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Organized Cognition: Theoretical Framework for Future C2 Research and Implementation

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Abstract: The classic concept of C2 has undergone radical changes since the 1990s. This paradigm shift in the traditional execution of C2, its advantages, basic problems, and potential possibilities are the subject of this paper. The paper outlines the notion of organized cognition as a thematic lens for an improved understanding of the basic problems of C2 practices and systems. The concept of organized cognition aims to integrate existing C2-related concepts and extend their use into a wider context. The work addresses on practical implications on the development of future C2 procedures and systems.

Keywords: Organized Cognition; Command and Control; Coup d'Oeil; Situation Awareness; Situational Awareness; OODA loop; Decision Making.

Organized Cognition: Theoretical Framework for Future C2 Research and Implementation

The common understanding of the concept of Command and Control (C2) in modern military organizations associates it with an optimal execution of operational plans in support of strategic goals [1, 2]. As such, C2 is conceived as a chain of iterative sequences of situational assessments, decisions, directions, and actions that terminate once a mission or a larger scale campaign were accomplished or aborted. Due to the highly dynamic and complex nature of large-scale contemporary operations, military organizations deploy systems of personnel, procedures, and technological means to facilitate the collection of situational information, analysis of courses of action, dissemination of orders, and monitoring of actions.

In conventional regular, symmetric, and linear operations, C2 systems are chiefly concerned with the military aspects of the battlefield and focused on top-down deliveries of action orders and bottom-up transmissions of situational reports and calls for support [3-5]. On the contrary, contemporary irregular, asymmetric, and non-linear operations require military organizations to adapt faster and decentralize their C2 processes while addressing multiple perspectives ranging from micro-tactical considerations to cultural differences and geo-political realpolitik [6-9]. While the continuous evolution in the nature of conflicts requires resultant changes in deployed C2 procedures and technologies, this transformation often lags behind the events and, consequently, lead to the use of sub-optimal C2 systems [10, 11]. As the nature of emergent future conflicts unfolds, it is essential to re-examine the concept of C2 and attempt to arrive at practical solutions for its current problems.

This type of discussion necessitates effective conceptual frameworks to allow addressing subtle issues that may, otherwise, evade the collective attention in the practitioner and scholarly literature. Nonetheless, an introduction of a conceptual framework requires careful consideration of two basic problems: unaware objectification and deficient semantic exchange. The problem of unaware objectification relates to the naturally-occurring assimilation of concepts into the common daily language of professional and scholarly communities and the gradual disconnection of the coined terms with their originating ideas as interpretations vary and change over time [12-15]. The problem of deficient semantic exchange, or lacking sprachspiel, relates to misinterpretations associated with lingual innovations which are based on theoretical intuitions and not on mutual experiences of individuals within and across organizations [16-19].

To reduce the affect of these naturally-occurring confusions, this paper introduces the concept of Organized Cognition (OC) as an overarching framing process that integrates and extends the theoretical coverage of common concepts in the practice and research of C2. In a brief, the concept of OC refers to an intentional process, at the individual and the organizational levels, of framing and reframing perspectives of situational references and extending the awareness range to include concealed phenomena such as hidden convictions that underlie organizations, societies, and cultures and the slow changes that affect them. As such, the notion of OC would enable better integration and use of conventional concepts such as Coup d'Oeil, Situational Awareness, and the OODA loop that focus on the eventual success of intuitive decisions, the level of congruence between ideal and actual knowledge, and the duration of time for acquiring knowledge of a situation, respectively. The paper commences with a brief historical review of the evolution of C2 and its correspondent relationships with the human and the technological factors, follows with the construction of the notion of OC and its relationships with common C2-related concepts, and culminates with few illustrative examples.

