Making An Impact: Supporting Effective Decision-Making in the Information Environment

Neill Bo Finlayson,* Aiden Hoyle, Charley Bosman, Chelsea Exel, Arnoud de Jong
TNO (The Netherlands Organisation for Applied Scientific Research) THE NETHERLANDS

*neill_bo.finlayson@tno.nl

ABSTRACT

The growth of artificial intelligence (AI) capabilities has ushered in a new era of human-machine collaboration. In particular, the potential of using AI-powered automated technology to support decision-making at all levels of warfare is becoming an ever-closer reality. However, for the planning and execution of operations in the information environment, the sensitivity and human- centric focus of these operations means it can be particularly important to maintain human decision-making at the core. The aim of the paper is to demonstrate how AI-powered semi- automated analysis tools can support human decision-making by effectively analysing data and suggesting possible decision options. This paper presents a semi-automated decision support tool for information-related activities (IMPACT) that harnesses the use of AI in an optimal manner while ensuring humans maintain meaningful control of decisions. Using IMPACT as a tangible example, this paper argues that while there is room for more AI-powered tools to help support decision-making in planning operations in the information environment, a balance needs to be struck with human cognition. The analysis and examples presented in this paper shows how such a balance can be struck to ensure humans remain at the heart of decision-making.

1.0 INTRODUCTION

The explosive growth of possibilities within artificial intelligence (AI) is ushering in a new era of human-machine collaboration. Across many different sectors of everyday life, AI is making significant progress, including "narrower" AI systems being deployed to make predictions and support decision-making with success in non-military domains, such as in the commercial sector [1], healthcare [2], and education [3]. For the military, using artificial intelligence and automated decision-making has been an accelerating topic of discourse across the last decade. Indeed, there has been a rapid growth of opportunities for AI technology to supplement human decision-making at all levels of warfare [4]. This drive has been reflected in recent doctrines that have acknowledged this rising implementation, specifically in the operational environment [5].

1.1 Literature Review

The promise of AI-powered technology to bolster command-and-control (C2) decision-making processes within the information domain has been particularly highlighted in recent years [6]. Indeed, AI-enabled capabilities have been touted as able to significantly enhance the potential of forces to effectively operate in the information environment. For example, machine-learning tools that can process and analyse large volumes of data quickly can help decision-makers observe and orient more efficiently and accurately. Moreover, there are possibilities for machine-learning algorithms to identify patterns in data that might be too subtle or complex for human analysts to detect, potentially enhancing intelligence gathering by providing new insights that improve situational awareness and anticipation of an adversary's actions [7]. For instance, it can provide a more comprehensive and up-to-date picture of the battlefield than humans through a greater ability to process and integrate data from various sources. It can even be used to suggest optimal courses of action, which is particularly useful in conflict scenarios where quick and precise decisions in the information environment are critical [8].

While the promise of emerging AI technologies has been appealing to militaries, several voices have also urged for caution. James Johnson, for example, argues for a cautious and balanced approach to integrating AI in the military domain, emphasising the need for AI to complement, rather than replace, human judgment and decision-making: “military decision-making is different as it is non-linear, complex, and occurs in uncertain environments. In C2 decision-making, commanders’ intentions, the rules of law and engagement, and ethical and moral leadership are critical to effective and safe decision-making in the application of military force” [9]. Johnson’s caution broaches a larger discussion of ‘meaningful human control’ within the field of AI ethics, which scrutinises the increasingly autonomous nature of machines in our everyday life, and posits that development of such technology should not come at the expense of human oversight. This is particularly so for fully-automated systems, such as autonomous vehicles or robots, that are fully capable of operating independently without human intervention.

Yet, increasingly, this discourse is focusing on the ethics of deploying AI-powered technologies in military settings. Recent examples, such as the Israeli deployment of AI to identify Hamas targets in the war on Gaza [10] or the use of autonomous drones by the US military in conflict zones [11], have pushed important ethical and moral questions to the forefront regarding the tension between developing efficient and useful AI technology and retaining human accountability in morally complex situations [12]. Artificial intelligence technologies are often viewed as “devoid of a social dimension” [13]. Indeed, how far can we responsibly embed AI in military decision-making for complex conflict situations with potentially significant civilian impact? In the information environment, targeting human audiences requires decision- making grounded in values, ethics, and a nuanced understanding of human nature and psychosocial dynamics. Removing humans from these decisions poses the risk of neglecting these vital aspects, which can result in the dehumanisation of intended audiences.

For the planning and execution of operations in the information environment, the sensitivity and human-centric focus of these operations means it can be particularly important to maintain human decision- making at the core. On a broader level, the embedding of AI-powered technologies poses strategic and ethical dilemmas. Current knowledge of automation bias, for example, might point to the potential danger of intelligence staff becoming overly reliant on machine decision-making. AI-powered technologies cannot understand the emotional impact of certain suggested decisions on audiences targeted by the operations, and will likely fail to adequately address the ethical dilemmas that may be posed by certain recommendations. Johnson suggests that “policymakers risk being blind-sided by the potential tactical utility – where speed, scale, precision, and lethality coalesce to improve situational awareness – offered by AI-augmented capabilities, without sufficient regard for the potential strategic implications of artificially imposing non-human agents on the fundamentally human endeavour of warfare” [9].

Yet on a more specific level, AI technology might struggle with tasks that are not routine and without clear parameters. Human qualities such as experience, flexibility, creativity, and empathy are crucial for effective decision-making - these are qualities that an AI-based system lacks. Difficulties in the utilisation of AI in the information domain have been demonstrated by, for example, research gauging Iranian citizens’ sentiments towards the Iranian elections. Although the automated analysis of social media was seen as promising for “assessing public opinion or outreach efforts and forecasting events such as large-scale protests”, the authors also highlighted problems with AI technologies accurately interpreting text within the context of the exercise, and the necessity of maintaining human supervision [14]. Again, James Johnson highlights that “because these quantitative models are isolated from the broader external strategic environment of probabilities rather than axiomatic certainties characterised by Boyd’s “orientation,” human intervention remains critical to avoid distant analytical abstraction and causal deterministic predictions during the non-linear chaotic war” [9].

There are also technical limitations associated with current AI technology that present pitfalls in their applicability in decision-making processes. At present, AI technologies exist at different levels of maturity, with many uses of AI still in infancy. Analyses such as aspect sentiment analysis are relatively robust compared to an AI-powered chat agent that is fully integrated into all steps of a decision-making process. This is because AI tasks relating to reasoning – be it mathematical, logical or causal – are still in early development and concerns have been raised over the risk of increased hallucinations (i.e. false or misleading results generated by AI models) [15]. As such, more research and experience is required before such AI functions can be fully integrated into decision-making systems. That is not to say, however, that simpler, more robust information analyses, like sentiment analysis, cannot play an important role in supporting decision-making.

For this reason, semi-autonomy – the combination of human and machine actions, with both elements typically coordinated by a computer system – can be a more realistic and ethically preferable option for military contexts. The desire here is that semi-autonomous systems develop to efficiently support human operators, so that this collaboration can outperform either system alone. Vold discusses how human and AI systems can become so closely integrated that they eventually work in symbiosis to effectively solve problems. Vold argues that viewing AI in this way "compels us to focus more on AI systems that are built to be more human-centred, rather than autonomous AI systems, which aim to be human-like." [16] Semi-autonomy can be particularly effective for operating in the information environment, whereby humans can retain control over determining which data about a society might be relevant and how it should be processed. In this way, selection and prioritisation should remain a human-centred task. AI can support in effectively analysing this data and suggesting possible decisions, but humans should ultimately decide on the significance of these findings.

1.2 Aim of the Paper

The aim of the paper is to demonstrate exactly this. While there is room for greater AI-power in planning and decision-making for operations in the information environment, a balance needs to be struck. This paper presents a semi-automated decision support tool for information-related activities, called IMPACT, that harnesses the use of AI in an optimal manner, while ensuring that meaningful human control remains central to decision-making. The tool will be described both conceptually and practically, using a proof-of- concept demonstrator and applying this to a scenario.

It is important to note that the scope of this paper extends only to information-related activities. That is, this paper only concerns activities or interventions that are implemented in the information environment, whether through virtual or physical means, all with the purpose of achieving effects in the cognitive dimension. Furthermore, this paper strictly focus on the tactical level of military planning and is not concerned here with the operational or strategic level of warfare. However, the importance of these processes to decision-making at the tactical level is acknowledged. There are further intricacies in the terminology used in this paper. It is noted that planning teams specifically for information activities do not exist; however, information-related planners are part of the broader planning team. Therefore, the term 'planners' or 'planning team' in this paper, refers specifically and only to those involved in information manoeuvre planning. Finally, it is important to state that the purpose of this paper is to provide a snapshot of ongoing research and development by TNO. The proof-of-concept demonstrator described in this paper, IMPACT, remains a work in progress and is due to be completed before the end of 2025.

2.0 DECISION-MAKING IN THE INFORMATION ENVIRONMENT

Before delving into the details of the proposed decision support tool, it is first important to get a grasp of the context in which this tool has been developed. The research in this paper has been conducted under a wider research programme in TNO, titled "Effective and proactive operations in a dynamic information environment", which primarily relates to the military concept of information manoeuvre in the Netherlands. The following sections describe this concept more fully, as well as the military decision- making process in the Netherlands which provides the foundational structure of this paper and the tool.

