

Game-based Simulation for Philippine Post-Typhoon Stability Operations Training

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ABSTRACT

This paper discusses the use of The First Person Cultural Trainer (FPCT) platform to develop pre-deployment stability operations training scenarios for typhoons in the Philippines and other natural disasters which require Army humanitarian missions. The FPCT platform, sponsored by TRADOC G2 Intelligence Support Activity, is a composable game-based simulation system capable of representing the cognitive complexity of non-kinetic population engagement in zones affected by natural disasters. The platform utilizes a PMESII (Political, Military, Economic, Social, Infrastructure, and Information Systems) model as the design framework for modular and interconnected training scenarios -- engaging users in cultural and communications decision-making for specific geographic regions and cultures. Within FPCT game simulations, players must communicate with game characters in a culturally appropriate manner to achieve stability post natural disaster, create alliances and ensure balance and stability between conflicting cultural and political groups. Using the FPCT platform, FPCT Philippines was created - inspired by events that followed Typhoon Bopha which occurred in December 2012. At the time of the storm, Bopha was the costliest and most severe typhoon to ever hit the Philippines. However, in November 2013, less than a year after the creation of FPCT Philippines, Typhoon Haiyan also hit the region, and was magnitudes greater in severity and aftermath. This paper explores the construct of the original FPCT Philippines model and potential enhancements necessary to accommodate scenarios for Typhoon Haiyan -- thereby analyzing the overall use and flexibility of the FPCT platform for pre-deployment training of stability operations in an environment of uncertainty and the usefulness of game-based simulations to train for humanitarian missions using the PMESII model.

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INTRODUCTION

Army training objectives are dictated by many factors, notably the evolving nature of various theaters of operations, concurrent missions, and the emergence of constantly improving training technologies. Meeting these training objectives requires a platform that is flexible, composable, cost-effective, and capable of representing the cognitive complexity of non-kinetic population engagement –which is particularly important in a time of stability operations. The First Person Cultural Trainer (FPCT), sponsored by TRADOC G2 Intelligence Support Activity, was created to address these needs. FPCT is a high fidelity, game-based simulation platform which has won numerous awards, including “Best in Government Category” in the Serious Games Contest at IITSEC 2011, first place in the “Innovations in DOD Gaming” competition at GameTech 2011, and the Cross Function Award from the National Training and Simulation Association (NTSA) in 2010. The FPCT platform supports population engagement for both Mission Command related activities and humanitarian missions integrating appropriate components of the Political, Military, Economic, Social, Infrastructure and Information Systems (PMESII) construct into gameplay. In regions where natural disasters occur frequently, need exists to understand and stay current with the PMESII-based socio-political landscape to train for and facilitate stability, humanitarian relief, and peacekeeping operations. FPCT Philippines was modeled using the FPCT platform to represent stability operations training based on the events and aftermath of Typhoon Bopha, which devastated the southern Mindanao region of the Philippines in December, 2012. In November 2013, less than a year after the completion of the FPCT Philippines proof of concept, another tropical super-cyclone -- Typhoon Haiyan -- caused catastrophic destruction in the Visayas central region of the Philippines. Estimates vary, but it is safe to say that both typhoons have resulted in excess of \$80 million in humanitarian assistance funding from the United States Agency for International Development (USAID; Philippines - Typhoon Yolanda/Haiyan, 2014). This paper will explore the methodology for modeling the FPCT Philippines proof of concept and apply it to examine the Army’s humanitarian aid and disaster relief efforts following Typhoon Haiyan.

THE FPCT PLATFORM -- COMPOSABILITY AND FLEXIBILITY FOR GAME-BASED SIMULATIONS

The FPCT platform applies cutting edge technology to train key leader engagement functions with non-combatants and indigenous counterparts. The platform features a variety of system architectural innovations to include a composable branching-conversation system that facilitates narrative gameplay, methods for displaying nonverbal communication, a journal component which allows warfighters to keep track of “golden nuggets” or key information in the environment, and a network identification component that allows players to identify social constructs.

FPCT is also a story-based gaming platform in which the narrative is driven forward through meaningful interactions with Key Non-Player Characters (NPCs). Every NPC has a set of emotional values and opinions, including opinions about the player. NPCs influence each other through assignments determined by age, gender, wealth, culture and other descriptive variables. Interactions with the player alter an individual NPC’s opinion of, and cooperation with, the player based on game choices. NPCs spread and share their opinions about the player throughout the game.