Historical Perspective

Civilizations are defined by and contained within complex dynamic networks of contemporary and historical relationships between individual actors and their personal, socially-inherited, and technologically-enhanced perceptions and cognitions of the environments they live in. The interaction between civilizations, whether instinctively acted or deliberately contemplated, is another complicated network of dynamic structures of interests, alliances, and rivalry between states, nation-like, and non-government actors in the global landscape [20, 21]. Taking a historical perspective, the landscape of civilizations has always characterized by slow and abrupt patterns of change that reflected periods of relative stability and transformations in the world order [22]. While certain changes resulted from naturally-occurring geo-political, economical, and/or social trends, other changes were the consequence of calculated or miscalculated intents of powerful social actors who influenced these trends to maintain or enhance their social status [23-26]. Although a validated identification of such subtle patterns is possible only from a retrospective and/or semantically-remote standpoints [14, 15], the ability to anticipate and react to these changes is an important factor in the competitive advantage of civilizations [27].

Warfare and C2

Whether instinctive or contemplative, organized competitive actions of civilizations are driven by individuals and executed by permanent or ad-hoc organizations commissioned to accomplish specific tasks over time or in specific occasions. These specialized social structures execute competitive actions that range from attempts to manipulate populations through commercial or cultural influence, gain a better position through diplomacy, stimulate changes through covert action, and project or demonstrate power through limited conflicts, large scale campaigns, or total wars [21, 26, 28]. The struggle for competitive advantage between rivaling civilizations motivated strategies such as the (a) selection and training of sufficiently-large enduring quantities of competitively skilled individual actors; (b) development and execution of competitive commercial, diplomatic, or military policies; or (c) research and development of technological means for enhanced competitive human action. Owing to the complexity of organized actions, the concept of C2 evolved over time as the art and science of achieving competitive goals through organized actions of people and technological means [29-32]. As such, C2 belongs to a family of related terms, such as the arts of governance and war, which deal with historically-proven techniques for gaining knowledge of the competitive situation, orchestrating action plans that effectively leverage skills and technologies, monitoring and controlling the actions of actors, and denying adversaries from the advantage of such knowledge and the ability to plan and control [24, 33, 34].

C2 and the Human Factor

Analyzing the sources of successful campaigns, scholars of the 19th century identified the concept of Coup d'Oeil as an essential virtue in battle champions. Coup d'Oeil, was a “quick recognition of a truth that the mind would ordinarily miss or would perceive only after long study and reflection” [24], or in other words, the ability to “seize, as it were, with a glance, the

advantages or disadvantages which may arise from the situation of ground or troops, and to single them out from all other objects” [34]. Lacking any method of identifying a-priori individuals who possessed this virtue, commanding generals were selected only after they demonstrated proven abilities in actual battles.

The emergence of combative aviation in World War I led to the identification of similar concept: the Ace-Factor. An analysis of aerial fights resulted with the conclusion that significant amount of victories was gain by few exemplary pilots which thought to possess a special quality [35-41]. As a result, the concept of the Ace-factor was continuously studied throughout World War II and the cold-war conflicts thereafter. Yet, akin to the concept of Coup d'Oeil, there was no deterministic way, other than exposing pilots to air fights, to identify a-priori individuals who possessed the Ace-factor. In the 1980s, aviation practitioners coined the term Situational Awareness (SA) as a thematic lens in reference to the stealthy Ace-factor [35]. In an attempt to formalize the concept of SA as a measurable mental function, scholars modeled and defined SA as the cognitive ability to perceive, comprehend, and project an unfolding situation as a prerequisite for effective decision making and action [42, 43]. The context of SA was later extended from aviation to general tasks and from the individual to the communal levels and has been considered a key factor of effective C2. Nonetheless, the concept of SA was criticized as vague, oversimplified, and lacking connection to its original context [12, 13, 44-46]. Additionally, like other cognitive concepts such as mental models [47, 48], SA could have been criticized for avoiding the subjective experience and wrongly assuming that formal notation could span semantically-open meaning [49, 50].