2.1 The Concept of Information Manoeuvre

The context of this research paper is grounded in the exploration and examination of the Dutch military concept of 'information manoeuvre'. The concept captures the use of information by military forces to gain a competitive edge in operations [17]. By better understanding and controlling the information environment, defence forces can better influence perceptions of target populations, disrupt adversaries, and protect their own interests. In this way, information manoeuvre complements traditional military tactics by operating in both the physical and digital domains. The concept of information manoeuvre was first used publicly in UK army doctrine in 2019, but has since become absorbed by the Netherlands [18]. Other militaries, such as Germany, France, or the US, have similar concepts of information as a weapon in their doctrines but do not use the terminology of information manoeuvre. For instance, the German Army views this concept of information as part of its cyber operations [19]. Indeed, there is no established doctrine on information manoeuvre meaning that the conceptual boundaries are still disputed with other different doctrinal and conceptual perspectives that bear similarities [20]. An example of this is 'cognitive warfare', which is defined by NATO [21] as "activities conducted in synchronisation with other instruments of power, to affect attitudes and behaviours by influencing, protecting, and/or disrupting individual and group cognitions to gain an advantage".

Similarly, the purpose of information manoeuvre, at its core, is to achieve relative competitive advantage over the adversary by generating effects to influence the audience's perceptions, attitudes and ultimately, behaviour [22]; [23]. According to Dutch doctrine, for an action to be classified as a contribution to information manoeuvre, the action must take place in the information environment [20]. This includes all forms of storage and transmission of data and information, both physical and digital [22]. The information environment itself is part of the wider operating environment and consists of three interrelated dimensions where effects are categorised: physical, virtual and cognitive. Physical and virtual activities related to information manoeuvre are conducted in the physical and virtual environments but the desired effect – to influence attitudes, perceptions and behaviours - lies in the cognitive dimension. Thus, the goal of information manoeuvre is to influence human attitudes and perceptions (the cognitive dimension), in order to induce changes in behaviours or decision-making in the operating environment, by conducting activities in the information environment. From here on, the term information manoeuvre will be used to describe the function responsible for planning and implementing activities in the information environment.

The true value of information manoeuvre as an operational concept is what it offers in the synchronisation and cross-synergy of information-related capabilities. Information manoeuvre can be interpreted as: "an overarching concept exploiting synergy existing between different capabilities such as Command, Control, Communications, Computers & Information (C4I), CEMA, Communication and Engagement (including PsyOps, StratCom, Military Public Affairs and Info Ops), Data Science and Artificial Intelligence Robotics (DSAIR), and Intelligence" [20]. However, owing to the novelty of the concept of information manoeuvre, there is a need for a greater understanding of how best to plan and synchronise operations across these capabilities effectively within the information environment. In particular, how can operations in the information environment make the best use of technological advancements such as artificial intelligence? Before answering this, however, it is first important to understand how decisions are made in the information environment.

2.2 Tactical Planning Process

To ensure any decision-making support tool is relevant and fit for military use at the tactical level, it should correspond with existing military decision-making processes. As such, the development of the decision support tool was structured around the Tactical Planning for Land Forces[1] (TPLF), a decision- making model used within the Dutch military at the tactical level. The TPLF consists of three phases: understanding the

[1] The TPLF recently replaced the Tactical Decision Model [*Tactisch Besluitvormings- Model*] (TBM) in the Dutch military which bears close similarities and is still based on the same 'understanding', 'judgement', 'decide' process.

situation; development of courses-of-actions; and communication (commander's decision and orders production) [24]. For ease, this paper will refer to these phases as understanding, judgement and decision.
The TPLF was developed to enable the transition of decision-making from the operational to the tactical level. At the tactical level, the primary goal for commanders is to formulate 'how' an assignment can be best implemented with the available resources – in essence, translating desired effects into military tasks that contribute to achieving supporting effects and ultimately the desired end state. As such, the tactical level requires a specific decision-making model that is tailored to the given environment. Therefore, a comprehensive and up-to-date understanding of the environment is of the utmost importance.

As stated, the TPLF focuses on three phases [24]. The first phase, understanding, requires forming an image of the specific aspects of the environment in which the assignment is to be carried out, which will contribute to situational awareness. Then, the judgement phase, based on the current image that has been built in the understanding phase, requires consideration of methods and means with which one can carry out the assignment. These methods and means are combined in potential courses of action. Only then can a decision be made, in the decision phase, over which chosen course of action has the greatest chance of success. This three-phase process forms the foundational structure of the proposed decision support tool.

According to Ijntema and van de Haar [25], decision-making is primarily a matter for the commander and their active involvement is an absolute necessity throughout the process. Poor decision-making in the planning process requires even stronger commander involvement in the execution, and vice versa. Therefore, a military decision-making model for planning activities, such as the TPLF, must make this a central concern. However, this is especially challenging when operating in the information environment. Decision-making in the information environment must account for many more actors than just the opponents and is impacted not just by the terrain or weather, for example, but by an infinite number of factors across the physical, virtual and cognitive dimensions. Understandably, this presents a number of challenges for planners, especially in the understanding and judgement phases of the TPLF process.

2.3 Challenges in the Understanding Phase

The main challenge in the understanding phase of the TPLF is ensuring that the information gained or provided by intelligence is easily accessible and comprehensible for the planners. For information manoeuvre, the understanding phase of the planning process is comprised of aspects of the 'Three Dimensions Intelligence Preparation of the Operational Environment (3D-IPOE)', a framework developed by the Dutch defence to analyse the operational environment[2]. The 3D-IPOE focuses on evaluating the environment, and the actors operating in this environment, across the physical, virtual, and cognitive dimensions using an array of different frameworks [26]. PMESSII-ASCOPE[3] 3D, for example, is used to explicate an array of factors about the operational environment, such as political, social and infrastructural factors, through different comprising elements, including actors, structures, and capabilities. In the 3D-IPOE, the original framework was expanded across the three dimensions. The output of the 3D-IPOE can therefore be comprehensive and navigating through such information packages can be costly in terms of time and cognition.

Additionally, to evaluate actors in the environment, the MICAV[4]-3D and FRIS[5]-3D frameworks are utilised to evaluate the actor, including their operational capacities and behaviours. These frameworks focus on analysing the more psychological aspects of (irregular) actors, including their motivations and intentions, and

[2] Please note that the 3D-IPOE, published in 2023, is an experimental concept within the Dutch military, based on a study, and therefore it has not yet been rolled out.

[3] PMESSII: political, military, economic, social, information, infrastructure; ASCOPE: areas, structure, capabilities, organisation, people, events.

[4] MICAV: motivation, intentions, capabilities, activities, vulnerabilities.

[5] FRIS: funding, recruitment, information support.

how they manage and recruit group members. Next to this, cultural psychological concepts such as 'The Culture Map', *EMIC Logic*, and Strategic Empathy are discussed as important additional analysis tools. For this paper, however, the GLICCS[6] framework is adopted in favour of these models. GLICCS is a broad framework, developed by TNO [27]; [28], to enhance target audience analysis by organising different psychological, social, and organisational factors into a structured model that is tiered according to abstraction and importance. In this, GLICCS incorporates the aspects outlined by the MICAV-3D and FRIS-3D models, while offering the potential for further development through other relevant and related factors. Nevertheless, despite being more streamlined, the output of the GLICCS can still be vast, much like the 3D-IPOE. Again, this causes issues over comprehension for planners who need to swiftly and efficiently navigate through the information.

2.4 Challenges in the Judgement Phase

Decisions regarding the selection of which intervention best fits a particular situation and desired effect is one that inherently requires human judgement. After all, these judgements are non-linear and require nuanced consideration of intentions, the rules of engagement, ethics and effects [9]. This is currently how it is done in military planning. However, as discussed, human cognition is limited when it comes to processing and analysing the current information environment. This means that currently planners naturally face difficulties when attempting to make decisions about actions in the information environment.

The first main problem is the sheer volume of information that needs to be analysed when formulating possible interventions. When it comes to processing vast swathes of data to develop information-based activities, are humans able to accurately and comprehensively analyse the environment and assess relevant intervention options? For instance, measuring the sentiment of a particular group online is nigh impossible when relying on human cognition alone because the amount of data that is required to analyse is too great. Without the use of semi-automated analytical tools, such as sentiment analysis, one is left to rely on broad assumptions, based on intuition and experience, which may be prone to biases. Yet, understanding the sentiment of said group is pivotal to how one then decides to intervene to influence that group. Furthermore, monitoring the information environment on a continual ongoing basis is also vital to help measure whether effects are taking hold or to track changes in the environment. Again, humans are unable to process and monitor this kind of information, on this scale and at this speed to the degree of accuracy that is required for military operations.