The gameplay behavior of Key and non-Key NPCs is constructed around a basic four-emotion model (Ekman, 1999), as well as by sociocultural characteristics and events in the Operational Environment (OE). Key NPCs hold information that is important to achieving mission objectives. They can also send the player to other Key NPCs, which in turn leads to achieving more mission objectives. The player needs to explore the OE and communicate with Key NPCs in a culturally appropriate manner in order to make important mission decisions. For example, as an Army leader assigned to provide relief to a local population after a natural disaster, the player is faced with myriad

cultural and communication choices – i.e. which group to approach first, which local leaders to trust, how to restore order, which infrastructure failures – such as roads, buildings, telecommunications – to tackle first, how to deliver aid in a timely manner, and how to remain neutral towards opposing cultural groups and not show favoritism.

The flexibility inherent in game-based simulations applies particularly well for stability operations and humanitarian missions. Games allow varying perspectives on data from first person, third person, or high-level view of the ground actions. A game engine allows for flexibility in representing time and space – affording flexibility in time of day, the ability to span time, and multiple gameplay instances. Another characteristic of a game construct is that it offers cinematics, or animated videos, which provide environmental cues, time transitions, points of synthesis, level transition and other ways to connect information. Game-based simulations are cost-effective, platform-agile, and easy to distribute to large numbers of trainees. Game-based simulations offer unique opportunities for tracking and assessment of player performance, and provide during action and after action review to aid the player (Zielke, 2012). All of the above mentioned functionality of game-based simulations is critical for high fidelity representations of the complexities present in post-typhoon Stability Operations training scenarios.

End-User Tools for Subject Matter Experts

The Army's ever-growing training needs require a quick, flexible, intelligent and cost-effective approach to building Stability Operations (and other) training scenarios. To this end, in the most recent development cycle of the FPCT platform a suite of end-user tools was added, specifically Visual Conscript and the World Culture Repository (WCR). These scenario generation tools allow master developers, subject matter experts, and in-theater warfighters to utilize their expertise and quickly generate immersive environments and narrative-driven simulations to respond to the uncertain and fast-changing nature of today's conflicts. Visual Conscript provides a training scenario developmental interface for end-user-developers (i.e., soldiers and tactical-level trainers) to map out branching storylines, and track conversations with multiple NPCs. The tools also allow end-user-developers to write new conversation branches based on emotion, information context, triggered events, player movement, and either positive or negative effects of PC to NPC interactions.

As Figure 1 below illustrates, the WCR is a working interface that allows end-user developers to create gameplay in a three-stage process by choosing assets from among existing FPCT game maps, NPCs and golden nuggets to create custom scenarios. The WCR is a repository for high fidelity 3D assets to represent infrastructure facilities, military equipment, and other models necessary to accurately represent the OE. This development is scalable and could include a variety of additional cultural assets beyond those that are part of the current FPCT platform.



Figure 1. New End-user Tools in the FPCT Platform Used in a Three-step Process: Step One -- Select Environment: The user is prompted to select an environment from the WCR on which to build their scenario. Overhead views of the Philippines, Afghanistan, and Nigeria are depicted here -- maps currently available in the WCR. **Step Two -- Configure Parameters:** Once an environment has been selected from step one, scenario configuration options can be adjusted. Here the user inputs the cultural composition they wish to be present, creates key characters, and sets up social groups. **Step Three -- Write Campaign:** After the initial configuration, the user can begin crafting scenarios. Using each of the tools, the user maps out the campaign, missions, and conversations.

USING PMESII AS A DESIGN FRAMEWORK

The PMESII model is one of the key concepts in Irregular Warfare and Effects-Based Operations simulations and an integral part of the FPCT Platform -- serving as the framework for modeling human behaviors. PMESII describes the foundation and features of an enemy or ally state and can help determine strengths and weaknesses, as well as help estimate the effects various actions will have on states across the variables (Pmesii.dm2research.com, 2014).

As depicted in Figure 2, FPCT campaigns are designed around PMESII variable interlinked missions, consisting of scripted and unscripted OE Events and branching dialog interactions with Key NPCs. Both events and Key NPC interactions can be designed to influence the mood and cooperation levels of the local population. The outcomes of interactions with Key NPCs from one mission can influence the mood and behaviors of Key NPCs and the overall population in other missions. Player interactions with Key NPCs must reflect the recent events that have taken place in the OE and follow the narrative of the interconnected PMESII missions. Key NPCs have greater influence in their environment and may lead the player to resolving mission objectives either by sharing important information or sending the player to other Key NPCs. Campaigns may be simple or complex, depending on the type and quantity

of OE events, Key NPC interactions, number of interlinked PMESII missions involved, and the interdependence of PMESII variables.