During the late 1980s and the 1990s, in parallel to the conceptualization of SA, another C2-related concept emerged – the Observe, Orient, Decide, Act (OODA) loop [51-53]. Likewise SA, the concept of OODA stemmed from the fast decision making cycles in combat aviation and developed later to the realm of C2. Originally, Boyd [54] attempted to develop a deterministic model that would allow pilots winning battles through the understanding of the Energy-Maneuverability (E-M) characteristics of aircrafts and weapons during air fights. Yet, as Boyd realized, winning a physical battle between rivaling technologies and tactics required also winning the mental encounter with a rival pilot [55]. The OODA loop was defined as a set of complex, non-linear, and simultaneous processes of observations guided by cultural, professional, personal, and hereditary factors named collectively as orientation. Once a threshold level of comprehension was established through the orientation process, a few potential courses of action emerged for testing. Once a test was concluded, its results were observed, another orientation cycle was triggered, a final decision was made, and a concluding action was taken. Boyd [52, 53] contended that winning a competition required one to run OODA processes faster than one’s opponent in order to ensure that the opponent reacted to one’s actions and not vice versa. While the OODA loop was probably the most accurate model of the subjective experience of C2, its practical interpretation had a foundational drawback that is discussed later in this paper.

Technology and the Human Factor

While civilizations have highlighted the skillful actions of exemplary warriors, champions and aces alone could not win battles and the improvement of the skills of the masses remained a continuous concern of rulers and policy makers. Given the natural inconsistencies that are associated with the human behavior, civilizations developed social methods, such as

education, training, motivation, and coercion, to increase the skill level and the predictability of their actors. In parallel, civilizations developed technical means to enhance the competitive edge of their actors and improve the ability of their organizations to exercise C2. Consequently, technology played a major role in modern conflicts and became a cornerstone of modern doctrines [31, 56, 57]. The continuous evolution of increasingly capable technologies highlighted the limitations of the human factor in combined human-machine systems. Military organizations made many attempts to solve human limitations through selection of exemplary operators [37-40, 58, 59], training [60], combat analytics [54], ergonomic optimization [61-64], and performance measurement [60, 65-70]. Although some attempts to shift the attention to human-centric solutions [51-53, 55, 71, 72] and the caveat that complete automation is problematic [73-75], the technological orientation as the dominant proponent of national competitive advantage prevailed.

The emergence of voice and data communication technologies in the early 1900s and the surfacing of computer networks in the 1970s maintained the human-centered nature of C2, but it was not until the 1990s that computer-centered data networks were established and altered to a great extent the context of C2 [76-79]. The concepts of Information and Network Centric Warfare and Operations emerged in the 1990s and caused a radical change in the way C2 was perceived and attempted. The unquestioned success of these technologies expanded the concept of C2 into the larger framework of Command, Control, Computers, Communications, and Information (C4I). Given the less predictable nature of human behavior in complex, dynamic, and stressful situations compared to the unrivaled capacity for speed, clarity, mass storage and retrieval, and heuristic analysis of automated systems, it seemed plausible to augment or even replace certain human-based C2 tasks with technological elements. The resultant introduction of C2 systems into service was inevitable and represented an acute need for competitive edge through enhanced access to large amounts of task-oriented information; acceleration of planning, analyses, and decision making through automation of procedural tasks; and the introduction of the common operating picture [80-82].

C2 systems streamlined written correspondences and facilitated the communication of orders, reports, and approvals. The initial transition seemed straightforward; with the exception of automated position location information reporting, most existing procedures for data collection and reports, information representation and analysis, and requests for support remained intact and just transitioned from voice-transmitted and paper-based to data-linked and cyber-hosted C2. Looking forward, C2 scholars identified metrics such as robustness, resilience, responsiveness, innovation, flexibility, and adaptation as key for improvements in the development and use of C2 technologies [31, 57, 83, 84]. Yet, the technological, logistic, and administrative challenges in enabling the initial transition were far more complicated than envisioned. Consequently, the main concern shifted toward the challenging tasks of acquisition management, program execution, development, testing, training, operation, and maintenance of enabling technologies such as wireless data communications, networks, and C2 software applications.