Another current challenge in the judgement phase relates to the synchronisation and integration of different capabilities that can produce effects in the effect dimensions. A core purpose of information manoeuvre is to provide greater synergy not only between information-based capabilities, such as C&E and cyber, but also with conventional interventions [20]. If human cognition is relied upon to fully and adequately assess all the relevant capabilities under information manoeuvre, is it certain that all options have been appropriately assessed? And is it certain that any decision is free from human bias? There is a risk that, because military functions and capabilities have hitherto been rather siloed, planners do not always take into account the potential of different capabilities to achieve the same effect. Furthermore, it is often difficult to account for, or model, the impact of 'waterbed' or unintended second-order effects that arise when implementing various different interventions. This relates to a final challenge in the judgement phase: how to adequately visualise or represent information-based interventions and effects so as to be understood easily by a non-expert in the information domain, such as a mission commander.

Considering these challenges, Section 3 below describes the proposed decision support tool based on the structure of the TPLF phases – understanding, judgement and decision. The tool is designed to harness the power of AI-supported analyses and processes to better support and guide a planning team and the commander in making decisions in the information environment and to better integrate information activities into its wider decision-making on courses of action.

[6] GLICCS: group, leadership, individual, culture, communications, society.

3.0 THE INFORMATION MANOEUVRE PLANNING AND COORDINATION TOOL (IMPACT)

It is evident that planners and decision-makers face a number of challenges when relying on their own human cognition while operating in the information environment. In light of these concerns, this paper sets forth the Information Manoeuvre Planning and Coordination Tool (IMPACT). As previously discussed, the ability of machine-learning tools to process and analyse vast volumes of data and identify patterns that are too complex for human analysts to detect offers the potential to improve not only intelligence gathering and situational awareness, but the entire planning process [7]. IMPACT thus aims to strike a balance between meaningful human control and automation in designing activities in the information environment. The tool is structured according to the TPLF, outlined above, to ensure that it aligns closely with current military decision-making practices. As such, the following sections describe the conceptual underpinnings of the proposed tool in order of the understanding, judgement and decision phases.

3.1 Understanding Phase

As stated, a comprehensive and up-to-date understanding of the operational environment is foundational to any decision-making process, such as the TPLF. Here, planners must form an image of the environment with regard to the objective and convert this general awareness into a situational awareness [25]. As discussed, however, the 3D-IPOE and GLICCS are comprehensive frameworks with a variety of different factors and concepts for intelligence staff to consider in their preparation. Automated tools can therefore be used to better support humans in the understanding phase, which is essential to building and maintaining awareness of the operational environment.

Indeed, the aim of IMPACT is to help alleviate that challenges outlined above that humans may face when implementing the understanding phase. The main challenge being how to reduce time and energy in accessing and navigating through the vast amount of information provided intelligence. As such, IMPACT incorporates a pre-trained agent chatbot that can be used as a search function when sifting through large intelligence documents or that can assist planners in prioritising the most important pieces of information for a given mission. Another example is the PMESSI classifier, which aids analysts in identifying relevant sources for each of the different PMESSI factors, discussed above, by examining each message processed through the pipeline to determine the factor to which it relates [28]. The benefit of these AI-powered tools is that the prioritisation and understanding of intelligence becomes semi-automated, and thereby quicker.

However, human intuition is still needed. In the understanding phase, certain triggers can be identified which can help monitor and understand relevant changes in the operational environment. The prioritisation of these triggers and the identification of the most relevant cognitive, virtual and physical factors should be done with human insight. The mission objective and environment should be scrutinised using relevant frameworks, such as PMESSI or GLICCS. Likewise, human cognition and creativity is also required to generate the output of the understanding phase; that is when the results of the understanding phase are communicated to the planning team to carry on with the judgement phase. Of course, this is only in accordance with the strict process of the TPLF; in reality, the understanding phase is never finalised and is a continuous, ongoing process.

3.2 Judgement Phase

Based on the initial understanding of the environment, the judgement phase involves the development of the methods and means with which to achieve the desired effects and ultimately fulfil the assignment. Essentially, this is the confluence of situational awareness and operational planning – what effects can be achieved to change the current state into the desired state? This melding of understanding and action relies heavily on human judgement, experience and intuition within the planning team of any given military operation. However, given the shortcomings of human cognition outlined above, this comes with certain challenges when operating in the information environment.

IMPACT therefore offers a solution to these problems by providing a more structured decision-making process using semi-automatic analytical tools. The purpose of employing analytical tools in IMPACT is to ensure that the information environment can be adequately and efficiently analysed – something which human cognition alone cannot achieve. Furthermore, the purpose of providing a more structured approach to intervention development and comparison is to ensure that different capabilities can be considered in the decision-making process which may achieve the same effects without the influence of human bias. Finally, IMPACT seeks to remedy the challenges associated with the visualisation and communication of the judgement phase, outlined above, by combining all these elements into one interactive diagram where variables, actors and interventions can be mapped.

However, to design such a tool, first, a database was created incorporating information-based interventions that would ordinarily fall under the umbrella of information manoeuvre. This comprehensive, but not exhaustive, database of interventions was collated from relevant literature on information operations and related fields [29]; [30]; [31]; [32]. The interventions database was structured according to how each intervention related to NATO's defined list of desired effects for operating in the information environment [33]. For example, the desired effect of 'manipulation' has a different corresponding set of possible interventions than the desired effect of 'assure'. An important feature of the interventions database is that it attempts to incorporate the most relevant information-related intervention options that fall under the information manoeuvre umbrella, which includes not just Communication and Engagement (C&E) capabilities but also cyber capabilities [32].

Cyber operations are defined as the use of "specifically designed or configured software to directly affect the confidentiality, integrity or availability or digital data or applications" to achieve desired effects through cyberspace [34]. As described by Gouweleeuw, the effects achieved by cyber operations are generally intermediate effects [34]. This conceptualisation is applied to IMPACT whereby cyber operations are considered only as enabling, supporting and contributing means to achieve the wider desired effects. This allows for the tool to offer an understanding of how cyber operations can act as an intermediary for C&E effects, all to achieve broader desired effects.

3.2.1 Effects Mapping

The number of factors, information, actors, effects and intervention options that one needs to decide upon when operating in the information environment is enormous. Therefore, the proposed tool centres around an effect mapping function to bring all of these elements together into one dynamic model. The effect mapping function resembles dynamic causal relations modelling techniques developed by TNO [36] and closely aligns with the work of the EU Horizon VIGILANT project (soon to be published) [37] in modelling the effects of interventions designed to mitigate disinformation. This type of causal relations modelling can help not only stimulate thinking about effects and interventions, but it helps to structure, understand and visualise complex problems, such as organised crime [38] or the impact of the COVID-19 pandemic [39]. By applying this type of causal relations modelling to the military domain, and more specifically information manoeuvre, it can allow planners and decision-makers to gain a more comprehensive and dynamic overview of their intelligence, intervention options, and potential effects in the information environment – a notoriously difficult environment in which to comprehend and visualise[7].

As such, for the decision support tool proposed in this paper, a qualitative effects mapping function was developed. This effect mapping function works as a kind of 'sandbox' in which information manoeuvre planners can map potential intervention options and assess their relations to key variables in the mission situation. In essence, it is a dynamic causal relations model that represents the situational awareness of a given mission (developed from the understanding phase) upon which intervention options and effects (developed in the judgement phase) can be mapped. It also contains, although not explicitly, a representation

[7] As discovered during expert interviews conducted by the authors.

of the 3D-IPOE factor integration process; the plotting of the effects map is a visual representation of the opponents' centres of gravity and high-value targets, while the plotting of interventions allows for an analysis of potential most likely or most dangerous outcomes.

The process of plotting interventions and effects in the effect map is the role of planners. However, before that, variables representing all the key factors and actors of the operating environment should be plotted in the effects map to represent a baseline of the mission environment. This should be provided by the intelligence team as an output of the intelligence preparation of the operating environment (IPOE). Once the baseline environment variables are mapped, then the planners can begin plotting their interventions and effects. Section 4 below, scenario demonstration, provides more details of this process.

3.2.2 Intervention Selection

There are a multitude of capabilities that fall under information manoeuvre. As such, the decision support tool aims to help filter these options based on hard and soft (or fixed and flexible) constraints. The first, and most important filter, is the desired effect that the mission seeks to achieve. Depending on these effects, intervention options can then be filtered based on constraints such as preparation time, audience type and level of conflict, for example. The parameters used for intervention filtering were selected based on literature, as well as interviews with relevant military planning experts, and refined through workshops within the research team. To make this filtering process slick, a simple decision tree was then designed to help navigate through this filtering process. This decision tree was designed using intuition, albeit the process was inspired by similar support tools for strategic planning[8] developed by military partners.

3.2.3 Intervention Development

After an initial filtering, intervention options need to be refined further according to more specific situational conditions or constraints. Such specifications include, for example, the demographics and make-up of the intended audience; the cognitive mechanism that the intervention should aim to exploit; or the channel in which the intervention is implemented. These more detailed parameters are based on the prior work by TNO [34]. This research provides a link between theory from the behavioural, cognitive and communication science to the actual implementation of information activities in the real world. For instance, Hof et al. [34] developed a "Battle of Perceptions" framework for information activities which specified the key components of an information activity: goals, source (sender), audience (target), manipulation (message), medium (channel), tools and technology. All of these components were incorporated as parameters within the interventions database, discussed above, as part of the intervention development phase to provide greater, more nuanced refinement of the given intervention.