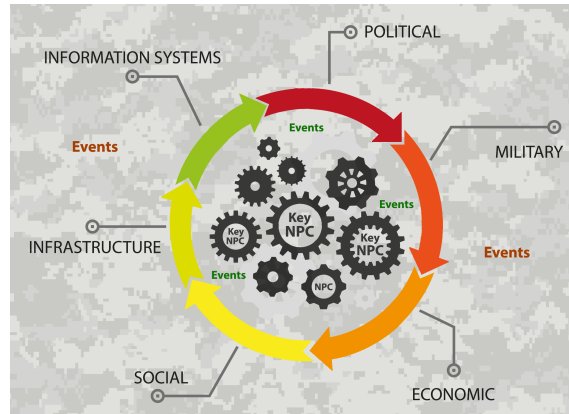


Figure 2. Interaction of PMESII Variables and Gameplay. FPCT campaigns are composed of PMESII variable missions, events, and interactions with key NPCs. In that the PMESII variables are interconnected, so are the FPCT missions.

FPCT PHILIPPINES CASE STUDY: TYPHOON BOPHA AND TYPHOON HAIYAN

The US Army has identified a growing need for humanitarian aid and stability operations training missions (Yarger, 2010). Modeling such effective and reusable training scenarios requires a firm understanding of all the PMESII variables that affect a region during and after a natural disaster. Further, the underlying conflicts of a region, such as opposition between cultural and political groups, poor infrastructure, corruption, poverty, unemployment, environmental concerns, and other issues may escalate when affected by severe natural disasters. A case study of FPCT Philippines offers a first glance of efforts to model a campaign inspired by a specific historical event. Further, as new world events unfold, the model can be modified and expanded through the end-user tools.

The Philippines through a PMESII Prism

As an overview, The Republic of the Philippines is an archipelago consisting of 7,107 islands categorized into three main regions (north-to-south respectively): Luzon, Visayas, and Mindanao. The country's position on the Pacific Ring of Fire and proximity to the equator provides biodiversity and natural resources -- yet also makes it prone to earthquakes, annual torrential rainstorms, and typhoons (McGinley, 2008). "On average, eight or nine tropical storms make landfall in the Philippines each year, with another 10 entering Philippine waters" (Brown, 2014). Within the country, 82.9 percent of Filipinos are Catholic, five percent are Muslim and the rest belong to Protestant Christian groups: Evangelical, Iglesia ni Kristo, Baptist, etc. (Abad, 2001). Because the majority of Filipinos are of mixed ancestry (Native, Chinese, Spanish, and others), society is divided by class and religion. The family is the basic and smallest unit in Filipino society that serves as the building blocks of the community. Respect and fear of the elderly are strong values in Filipino culture as is pakikisama, which discourages individuals from deviating from the mainstream even in situations that seem unethical or immoral (Abad, 2001). The national economy of the Philippines is the 39th largest in the world. The transportation infrastructure in the country is relatively underdeveloped as Philippines is a newly industrialized country, with an economy transitioning from one based on agriculture to one based more on services and manufacturing (Country Profile: Philippines, 2006). The Philippines has a democratic government currently led by President Benigno S. Aquino III. The Philippines was under U.S. administration from 1898 to 1942, became an independent state in 1946, and has been an ally since the end of World War II. The U.S. Department of State (DoS) 2014 Fact Sheet explains that DoD, DoS, and USAID's "programs in conflict-affected areas of Mindanao aim to strengthen the foundation for peace and stability in the area" (U.S. Department of State, 2014). In the wake of recent natural disasters and all of the humanitarian aid and assistance received from the United States, the Philippines are more welcoming to the expanded U.S. military presence (LaFranchi, 2013). During a state visit to the Philippines in April 2014, President Obama stated: "At the invitation

of the Philippines, American service members will rotate through Filipino facilities. We'll train and exercise more together so that we're prepared for a range of challenges, including humanitarian crises and natural disasters like Yolanda" (Tatoy-Rabor, 2014).