The introduction of C4I technologies lead to the realization of networked collaborative environments and enabled the development of technology-driven C2 tactics, techniques, and procedures [4, 5]. Additionally, integration of C2 systems with sensors and weapon systems enabled sharing precise geo-located information for tightly-coordinated operations [85-87]. The introduction of remotely-operated and semi-autonomous sensors and unmanned systems, as well as the expansion of competitive actions into the Internet, extended the context of C2 to the cyber

realm where cooperating human actors operate through remote or virtual embodiments [88-91]. As a result, the concept of C2 has outgrown its conventional physical context and has extended to the monitoring and coordination of virtual teams that operate in virtual realities against virtual adversaries. Nonetheless, these virtual acts, such as influence and cyber operations, have led to actual results [28, 91].

As common with any introduction of significant military technologies, the materialization of technology-centered C2 concepts led to the emergence of ground-, airborne, space-, and cyber-based defensive and offensive measures and countermeasures [92, 93]. Yet, the latent technological race between nations in the past decades overshadowed the fact that the battlegrounds of clashes between cultures exist in the rivaling minds and not on any physical or cyber terrain. The symmetric strategies of the 20th century that led to the proliferation of overwhelming mass destruction means were answered in the 21st century by asymmetric strategies that allowed technologically-disadvantaged nations to lessen the competitive advantage of technologically-superior nations [92, 93]. This shift led in turn to reactive development of counterinsurgency and counterterrorism doctrines in an attempt to recover the erosion of competitiveness [8, 92, 94, 95].

This gravitation toward technology-based C2 and its apparent effectiveness did not change the longstanding fact that C2 is profoundly a human-centered function conducted by humans that compete with other humans. Although the extensive training and the social pressure to think and display behaviors within strict structured computerized contexts, certain limitations of the computerized environment both overwhelmed and impaired the natural ability of human operators to adjust to change, survive technical malfunctions, handle complexity, reason, and make sense [11, 74, 96, 97]. In addition, these technological limitations have led to the evolvment of naturally-occurring practical drifts that enabled adjustment to environmental changes but induced operational risks that materialized in certain cases [98, 99].

Imperfections in communications and information systems put operators in doubt whether their information was updated and accurate and highlighted the need for specialized user interfaces for operators in combat environments or in command shelters [11]. Oversimplification of the battlefield's complexity, induced by technologically-tunneled thinking and amplified by groupthink, led in certain occasions to unexpected results due to lack of certain data and overwhelming abundance of others [100]. Even when this gap was identified and a corrective action determined, institutional and technological constraints led to prolonged development and deployment cycles [101]. Consequently, the adaptation of C2 procedures and technologies often lags behind the changing environments and limits the effectiveness of C2 in operations [11, 100, 101].

Organized Cognition

The symptoms listed above call for a revision in the way C2 is currently thought, applied, and technologically supported. This required shift in the paradigm of C2 is outlined briefly in the remainder of this paper and addressed in detail in an ongoing study on the concept of SA in Organizations [102]. For the purposes of this discussion, the notion of Organized Cognition (OC) is a thematic lens for illustrating the concept of C2 as an intentionally coordinated interplay between individual, social, and cultural instances of awareness, decisions, and actions within the military organizational context. Likewise other thematic lenses, the notion of OC is prone to false objectification and, for this reason, it has to be noted that the concept has no physical existence in itself and is introduced herein as an instrument of thought to highlight details that,

otherwise, could not be addressed clearly due to biases and deficiencies of the language. For clarity, the problem of false objectification is prevalent in the social studies and affects multiple concepts, such as Situational Awareness (SA) or Intelligence Quotient (IQ), that instead of pointers to the actual aspects of the phenomena are thought to be phenomena in themselves [12, 13, 46, 103].

The Construction of OC

The notional framework of OC stems from a phenomenological standpoint that analyzes C2 as subjective and inter-subjective experiences of human actors that interact within given cultural and professional contexts. As such, the departure point for understanding the construction of OC is the subjective experience of the constituted world [104-106]. The concept of World Constitution (WC) refers to the subconscious and conscious modes of conceiving the given world as a continuous flow of anticipated percepts that materialize to actual percepts and decay into recollections [104, 106]. Eventually, all anticipated percepts derive from recollections of actual or socially-inherited experiences, and for this reason, the constituted world is always a combination of semi-static and dynamic aspects of the actuality.