This process of intervention refinement demands dynamic interaction between intelligence and planning teams - the refinement of an intervention depends on a deeper understanding of the given mission situation and any mitigating circumstances. As such, the intelligence provided to information manoeuvre planners and decision-makers should be easily accessible and understood. This is something that AI tools can help with. As discussed in the understanding phase above, a pre-trained agent chatbot has been incorporated into IMPACT which can also help with intervention development. When working through the intervention development step, the planners can use this chatbot tool to offer suggestions for interventions or intelligence that planners may have missed or not deemed relevant based on their own intuition. Therefore, AI tools can help mitigate any human blind spots in deciphering intelligence, while simultaneously helping to design intervention options.

[8] For e.g., the TOPFAS (Tool for Operational Planning, Force Activation and Simulation) tool which is a data and planning support system developed by NATO for operational planning and force activation.

3.2.4 Live Monitoring

Mapping variables, interventions and effects may be useful to get a snapshot of a given mission situation. However, decision-making in the field is rather more dynamic. As Ijntema and van de Haar [24] outline, decision-making does not start when an order is received, nor does it end when a decision is made; decision-making is a continuous process that requires an ongoing investigation of the operating environment. This can essentially be described as monitoring: the construction and subsequent maintenance of general and situational awareness. An array of AI-supported analyses exist that can support this. Such tools include narrative analysis, which tracks and compares narrative trends; aspect sentiment analysis, which measures the overall sentiment of texts; and propaganda analysis, which examines language patterns to uncover various propaganda techniques. Such tools can offer efficient and innovative ways of analysing information, moving beyond traditional methods of gathering, analysing and interpreting open-source intelligence that relies heavily on human expertise, and potentially enhancing the decision-making process in a manner close to ‘cognitive teaming’ envisaged by Vold [15].

IMPACT therefore incorporates a selection of analytical tools to assist in analysing the information environment. This is linked to the effects map through performance indicators, which are identified in the understanding phase as key indicators that can be used as a proxy to assess the current state of any given variable in the situation. This indicator can then be monitored using AI-supported analyses, such as aspect sentiment analysis. Other analyses that can be used to monitor indicators in the information environment include narrative analysis, propaganda analysis and moral foundations analysis, as described in prior TNO research [27]. These analytical tools not only provide data to support planners’ decision-making, but they also allow for live monitoring of any potential effects or changes in the environment. In this way, the AI toolbox can also help update or fill in the gaps in the intelligence package. Details of how these monitoring tools operate are described in Section 4 below.

3.3 Decide Phase

The final step in the TPLF decision-making process is the decide phase. Put simply, in this phase the commander makes a final assessment of his options and then decides on the course of action. This comprises two steps: the analysis of one’s own possibilities and the decision. In accordance with the TPLF, the analysis of one’s own possibilities requires consideration of how the intervention options can be adjusted to optimise effects and how they interact or influence other actors or actions, in other words, second-order effects. This then culminates in a final assessment of the overall risks and opportunities associated with the interventions. The effects map allows for an immediate and comprehensive understanding of the interventions, their relation to the target variables and how they interact with other actors or interventions. This is where the effects mapping has particular value in allowing for intervention option comparison in that it provides insights into the effects and possible benefits of intervention decision A over intervention decision B. In this way, IMPACT– and its accompanying analyses – aims to fully support this stage of the decide phase.

The final step, the decision, requires only the human cognition of the commander. This is where any semi-automated or AI-assisted analyses must give way to human control, for reasons discussed in the introduction. Up until this point, IMPACT can provide structured, ongoing support to the decision-maker but, ultimately, the decision on how to carry out the assignment rests on the human faculties of the commander.

4.0 SCENARIO DEMONSTRATION

Having described the conceptual underpinnings and basic structure of IMPACT, the following section provides a proof-of-concept practical demonstration of the tool. A mock demonstrator guides the user through various dashboards and software, providing a step-by-step walkthrough of how information manoeuvre planners might use IMPACT in a given mission. A fictitious scenario (see Appendix) was developed for this paper by TNO which described a lifelike situation that an information manoeuvre planner may believably encounter. The scenario outlines a crisis situation in which a German-Netherlands Corps (1GNC) is contributing to a multinational battlegroup to defend ALLIES territory against an adversary nation, Robia. As part of the wider force, a small Dutch battle group, comprising information manoeuvre planners, are tasked with planning information-based activities to achieve the desired effect of manipulating the attitudes of pro-Robian population in Lethovia to reduce support for Robian operations in Lethovia and increase support for the ALLIES force. The full scenario is available in the Appendix.

The information manoeuvre planners (InfoMan) are briefed on the mission and the necessary background on the situation. They then receive the intelligence package, provided by the intelligence team. This represents the situational awareness for the mission, based on the commander's guidance and the corresponding objectives. The intelligence has been carefully prepared and has already been uploaded to IMPACT. The intelligence package consists of an environment evaluation and audience. The environment evaluation (Figure 1) is structured along a prioritised list of factors from the 3D-IPOE, and the audience analysis (Figure 2) provides insight on prioritised factors from the GLICCS framework. These frameworks can be found under the 'Intell' tab in the demonstrator.

The 'Intell' tab contains two sections: *the environment evaluation* and the *audience evaluation*. The *environment evaluation* section presents a cube that illustrates the PMESII ASCOPE framework in three dimensions, the *virtual*, *cognitive*, and *physical*. The cube is organised in a way that each plane represents a dimension for which the PMESII ASCOPE framework is filled in accordingly (Figure 1). Because it contains a lot of information, colours are used to highlight important information relevant to the current particular mission scenario, so it makes it easier for the planning team to quickly find relevant information. For this mission, InfoMan wishes to examine the virtual dimension, specifically the Social (S) component of PMESII and the People (P) component of ASCOPE. The team can navigate to that specific area of the cube to view the relevant corresponding content.

Based on this, the intelligence team provide a visual representation of the information environment, plotting the most relevant key variables and actors under the 'Diagram' tab (Figure 3). The diagram, referred to in this paper as the effects map, represents the operational environment and comprises mission objectives or desired effects; key target variables (identified in the understanding phase) which the mission seeks to affect; and relevant actors. The arrows connecting these nodes represent the causal relationship between the goal objectives, the variables and the actors.

4.1 Intervention Selection Process

InfoMan is now aware of the objectives and key variables that comprise the information environment in which they must operate. The team can now begin selecting and developing interventions that will help them achieve the desired effects. The first step in this process is to select the desired effect (see Figure 4). For this mission, the effect that is selected is "manipulate" as this corresponds with the objective outlined in the scenario.

InfoMan is only interested in interventions that are applicable for the current mission scenario. To this end, they can apply filters based on various criteria, for example, *preparation time*, *target audience type* and *scope*. InfoMan then selects some fixed and flexible filters. Here, the *activity goal* of 'proactive', *preparation time* of 'weeks' and *execution time* of 'days' have been identified as fixed conditions for this mission (left pane of Figure 4). The purpose of fixed and flexible filters is to indicate the severity of this condition for optimising the intervention. For instance, the flexible filter indicates that while the condition of a *preparation time* of 'weeks' is preferred, it is not a necessity. Following the application of the filters, a list of potential interventions is shown. This list presents two suitable interventions (left pane of Figure 4), ordered by their alignment with the specified criteria. The percentage displayed alongside each intervention indicates its degree of compatibility with the specified filters. In the context of the scenario, InfoMan has identified *key leader engagement* and an *online information campaign* as interventions. Once the intervention is selected, InfoMan will proceed to the *intervention development* step.