Modeling FPCT Philippines based on Typhoon Bopha

As mentioned, the FPCT Philippines proof-of-concept campaign is inspired by the aftermath of Typhoon Bopha, also known as Typhoon Pablo in the Philippines. At the time it occurred in December 2012, Bopha was considered to be the strongest Category 5 tropical cyclone to ever hit the Philippines, with winds reaching 175 mph. Bopha caused power outages, destroyed houses, disrupted communication, uprooted trees, wiped out banana plantations, flooded plains, and made roads impassable. Bopha caused crop damage worth 8.5 billion pesos (\$210 million). The death toll is estimated at 906 people, with 149,000 houses damaged or destroyed and a total of 5.5 million people affected. USAID's total humanitarian funding for this event reached \$3,646,629 for fiscal year 2013 (Philippines - Typhoon, 2012). Overall, the PMESII variables serve the FPCT framework well in modeling the typhoon-affected area of Mindanao. Mindanao consists of conflicting indigenous populations, government forces, and paramilitary rebel groups with long-standing conflicts.

Gameplay

In order to succeed in FPCT Philippines, the player must understand the OE presented by the PMESII missions, and make intelligent choices when it comes to picking allies and collecting sensitive mission objective-related information. To this end, the player is presented with a prologue that outlines the situation, which explains the general perception of the player by the populace, recent violence, unrest, and other factors. The player is also given a list of goals to meet. The goals are separated into missions, each of which is based on either tactical gameplay or on one or multiple PMESII categories for humanitarian gameplay.

The FPCT Philippines proof-of-concept campaign unfolds in a high-fidelity 3D map representing the New Bataan municipality of Mindanao affected by Typhoon Bopha. As depicted in Figure 3, The OE map consists of refugee camps and destroyed homes, a mining village in the southeast, ruined banana plantations in the northeast, and a small-town marketplace with neighboring settlements occupying the middle of the map. The map is populated by nearly 200 NPCs and the player needs to explore the area, identify Key NPCs, collect mission-sensitive information and store it in the journal, and build alliances with local leaders while understanding the tensions between the three prominent opposing groups: the Mansaka, the government, and the townspeople.



Figure 3. Top-down view of New Bataan municipality post Typhoon Bopha. This map depicts the town hall, marketplace, destroyed homes and banana plantations, refugee camps and a mining village. Players must navigate the map to accomplish objectives described in the prologue. This map is one of several that can be selected from the WCR.

For the FPCT Philippines proof-of-concept campaign, three of the six PMESII missions were developed: 1) Social, which requires discovering who the local leaders are and building relationships with them; 2) Economic, which involves gathering information about the government's position on a major economic generator, mining and logging, and the typhoon's impact on local residents; and 3) Infrastructure, in which the player must convince New Bataan residents who are living in tents to overcome their distrust of government officials and attend meetings to discuss the rebuilding of the town's housing infrastructure. The missions can be accomplished in any order. In the proof-of-concept campaign they are not interdependent but, if desired, could be linked. These three missions are illustrated below in Figure 4.



Figure 4. The three PMESII variable missions developed in FPCT Philippines proof of concept – social, economic and infrastructure. **1. Social Mission:** Even in extreme conditions such as post-Bopha, the social norms and hierarchy in the Philippines are respected and relied upon. The player must navigate the local citizens with cultural sensitivity. If successful, the player will be introduced to the barangay captain, Sheriff Tito, a Key NPC with whom they must build a relationship in order to influence other NPCs. Building a relationship includes visiting the sheriff's home and singing karaoke with the family. **2. Economic Mission:** Most of the local economic vitality has been destroyed by Bopha: banana plantations were wiped out, mining operations have slowed to a crawl, and local businesses struggle to rebuild. Locals and government officials clash over mining operations, which have been blamed for contributing to the devastating mudslides during the typhoon. The player must assess the situation through conversations with local residents and government representatives, and mediate the discussions without appearing to take sides. **3. Infrastructure Mission:** The government's Department of Social Welfare and Development (DSWD) has tried several times to hold meetings in the tent city housing citizens left homeless by Bopha. Wishing to accelerate the rebuilding of New Bataan's infrastructure and housing, the DSWD suffers from a lack of trust among the locals, who are refusing to attend the meetings. The player must bridge this gap in trust and convince the citizens that attending the meeting to discuss housing is in their best interest.

The player must balance the interests of opposing groups while gathering mission-sensitive information in a culturally appropriate manner. This is especially difficult during a time of natural disaster as each group may try to defend its own interests first and foremost, instead of combining forces to tackle big issues in a collaborative manner. If the player sides too closely with any one of the groups, the cooperation shown to the player by the groups might suffer. The PMESII construct also allows the outcome of one mission to impact other missions. For example, if the player decides to favor the Mansaka indigenous peoples in the social mission by only helping this group during the relief efforts, then the government and townspeople groups can be designed to be less cooperative towards the player in the economic and infrastructure missions.