In many instances of the regular civilized life, the lifeworld, anticipated percepts materialize as envisioned to the extent that some actual percepts flow unnoticed and pass without recollection. On the other hand, anticipated percepts that fail to materialize as envisioned may lead to rupture of the WC and induce strong reactions. Consequently, the regularly-occurring WC of the daily life is contained and confined within the horizons of the known. The collection of all that is commonly known in a professional society or a culture is defined as the Natural Attitude (NA) or the Common Sense of that society or culture. While many aspects of the NA are visible to the dwellers of a particular culture, some aspects remain hidden and therefore unquestionable. Many basic problems in the history of mankind related to such hidden beliefs that were never questioned until surfaced to the collective awareness and formed the basis for a social change.

As noted, both WC and NA are structures of modes of knowing and meaning that contain semi-static and dynamic components. The dynamic aspect of the WC was described above as a flow of protentions that materialize onto the consciousness of the present time and then fade away into retentions of varying depths [104, 106]. The semi-static aspect of the WC and NA is an unnoticeable flow of concepts and meanings whose changes are evident only on a historical scale and even then only from a semantically-remote standpoint [14, 15]. As addressed in detail by Husserl in his investigation of the concept of logic, rational determinations are plainly derived from the NA of a specific discipline in the sense that a decision is determined to be 'reasonable' based on its congruence with the common sense [105, 107-110].

Likewise rational decisions and judgments, intuitive decisions derive from the WC and the NA but are made without deliberated reasoning [111]. Consequently, the acts of judgment and decision-making are based on the more foundational concepts of WC and NA. The natural living experience is unaware of the latent existence of the processes of WC and NA and for this reason both concepts are not intuitively grasped and are difficult to be identified [15, 112-115]. Therefore, the notion of OC refers to intentional individual and collective efforts to obtain unbiased knowledge of the semi-static and dynamic aspects of the constitution of the world and the natural attitude of individuals, societies, or cultures. Using the notion of OC as framework, it is possible now to re-address the previously mentioned concepts of Coup d'Oeil, Ace-factor, SA,

and OODA and handle them from a different perspective. This discussion is only an outline of a more detailed theoretical and methodological treatment of the subject [102].

OC and Coup d'Oeil

The concepts of Coup d'Oeil and the Ace-factor were coined to explicate the, otherwise unexplainable, ability of gifted individuals to promptly and effectively assess, understand, decide, and act in complicated situations. These concepts attributed eventual successes to the assumed existence of special human qualities which were objectified and labeled as Coup d'Oeil and the Ace-factor. As objective means proved unable to identify and measure these qualities, the frameworks of Coup d'Oeil and the Ace-factor cannot explain the phenomenon. Using the notion of OC, it is possible to explain the concepts of Coup d'Oeil and the Ace-factor as a natural ability to inhibit protentions, enhance the living experience of the present time, and reconstitute the world without heavy reliance on the NA. In other words, the WC of individuals who are gifted with Coup d'Oeil or the Ace-factor allows them to frame and reframe [116] their interpretations of the reality without complete reliance on the NA but with full awareness of its existence.

OC and SA

Early interpretations of the concept of SA identified it with the essence of the Ace Factor and associated it with the ability to track events and foresee occurrences in highly dynamic environments [35]. Owing to the frequent use of SA as a term, the concept was objectified and became part of the professional and the scholarly jargons to the extent that, instead of serving as a reference to the natural phenomenon, it became an object in itself for research and technological development [12, 43, 61, 62, 117]. Examining the evolution of common interpretations of SA [42, 118-121], it is evident that the underlying assumption of the concept became the existence of an ideal representation of the reality that its knowledge would result with correct decisions and actions in a timely manner. As a result, the concept of SA focused on the level of congruence between individual and prescribed representations of the reality within given contexts. The proliferation of SA-enhancing technologies and the inclination to measure SA performance amplified the reliance on framed representations and inhibited the ability to reframe.

