact of economic activity on the environment. In a rare instance of acknowledgement, the producers advocated a dynamist position (Postrel, 1998) in which a solution was presented as likely to emerge from the very source of the problem:

(13)

> Technology and markets **are likely** to have a more important impact in reducing carbon emissions than efforts to negotiate any comprehensive or updated Kyoto-style agreement –the success of which looks questionable for the next decade or so (2030).

Such discourse advocated a business-as-usual model in which a techno-fix would be preferred to any regulative change to the status quo (Asayama, 2015). The discourse also posited a future in which technology will be unquestioningly employed for unrestrained economic growth. Indeed, the idea of infinite economic growth went completely unchallenged in the discourse, despite a good body of literature that contradicts the standard techno-optimist position, e.g. infinite growth on a finite planet is logically impossible (MacKellar, 1996; Leonard, 2011; Bourne, 2015; Higgs, 2016).

Alternative economic arrangements like steady state or seasonal economies were excluded from the discourse.

The technological imperative

The technological imperative was the third largest thematic category in the data (n = 14.1%) and contained both the highest percentage of categorical statements (n = 88.5%), as well as the lowest percentage of possibility (n = 10.0%). As with economic issues, possibility often involved the expression of (dis)preference for certain futures. The discourse largely focused on the issue of societal/state censorship of the technological domain. Fully consistent with the standard techno-optimist position, technology was often imbued with a sense of impunity beyond the control of society. Attempts by states to exercise control over the technological domain were presented as increasingly difficult:

(14)

> Nations also **will** face serious challenges in oversight, control, and prohibition of sensitive technologies. With the same technology, such as sensors, computing, communication, and materials, increasingly being developed for a range of applications in both everyday, commercial settings and in critical military applications the monitoring and control of the export of technological components **will** become more difficult. Moreover, joint ventures, globalized markets and the growing proportion of private sector capital in basic R&D **will** undermine nation-state efforts to keep tabs on sensitive technologies. (2020).

Through repetition and exemplification (with a focus on current technologies and technological trends), the excerpt above clearly expressed the idea of state control as futile. Such representations denied the simple assertion that technology 'is not an exogenous force over which we have no control' (Schwab, 2016: 4). Elsewhere, the march of technology was also presented as beyond recall:

(15)

Some aspects of globalization—such as the growing global interconnectedness stemming from the information technology (IT) revolution—**almost certainly will** be irreversible (2025).

In the example above, the producers interrupted the discourse flow with a parenthetical code gloss (i.e. 'such as the growing global interconnectedness') that tied the proposition to a current trend. It should be noted that the modal phrase (i.e. 'almost certainly') was coded as an expression of relative certainty. Had the producers simply used 'will' to indicate futurity then the construction would have been coded as a categorical certainty. However, the presence of 'almost certainly' qualified the utterance such that the full epistemic warrant was compromised. Even if the construction had omitted the approximator 'almost' so as to read 'certainly will', the presence of the adverb would have been taken as having comprised the full epistemic warrant of the proposition. As already explained above, any qualification of the tropic component was taken as a derogation from the epistemic warrant involved in a categorical statement. In other words, 'there is no epistemically stronger statement than a categorical assertion' (Lyons, 1977: 809).

In other places, the discourse openly recognised the fact that technology can indeed be conditioned by social forces. For example:

(16)

Nations that remain behind in adopting technologies **are likely** to be those that have failed to pursue policies that support application of new technologies—such as good governance, universal education, and market reforms—and not solely because they are poor (2020).

In the example above, it is possible to infer that certain aspects of technology (i.e. adoption) do indeed rely on contextual circumstances for success (i.e. technology is not an autonomous, independent, predestined force). The parenthetical code gloss in the example above (i.e. 'such as

good governance, universal education, and market reforms') served to bolster the sense of certainty conveyed by providing examples of policies that omnitemporally support successful adoption. In the following passage recognition was given to the (albeit, low) possibility of public interference in the non-industrial application of intelligent robots:

(17)

The public's reaction also **could** affect the development of nonindustrial robotics (2030).