All missions are accessible through the journal tool, which provides smart cards with facts about the indigenous peoples (IPs) of the region, such as the Mansaka; the local industries, such as mining, banana plantations, and farming; and the nature of conflict between IPs, the government, and townspeople. The journal also includes environmental glimpses, which are additional useful facts collected by the player as they travel through different sections of the game map.

As illustrated below in Figure 5, to complete a single FPCT mission, the player will encounter many NPCs. Before talking to an NPC, the player is asked to evaluate the character's mood. After a conversation, the player can select the character's culture and population group. The player's understanding of a particular character's traits is critical

to successfully navigate a conversation. The player's performance in each conversation can branch the player through the narrative down a path that will result in mission success or failure.




Social	Infrastructure	Economic
 <p>Franco Tito</p> <p>Key NPC: Sheriff Tito, an influential character. Player must build a relationship with Tito.</p> <p>Character Statement: "No, why would I kid you about serious business? In the Philippines, everyone sings Karaoke. And in Franco Tito's house, you Karaoke. Yes?"</p> <p>Player Responses:</p> <p>Player: Mr. Tito, respectfully, I cannot and will not make a fool of myself. Thank you, for the hospitality and all that, but no way.</p> <p>Player: Franco, give me the microphone, sir.</p> <p>Player: I'm at your mercy, it seems.</p>	 <p>Argie Paano</p> <p>Non-key NPC: Player needs to convince Argie to attend meetings about housing reconstruction</p> <p>Character Statement: "A good day is a busy day. Are you here to make me go to another government meeting?"</p> <p>Player Responses:</p> <p>Player: I'm not here to force you into anything. I am only here to assist you.</p> <p>Player: This isn't propaganda. If you'd just listen to reason.</p>	 <p>Syed Wadi</p> <p>Key NPC: Miner. Player must learn about tension between miners and government.</p> <p>Character Statement: "You see the mudslide in the valley? They say we caused it by mining and logging."</p> <p>Player Responses:</p> <p>Player: They hold you responsible for that? I'm sure they have your best interests at heart.</p> <p>Player: If that's the reason the mudslide occurred, then maybe the government is just concerned for you all.</p>

Figure 5. Character Dialog. Player conversations are a key part of the FPCT Philippines gameplay and are illustrated in the proof-of-concept. The Visual Conscript user tools allow subject matter experts to create character dialog which represents the current training need as well as specifics of current OE situations.

In summary, overall gameplay elements utilized by FPCT Philippines are illustrated below in Figure 6.



Figure 6. Elements of FPCT Philippines Gameplay: a,b) **The Journal:** The center of information for the player. From the journal, the player can start missions, check their progress, view smart card information, and rate characters. c) **Characters:** High-fidelity procedurally generated characters populate FPCT's environment. d) **Environmental Glimpses:** Context-specific information that give players additional insight into community issues. e) **Conversations:** The gameplay mechanic through which players progress through the narrative.

Additional Model Insights and Perspectives from New Typhoon Haiyan

Despite the severity and magnitude of Typhoon Bopha's aftermath, an even stronger super-cyclone followed in its wake only one year later in November 2013. Typhoon Haiyan, known as Typhoon Yolanda in the Philippines, is

now considered the deadliest Philippine typhoon on record, killing at least 6,300 people in that country alone (Del Rosario, 2014). An estimated four million people were displaced, one million left homeless, and a total of 16 million people were affected by the damage (Philippines - Typhoon Yolanda/Haiyan, 2014). Reportedly some 600,000 people had not received aid two weeks after Typhoon Haiyan made landfall. The same source reported that the government's delays with getting the aid out were tied to repackaging international aid to have the DSWD labels, or labels saying the goods were from Vice President Binay (Global Research, 2013). The USAID Factsheet for fiscal year 2014 reported total assistance in humanitarian funding of \$87,735,775 to the Philippines (Philippines - Typhoon Yolanda/Haiyan, 2014).