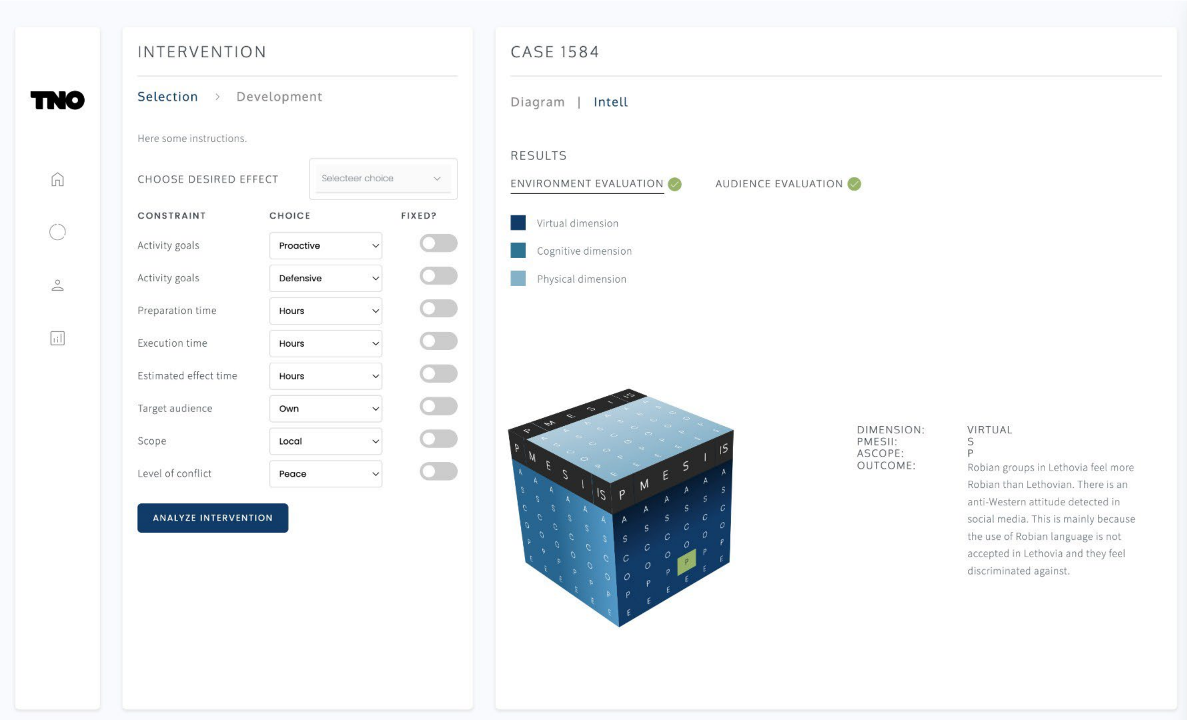

Figure 1: The IMPACT dashboard. Under 'Intell' and 'Environment evaluation' in the right pane, the PMESSI/ASCOPE cube is displayed. The user has selected S from PMESSI and P from ASCOPE in the virtual dimension. The relevant intelligence is displayed on the right under 'outcome'.

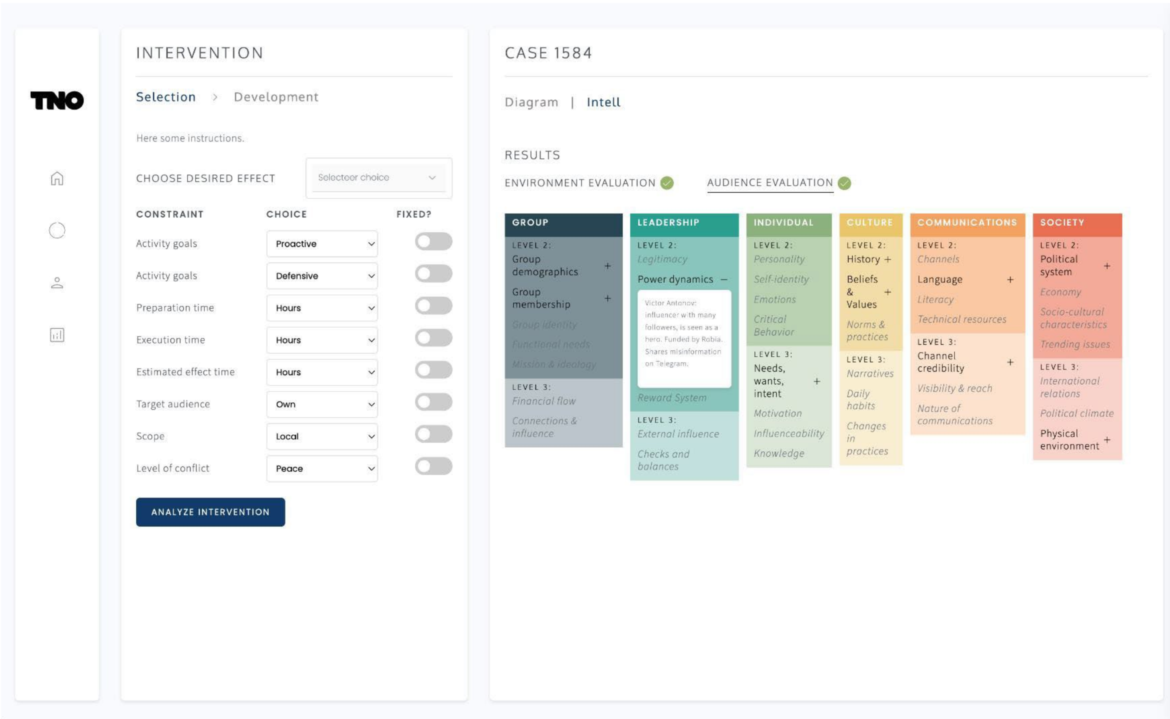

Figure 2: Under 'Audience evaluation' an interactive representation of the GLICCS framework is displayed.

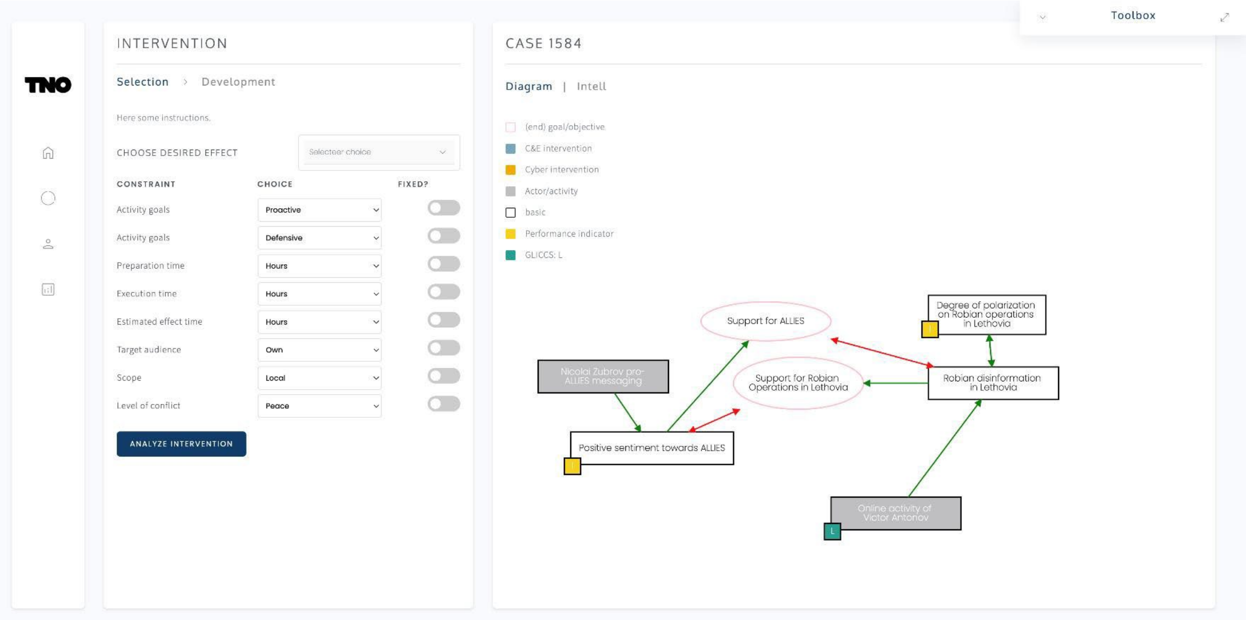

Figure 3: The right pane shows the effects map under 'Diagram' with only the baselines plotted. The left pane displays the intervention selection process.

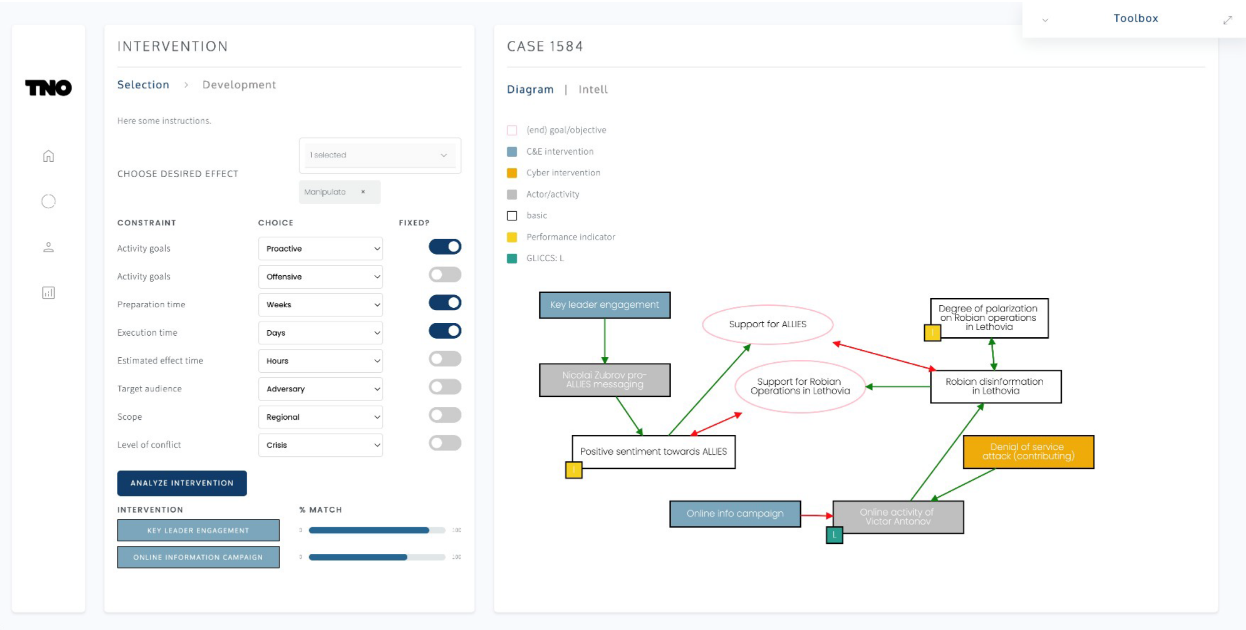

Figure 4: The left pane shows that the intervention selection process has been completed and IMPACT offers two intervention suggestions. These have then been plotted onto the effects map (right).