Discourse concerned with the technological imperative appeared to express contradictory positions. On the one hand, interference in the technological domain was presented as fruitless (i.e. technology is beyond societal control); on the other hand, recognition was given to external stifling forces that can be brought to bear on technology (i.e. technology can be subject to societal control). In the final instance, ideology is an invitation to simply feel a certain way about a certain phenomenon (Žižek, 2002: 24; Smelser, 2010: 89). Furthermore, ideology is particularly potent when representations which at first sight contradict each other, start to function as arguments in favour of the same ideological position. I would argue that the two strands of discourse identified in the data functioned in favour of the same techno-optimist ideological position. The majority of the discourse, expressed with the highest epistemic warrant, presented social intervention as undesirable. In alternative strands of discourse, recognition was given, albeit with a low epistemic warrant, to the negative impact of possible social obstruction. Both strands of discourse invited the readers to feel negative about the prospect of future social intervention. The best a government can do is to enable felicitous conditions for technological progress, after which the technological domain should be left unmolested. Such representations serve to delegitimise public concern in regards to the realm of technology (Tollefson, 2014), and through premeditation (Grusin, 2004) help ensure that undesirable outcomes do not happen.

Conclusion

The first research question of the present paper was to explore the presence of techno-optimism in discourse concerned with the future and technology. As can be seen from the discussion above, the producers of the NIC expressed a pronouncedly techno-optimist position in discourse concerned with the future and technology. In the discussion of security issues, the producers disclosed themselves as firmly attached to the idea of military dominance as a guarantor of global peace. The discourse concerned with new security threats was less techno-optimist than other issues, although ultimately pointed to technological solutions (e.g. surveillance). In terms of the economy, continued economic growth was placed beyond question. The producers focused on the economic benefits gained by technological innovations. Issues such as environmental degradation and species extinction were largely overlooked. In terms of the technological imperative, the producers took a pronouncedly techno-optimist stance in that technology was presented as an inevitable force free from societal censorship. As used here, the concept of Techno-optimism was not intended to give rise to a dismissive label that operates to censor or silence discourse containing a positive view of technology in overcoming the problems of humanity. Indeed, it may be perfectly acceptable to hold an optimistic view in certain regards. My main concern, however, is that an excess of techno-optimism is undesirable if not dangerous. From Malthus to The Club of Rome, naysayers and doomsday prophets have played a crucial role in raising awareness of future problems and gaps in thinking ignored by the consensual centre.

The second and third research questions concerned the expression of propositional certainty in representations of the future and technology. As already stated, the producers expressed a high degree of propositional certainty throughout the discourse. Indeed, 80.5% of all propositions were expressed with categorical or relative certainty. In other words, the future was largely presented as a

closed inevitability and, in a typical modernist vein, as something that can be known (Heller, 1999:3). This meant that many of the ideas presented by the producers (e.g. military dominance will ensure global peace) were not opened up for debate despite the fact that the 'future imagined in sociotechnical discourse is totally human' (Pellegrino, 2015: 224). Interestingly, epistemic possibility was often used to promote preferential futures (e.g. the potential for great rewards arising from technological adoption), and to warn against disfavoured action (e.g. economic stagnation arising from non-adoption). According to Taleb, 'when we think of tomorrow we just project it as another yesterday' (2007: 193). In order to deal with the inherent uncertainty of the future, the past and present were constantly called upon by the producers (characteristic of modernist futurological discourse: Alessandrini, 2003). Indeed, the technologised future presented by the NIC was largely an extension of today and yesterday. This significantly closed down space within the discourse for imaginative discussion of reform or change to existing arrangements (Polak: 1973: 142).

Two important avenues of research arise out of the present paper. In order to identify modal types, a rebuttable presumption was upheld in which the syntactical placement of an item determined its subjective/objective status: if an item was embedded within a propositional nucleus, it was assumed to disclose objective modality. Future research could, therefore, be conducted with the producers of futurological discourse in order to understand the relationship between certain forms (e.g. modal verbs) and subjective/objective modality. The present research was also mute as to claimed or observed reactions of consumers with regards to the expression of propositional certainty in futurological discourse. Research could, therefore, be conducted into the reception of such expressions by consumers of such discourse.

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