Similarities and differences presented from these typhoons can be modeled and stored in the FPCT platform through the robust PMESII framework and show the value of the flexible repository approach. The aftermath from both typhoons resulted in significant increase in communication and infrastructure failures, escalation of conflict between culturally and politically opposed armed groups, shortage of humanitarian aid, and an increase in government criticism for slow distribution of humanitarian aid (Grudgings, 2014). Infrastructure damage, such as flooding, mudslides, destroyed villages, and impassable roads, was significantly greater during Typhoon Haiyan, and overall more cultural groups and geographical areas were affected (Whitehouse.gov, 2013). Unlike Typhoon Bopha, which affected only Mindanao, the southern region of the Philippines, Typhoon Haiyan stretched across the entirety of the central region of the country, first making landfall in East Samar, then spanning across all of the Visayas (central islands), and exiting into the South China Sea to make its final landfall in Northern Vietnam (USG Humanitarian Assistance For Typhoon Yolanda/Haiyan, 2014).

The scale of Typhoon Haiyan aftermath was several orders of magnitude higher than Typhoon Bopha, and therefore the number of USAID and DoD-coordinated stability operations required was significantly higher (Global Research, 2013). From a military execution perspective, new Army Osprey transport airplanes were used for the first time for more effective delivery of humanitarian aid to multiple regions at once with a higher load capacity (Defense.gov, 2014). Typhoon Bopha primarily resulted in just two types of humanitarian assistance missions: logistics and relief commodities; and water, sanitation, and hygiene (USAID/OFDA Humanitarian Assistance for Typhoon Bopha, 2012). Typhoon Haiyan, in addition to the two mentioned humanitarian assistance missions, also resulted in: cash-for-work, economic recovery and market systems, humanitarian coordination and information management, locally and regionally procured emergency food assistance, protection, risk management policy and practice, shelter and settlements, Title II Emergency Food Assistance (USG Humanitarian Assistance For Typhoon Yolanda/Haiyan, 2014).

As in all new datasets, a new campaign based on Typhoon Haiyan aftermath would require the implementation of all six categories of interlinked PMESII missions to accurately represent the OE for stability operations training. Furthermore, additional game content would be needed to adequately represent new cultural groups, military equipment, communications decisions, and regional maps of central Philippines and northern Vietnam related to the expanded path of Typhoon Haiyan. The suite of end-user tools and the repository approach enables potential subject matter experts to implement these enhancements quickly and prepare for the new campaign.

With this composable approach, the relative importance of each of the PMESII variables can ebb and flow based on circumstance in natural disasters such as typhoons. As military training experts analyze datasets from natural disasters and other real world events, they can decide the relative complexity of each PMESII mission needed to better represent the specific training mission objectives. Figure 7 below compares the prominent PMESII variables initially modeled for the FPCT Philippines campaign based on Typhoon Bopha's aftermath to a possible campaign based on Typhoon Haiyan's aftermath and considers possible consequences of a third campaign based on a future Typhoon X.

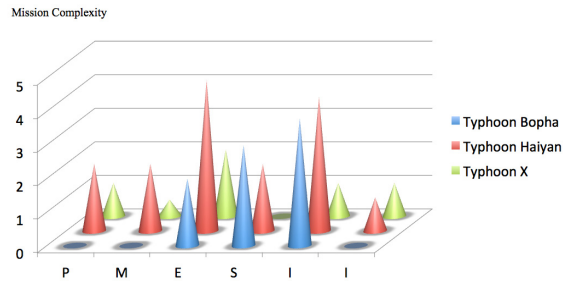


Figure 7. Comparing Stability Operations Campaigns modeled on differing PMESII variables across several Typhoons (Bopha, Haiyan, X). Along the x-axis are the Political, Military, Economic, Social, Infrastructure, Information Systems variables. The y-axis stands for mission complexity, with values defined by the type and quantity of OE events, Key NPC interactions, and interdependencies between PMESII variables.

SUMMARY AND WAY AHEAD

The FPCT platform provides capability for generating new training scenarios based on real world events, and, importantly, a repository for saving and analyzing the datasets to better understand and anticipate future natural disasters and the corresponding humanitarian relief efforts. Further, key components of the development can be dismantled and reused to create new, more on-point development as situations evolve. The end-user tools are a critical asset in creating composable, quickly developed training environments. For example, in its full manifestation, the Visual Conscript interface would allow SMEs and warfighters to manipulate the physical characters in the narrative, more freely configure placement of physical golden information nuggets, and modify environment maps, all of which would be stored in the WCR. Additionally, new 3D regional maps may be added into the WCR as needed, to accurately represent all of the geographical regions of interest. Research into development such as the FPCT platform can support the Army and other branches of the military in developing quick, responsive training for natural disasters and other humanitarian campaigns in uncertain environments.

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