4.2 Intervention Development Process

As described above, in the intervention development process the intervention will be refined. Specific questions related to the intervention must be answered, and other suggestions for the intervention are provided (Figure 5). For each intervention, InfoMan answers target specification questions on the *target specification*, *capabilities*, *synchronisation* and *indicators*. These questions act as prompts to guide the user in which information from intelligence is most relevant to refine a given intervention. For instance, for *key leader engagement*, questions will prompt the user to analyse and identify potential leaders to engage with for the intervention. In this process, it is important that InfoMan can easily access the intelligence package. In IMPACT, the team can switch easily between the 'Intell' tab and the 'Diagram' tab to refer back to the intelligence package (Figure 1). Here, InfoMan accesses more information, specifically information about the identity of Robian groups in Lethovia which can be used to further refine the details of the *online info campaign* intervention directed at the online activity of pro-Robian political influencer, Victor Antonov.

Upon completion of the intervention development, these interventions are added to the effects map. This allows InfoMan to plot the causal relations between the interventions and the key variables, with the aim of understanding the impact and effects of interventions on the environment variables. InfoMan begins mapping the relations between the interventions and the target variables by drawing arrows. These relations can either be green (positive: an increase in one will result in an increase in the other) or red (negative: an increase in one will result in a decrease in the other). The strength of a relation can also be indicated by the brightness or transparency of the coloured line.

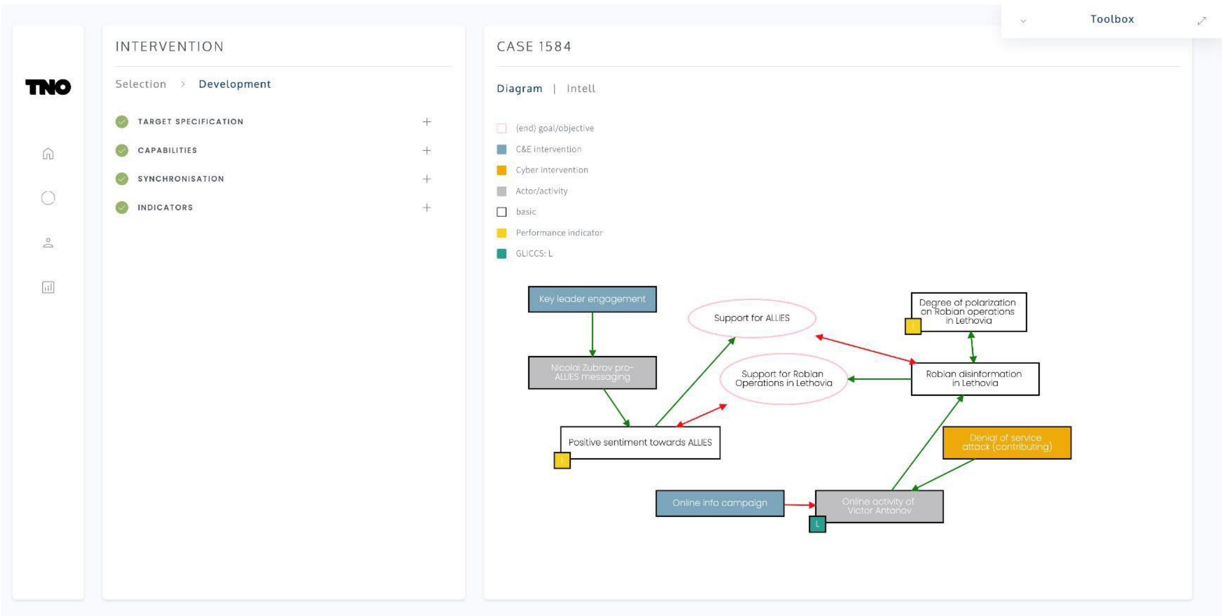

Figure 5: The left pane displays the intervention development process, listing the categories of questions that IMPACT prompts the user to answer in order to refine the interventions options and consider cyber means. As seen in the effects map (right, shown in orange), the user has selected a denial-of-service attack.

For example, in this mission, InfoMan selects and develops an online information campaign intervention and places it on the effects map. They draw a green arrow from the *online info campaign* towards *online activity of Victor Antonov*, as they predict that this intervention, all going well, could have a negative influence on the online activity of pro-Robian political influencer Victor Antonov. InfoMan can tweak and adjust the intervention placement and properties on the effects map, to gain a better understanding of any first- and potential second-order effects of the intervention. Furthermore, the team can determine whether another intervention is needed to support achieving the desired effect. If so, the team can revisit the intervention selection pane, change the filters if necessary, and develop and refine other interventions, which can then be added to the effects map.

4.3 AI Toolbox

InfoMan has access to a large amount of information. IMPACT can assist InfoMan in conducting analyses or finding relevant pieces of intelligence or data at various points in the process using in-built AI- supported analyses and functions in the ‘AI toolbox’ (Figure 6). Such analyses include *propaganda analysis*, *narrative analysis* and *aspect sentiment analysis*, while the toolbox also includes functions such as the *PMESSI classifier*. For this mission, the planning team needs more information on sentiments about ALLIES, and so they initiate an aspect sentiment analysis in the AI toolbox and ask for an overview of sentiments from the last five months. The output of this analysis is then presented on the far-right pane in the form of graphs or charts (Figure 6). This output will also be made accessible via the effects map by clicking the yellow ‘I’ button attached to the *positive sentiment towards ALLIES* variable (Figure 6). This is so data can be handily accessed and displayed for live monitoring of the variables when assessing the effects map, as described in 3.2.4 above. This live data is presented in the form of graphs and tables over time, allowing for a comprehensive understanding of the indicator’s performance. When the planning team clicks on a particular variable within the effects map, they can also see more background information about that particular variable and the piece of intelligence from which it came. For example, if you click on the actor variable of Viktor Antonov’s online activity, you will be presented with live data showing details about his recent online activity.

The chatbot function here can also be used to quickly search the information that is already available, whether it is contained in the intelligence package (i.e. the PMESSI ASCOPE cube) or from prior or ongoing analyses performed by the AI toolbox. The AI toolbox is designed only to assist the user in semi-automatically conducting analyses or to find relevant intelligence information. The human user provides the input thereby maintaining control of what analyses are conducted and what information is prioritised.

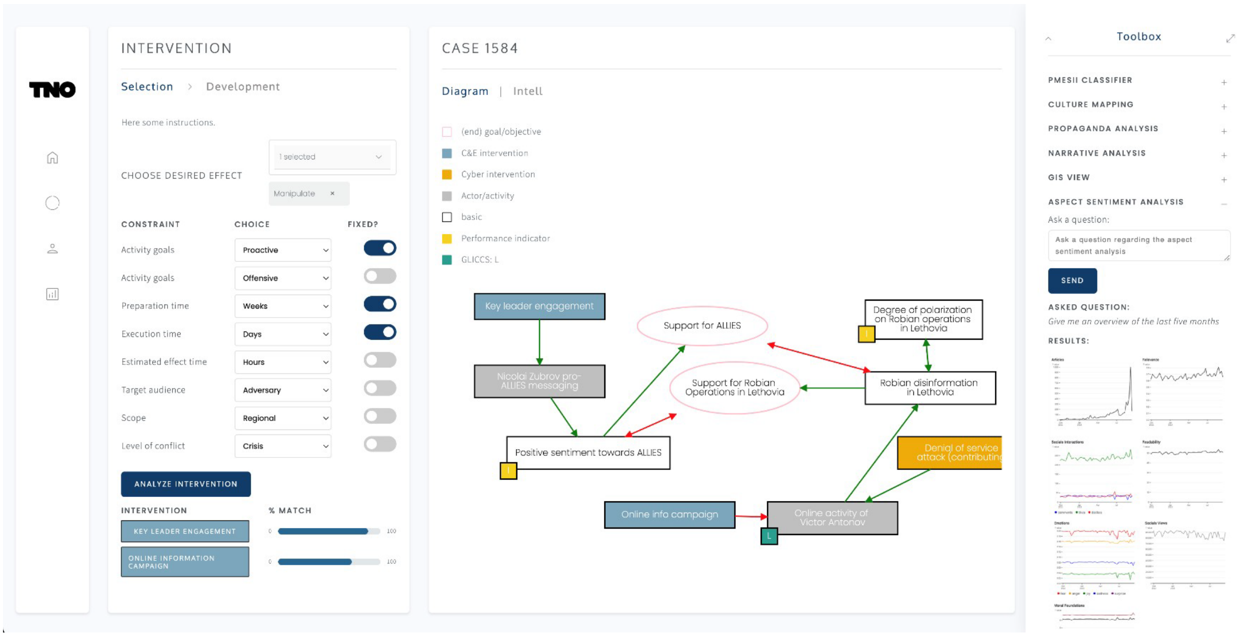

Figure 6: The final effects map including environment variables and possible interventions. In the far-right pane, the AI toolbox is displayed, listing all the possible AI-supported analyses in the tool that can help monitor changes in the environment or provide extra insights on certain variables or actors.

It is important to note that the process of IMPACT, as described in this section, is non-linear. The user is able to move back and forth through the steps in the tool to iteratively construct the diagram and intervention options, dynamically interacting between the intelligence, intervention and effects mapping functions of the dashboard. Each step described above provides the user with more insight which can therefore be used to refine and adapt the selections and previous choices. This allows decision-making to be dynamic and responsive to ongoing changes in the environment, which reflects the non-linear process in real-world military decision-making in the information environment.

5.0 DISCUSSION

The sheer volume and complexity of the current digital ecosystems means it is nigh impossible for humans to accurately and timeously analyse [13]. This presents a significant challenge for military decision- makers operating in the information environment, especially in conflict situations where the consequences are critical [8]. As discussed, automated or AI-supported analyses offer a solution to this problem by providing rapid identification and integration of patterns in data that humans cannot feasibly process. Intelligence gathering, situational awareness and decision-making seek to benefit from this expansion of automation into decision-making [7]. However, this is not without pitfalls. Technology, such as artificial intelligence, is often said to be "devoid of a social dimension" [13]. Therefore, a balance must be struck between harnessing the power of these automated tools and ensuring that human cognition remains at the heart of decision-making. The decision support tool described in this paper aims to help practitioners strike this balance.

5.1 Striking a Balance with IMPACT

Across the various phases of the TPLF, a model adopted by the Dutch military to aid tactical decision-making, there is ample opportunity for automated analysis to support decision-making. In the understanding phase, automated AI-driven tools such as a pre-trained agent chatbot and a PMESSI classifier can transpose a vast amount of information into a more user-friendly method of information presentation that enhances the accessibility of the data. This can alleviate key issues in the understanding phase, namely that planners require the ability to efficiently analyse data and extract meaningful information, by prioritising and identifying relevant sources already. Similarly, AI-supported tools can aid in the judgement phase, where decisions need to be made about what interventions are possible, and what are the most appropriate. IMPACT incorporates a suite of tools, including an intervention filtering mechanism, a pre-trained chatbot, and an effects mapping function, to facilitate the identification of optimal interventions. Moreover, the tool integrates monitoring tools that continuously extract and interpret data from the operational environment, thereby accounting for its dynamic nature. Such tools can mitigate the impact of human biases and the development of siloes of capabilities.

Nevertheless, despite the significant opportunities for AI to optimise the decision-making process, the tool has endeavoured to preserve human agency within the decision-making processes to account for ethical considerations, such as those outlined by Johnson [9]. Aspects that require human judgement can be found at every step of IMPACT. The understanding phase relies heavily on human input to identify and provide critical information and data to the planning team. This involves human-driven tasks such as 3D-IPOE factor integration, Centre of Gravity analysis, and a comprehensive evaluation of the intended audience. Especially in the latter, human judgement is essential; AI tooling is not equipped to comprehend the cultural or interpersonal nuances that influence an intended audience's behaviour. In the judgement phase, human involvement is more interactive, where planners and the AI-tooling work synergistically, both in the development of possible interventions and in the forecasting of their potential effects in the operational environment. The final stage, the decide phase, is inherently reliant on human judgement – a commander must make the final call.

5.1 Limitations and Future Research

There are, of course, limitations to this paper. Most importantly, IMPACT is a product of an ongoing research effort by TNO into information manoeuvre in the Dutch context. Therefore, everything contained in this paper is a work in progress and the tool presented in this paper is merely a snapshot of ongoing work. Future work in this area will involve further development and refinement of the tool, including fine-tuning the AI-driven tooling to optimise its value in the decision-making process. Furthermore, the goal of continued research is to extend the scope beyond just C&E and cyber interventions but to also include electronic warfare capabilities and interventions. This aligns with the research project's goal of integrating all capabilities and functions related to information manoeuvre into a single decision support tool.

Ultimately, however, the aim is not only to integrate capabilities within information manoeuvre but to integrate information manoeuvre into other military operations. As such, future research could see IMPACT become just one piece of a large decision-support tool designed to support military courses-of-action development across all environments and domains, not just the information environment. In other words, all of the information manoeuvre interventions and effects could be incorporated into wider mission planning that includes land, sea and air capabilities. Although this paper is just an initial step in formulating a decision-making support tool for information manoeuvre, it marks a significant milestone toward the broader integration of information activities in other military operations.

6.0 CONCLUSION

The rapid growth of AI technology has ignited the debate around its ability to supplement human decision-making in warfare. This growth has been reflected in military doctrines and strategies that have acknowledged the potential of AI, specifically its application in bolstering command-and-control (C2) decision-making processes within the information environment. However, while there is room for a more AI-powered tool to help support decision-making in planning operations in the information environment, a balance needs to be struck. For the planning and execution of operations in the information environment, the sensitivity and human-centric focus of these operations means it can be particularly important to maintain human decision-making at the core. The goal of this paper was to highlight how AI-powered semi-automated analysis tools can support human decision-making, by effectively analysing data and suggesting possible decision options. To demonstrate how this can be done, this paper presented IMPACT, a semi-automated decision support tool for information-related activities, which aims to help military decision-makers strike this balance. The tool harnesses the use of AI in an optimal manner, while ensuring that meaningful human control remains central to decision-making. This paper, in describing IMPACT both conceptually and practically, using a scenario demonstration, offers a tangible example of how a balance can be struck between AI-supported analyses and human cognition, while ensuring the latter maintains meaningful control.

7.0 REFERENCES

[1] C. Heins, "Artificial intelligence in retail–a systematic literature review," *Foresight*, vol. 25, no. 2, pp. 264-286, 2023.

[2] M. van Hartskamp, S. Consoli, W. Verhaegh, M. Petkovic, and A. van de Stolpe, "Artificial intelligence in clinical health care applications," *Interactive Journal of Medical Research*, vol. 8, no. 2, p. e12100, 2019.

[3] N. McDonald, A. Johri, A. Ali, and A. Hingle, "Generative artificial intelligence in higher education: Evidence from an analysis of institutional policies and guidelines," *arXiv Preprint*, arXiv:2402.01659, 2024.

[4] I. Szabadföldi. “Artificial intelligence in military application—opportunities and challenges.” *Land Forces Academy Review*, vol. 26(2), 157-165, 2021.

[5] S. Kriegler. “Artificial Intelligence Guided Battle Management: Enabling Convergence in Multi-Domain Operations”. Doctoral dissertation, School of Advanced Military Studies, US Army Command and General Staff College, Fort Leavenworth, Kansas. 2020.

[6] J.A. van Dalen, and P.A.P. Dekkers, “Information Manoeuvre - Het gebruik van informatie als wapen,” Nederlandse Officieren Vereniging. 2022. Available: https://nederlandseofficierenvereniging.nl/information-manoeuvre/. [Accessed: 17-Sep-2024].

[7] A. B. Rashid, A. K. Kausik, A. Al Hassan Sunny, and M. H. Bappy, “Artificial intelligence in the military: An overview of the capabilities, applications, and challenges,” *International Journal of Intelligent Systems*, vol. 2023, no. 1, p. 8676366, 2023.

[8] M. A. Baker, K. A. Al-Khalifa, I. N. Harlas, and M. L. King, “AI and ML in the multi-domain operations era: vision and pitfalls,” in *Artificial Intelligence and Machine Learning for Multi-Domain Operations Applications II*, vol. 11413, pp. 358-375, SPIE, 2020.

[9] J. Johnson, “Automating the OODA loop in the age of intelligent machines: reaffirming the role of humans in command-and-control decision-making in the digital age,” *Defence Studies*, vol. 23, no. 1, pp. 43-67, 2023.

[10] N. Sylvia, “The Israel Defense Forces’ Use of AI in Gaza: A Case of Misplaced Purpose,” *RUSI*, 4 July 2024. [Online]. Available: https://www.rusi.org/explore-our-research/publications/commentary/israel-defense-forces-use-ai-gaza-case-misplaced-purpose [Accessed: 17-Sep-2024].

[11] A. Konert and T. Balcerzak, “Military autonomous drones (UAVs)-from fantasy to reality: Legal and ethical implications,” *Transportation Research Procedia*, vol. 59, pp. 292-299, 2021.

[12] Z. Stanley-Lockman, “Responsible and ethical military AI,” *Centre for Security and Emerging Technology*, 2021. [Online]. Available:” https://cset.georgetown.edu/publication/responsible-and-ethical-military-ai/.[Accessed: 17-Sep-2024].

[13] W. Horyń, M. Bielewicz, and A. Joks, “AI-supported decision-making process in multidomain military operations,” in *Artificial Intelligence and Its Contexts: Security, Business and Governance*, Cham: Springer International Publishing, pp. 93-107, 2021.

[14] S. B. Elson, D. Yeung, P. Roshan, S. R. Bohandy, and A. Nader, “Using Social Media to Gauge Iranian Public Opinion and Mood After the 2009 Election”, *RAND*. 2012. Available: https://www.rand.org/pubs/technical_reports/TR1161.html [Accessed: 17-Sep-2024].

[15] J. Sun et al., “A Survey of Reasoning with Foundation Models,” *arXiv (Cornell University),* Dec. 2023, doi: https://doi.org/10.48550/arxiv.2312.11562

[16] K. Vold, “Human-AI cognitive teaming: using AI to support state-level decision making on the resort to force,” *Australian Journal of International Affairs*, vol. 78, no. 2, pp. 229-236, 2024.

[17] “Manoeuvring into the Future of Information Manoeuvre,” *The British Army*, March 2020. [Online]. Available: https://www.army.mod.uk/news-and-events/news/2020/03/manoeuvring-into-the-future-of-information-manoeuvre/. [Accessed: 17-Sep-2024].

[18] "Besluit van 12 november 2020 tot vaststelling van het tijdstip van inwerkingtreding van de wet van 24 juni 2020," *Overheid.nl*, 2020. [Online]. Available: https://wetten.overheid.nl/BWBR0044330/2020-11-20. [Accessed: 17-Sep-2024].

[19] "Bearbeitung der lage im Informationsumfeld," *Zentrum Operative Kommunikation der Bundeswehr*, Munich, DE. 2019

[20] J. T. van de Kuijt, N. Keja, and J. C. Slaager, "The Concept of Information Manoeuvre: Winning the Battle of Perceptions," *The Hague Centre for Strategic Studies (HCSS)*, 2020. [Online]. Available: https://hcss.nl/report/the-concept-of-information-manoeuvre-winning-the-battle-of-perceptions/. [Accessed: 17-Sep-2024]

[21] NATO, "Cognitive Warfare: Strengthening and Defending the Mind," *NATO's ACT*, Apr. 05, 2023. https://www.act.nato.int/article/cognitive-warfare-strengthening-and-defending-the-mind/. [Accessed: 17-Sep-2024]

[22] CLAS, "Vision Information-Driven Operations for Land Forces: Maneuvering in the Information Environment [Translated from: Visie Informatiegestuurd Optreden voor de Landmacht: Manoeuvreren in de Informatieomgeving]". Utrecht, NL. 2020

[23] P. B. M. J. Pijpers and P. A. L. Ducheine, "'If You Have a Hammer…': Shaping the Armed Forces' Discourse on Information Maneuver," *International Journal of Intelligence and CounterIntelligence*, pp. 1–20, May 2023, doi: https://doi.org/10.1080/08850607.2023.2197560.

[24] NATO "Tactical Planning for Land Forces," *NATO Standard, Allied Procedural Publication APP-28. Edition A, Version 1.* 2019.

[25] P. D. R. M. IJntema and G. P. van de Haar, "Het tactisch besluitvormingsmodel (TBM), *Militaire spectator.* 2024. https://militairespectator.nl/artikelen/het-tactisch-besluitvormingsmodel-tbm. [Accessed: 17-Sep-2024]

[26] Ministerie van Defensie, "Three Dimensions Intelligence Preparation of the Operational Environment (3D-IPOE)". *OOCL/JISTARC.*

[27] K. Kruijver, B. Cadet, T. Powell, A. de Vries, and J. van de Kuijt "Made-to-measure: target audience analysis in today's information environment." *Proceedings of the NATO IST-195 Symposium on Societal challenges for Operations in the Information Environment.* 2022. Stockholm: NATO.

[28] N. Finlayson, A. de Vries, A. de Jong, J. van de Kuijt, and K. Kruijver, "Insight, Foresight and Understanding of the information environment: the IEA selection process." TNO Defense, Safety, and Security, Den Haag, NL, 2023. *RESTRICTED REPORT*

[29] M. Schwille, J. Welch, S. Fisher, T. M Whittaker, and C. Paul, "Handbook for Tactical Operations in the Information Environment". *RAND Corporation.* 2019. https://www.rand.org/pubs/tools/TLA732-1.html. [Accessed: 17-Sep-2024]

[30] C. Wilson, "Information operations, electronic warfare, and cyberwar: Capabilities and related policy issues". Congressional Research Service. 2007. https://apps.dtic.mil/sti/pdfs/ADA466599.pdf. [Accessed: 17-Sep-2024]

[31] L. Boswinkel, M. Rademaker, and R. Romansky, "Information-based behavioural influencing in the military context: mapping current expert thinking." *The Hague Centre for Strategic Studies.* 2022. https://hcss.nl/report/information-behavioural-influencing-expert-thinking/. [Accessed: 17-Sep-2024]

[32] P.A.L. Ducheine, and M. Timmer, "Conceptual manoeuvering". *Militaire Spectator.* 2023. https://militairespectator.nl/artikelen/conceptual-manoeuvring

[33] NATO, *Allied Joint Doctrine for Information Operations (AJP-10.1)*, 2023.

[34] R. G. W. Gouweleeuw, "An Introduction to Cyber Effects in the Military Context ," TNO Defense, Safety, and Security, Den Haag, NL, 2020.

[35] T. Hof, B. Cadet, and J. H. Korteling, "Towards a Battle of Perceptions Framework for Information Activities ," TNO Defense, Safety, and Security, Den Haag, NL, 2023.

[36] G. A. Veldhuis, P. van Scheepstal, E. Rouwette, and T. Logtens, "Collaborative problem structuring using MARVEL," *EURO Journal on Decision Processes*, vol. 3, no. 3–4, pp. 249–273, Nov. 2015, doi: https://doi.org/10.1007/s40070-015-0045-1.

[37] Y. Maas, A. de Vries, A. de Jong, N. B. Finlayson and E. Poot, "VIGILANT D5.1 Impact Analysis," unpublished, *VIGILANT: Vital Intelligence to Investigate Illegal Disinformation,* EU Horizon 101073921, more information available on request.

[38] J. Kerstholt, B. Keijser, G. Veldhuis, and E. Smits-Clijsen, "Organized crime requires dynamic decision making," *Frontiers in Psychology*, vol. 15, Feb. 2024, doi: 10.3389/fpsyg.2024.1205135.

[39] G. A. Veldhuis, E. M. Smits-Clijsen, and R. P. M, "Techniques to enhance the public policy impact of qualitative system dynamics models," *System Dynamics Review*, Dec. 2023, doi: https://doi.org/10.1002/sdr.1758.

8.0 APPENDIX

The following is a fictitious scenario created specifically for demonstration purposes:

TIER-I: CRISIS

Status

The Robian invasion of Ukraine and the subsequent war has seriously deteriorated the security situation in Europe. This is only expected to increase. This makes ALLIES's collective defence function on the eastern flank even more important.

A new rotation of the NLD enhanced Forward Presence Battle Group Lethovia (eFP BG LT) has been deployed in Lethovia. As a brigade you are part of the GNC (German-Netherlands Corps) which, contributing to the multinational battlegroup, is already positioned in Lethovia to help defend ALLIES territory against Robia. The eFP will contribute to the credible deterrence of the threat and reassurance of the Lethovian population.

Hybrid threats from Robia, especially those in the information environment, are an essential feature of this crisis situation and these activities are carried out secretly or are difficult to distinguish from normal activities. More than ever, this threat consists of manipulating information to stir up polarisation and unrest among the population, especially within the ethnic Robian enclave close to the Lethovia-Robia border.

Assignment

GNC is tasked with contributing to the deterrence of Robian threats. Considering the threat of escalation, the eFP has been given four weeks in which to plan, prepare and execute any information-related activities. Robia has been conducting sustained and aggressive disinformation campaigns against the Lethovian population, as well as the ethnic Robian enclaves in the border territories. Indications emerge showing that:

- Despite continued disinformation attacks, the Lethovian public remain largely supportive of ALLIES but scepticism is growing. State media is mostly pro-ALLIES.
- The ethnic Robian population in the border territory is increasingly hostile to the eFP and are generally supportive of Robian incursions in Lethovia.
- Most ethnic Robians identify as Robian rather than Lethovian. They feel marginalised by EU and ALLIES expansion, narratives and sentiments that are reinforced by Robian state propaganda online and on Robian TV. The same narratives and sentiments are widely shared by ethnic Robians on Telegram.
- A grassroots pro-Robian far-right Lethovian movement (LRP) is gaining popularity among ethnic Robians, particularly with their anti-ALLIES stance.
- The LRP's leader, Viktor Antonov, is a populist politician who uses Telegram to share Robian-aligned disinformation and conspiracies to his large and loyal audience, who view him as a 'hero' figure standing up for ethnic Robians in Lethovia. It is suspected his political ambitions are being funded by Robia.
- Centrist politician, Nicolai Zubrov, is influential on Robian relations owing to his Robian ethnicity. He is largely pro-ALLIES but sympathises with pro-Robian groups and has close ties to the pro-Robian population, politically and personally.
- Since the invasion, a private military company (RLR) has formed comprising pro-Robian extremists. They recruit members via various social media channels using Robian propaganda and offering generous wages.

Following the commander's assignment, GNC have determined the following objective:

Manipulate the attitudes of pro-Robian population in Lethovia to reduce support for Robian operations in Lethovia and increase support for the eFP/NATO.