Using the notion of OC, it is clear that the common interpretation of SA refers to the measurable ability to adjust the natural WC and operate within the NA through technological representations of the reality. Since the relationship between an actuality and its conception depends on the NA that shaped the conception, the concept of SA cannot transcend the NA and remains confined within its horizon [46]. In other words, SA models and measurements are unable to refer to and detect the ability to reframe, the crux of Coup d'Oeil or the Ace-factor, and focus instead on the level of adherence to the NA. Consequently, the common understanding of concept of SA seems to fall short in its attempt to explain, predict, and improve decisions and actions at the individual and the organizational levels.

OC and OODA

Compared to the concepts of Coup d'Oeil, the Ace-factor, or SA, the concept of OODA offers an accurate and complete model for decision and action in certain cases [102, 122]. Boyd captured, at least for some extent, the complex nature of the WC and the NA by referring to them as Orientation [51]. He also correctly described the need for awareness of the constituents of the WC and the NA in order to interact directly with the environment while avoiding biased views [51]. As such, OODA and its current tactical interpretation [31, 83, 84] emphasized the need for (a) unbiased interaction with the situation, (b) short decision-action cycles, and (c) decentralized organizations. Given his background and the NA of his time, Boyd's focus on fast actions and reactions is reasonable; yet, given his acquaintance with the works of Gödel, Polanyi, and Heisenberg, his motives for omitting the historical scale of the semi-static structures of NA remain unknown. The missing link between OODA and the concept of OC is the awareness of the unnoticeable flow of the NA and its powerful affect on the WC of individuals and societies. This relentless drift, as manifested in the daily life of virtually any organization, seems to be essential for understanding the root causes of the basic problems in C2 and attempting to resolve them.

Organized Cognition and C2

The discussion above outlined the notion of OC as intentional individual and collective efforts to obtain unbiased knowledge of semi-static and dynamic aspects of the constitution of the world and the natural attitude of individuals, societies, or cultures. From this vantage point, C2 is an iterative and concurrent process of organized cognition, unbiased evaluation of courses of action through interactive experimentation, and execution. As such, the notion of OC seems as an effective thematic lense for constructing more capable C2 systems that are able to support the entire range of current and future military operations. The remainder of this paper addresses potential areas of interest where the non-objectified notion of OC could contribute to future research and implementation of C2 systems [102].

OC and C2 in Influence Operations

As discussed, current doctrines and procedures find difficulties in coping with asymmetric, irregular, soft power, and influence operations. Given the unmitigated momentum of the military NA it is obvious that organizational awareness, decisions, and actions will lag behind the invisible changes of naturally-occurring and contemplated influence operations. While an OODA-oriented worldview may initiate and react very effectively to abrupt changes in the world order, it is practically blind to slow paced threats [93, 123-125] and harmful internal drifts [18, 98, 126]. Therefore, future military training and C2 systems should pursue OC skills and capabilities in order to initiate, execute, anticipate, and counteract future influence operations that may lead to or affect conventional conflicts [6, 92, 95, 127-129]. Gooch [27] claimed that while historical awareness of ideologies and doctrines may, for some extent, enable the prediction of future behaviors of societies, this is not the best use of such knowledge mainly because "linear development from the past into the future is often unreal" [27]. Alternatively, he stressed, strategic historical analyses could help determining what may be unthinkable in certain societies and, therefore, could serve as a basis for a strategic advantage. The OC approach, in some form and fashion, is already manifested in the operations of virtually all intelligence

organizations; yet, it is essential to add this capability to the skill set and arsenal of military organizations [6, 92, 95, 127-129].

OC, Development, and Implementation of Technologies

The notion of OC could also lead to more effective development and implementation of technologies. As noted, current C2 technologies fall short in their relevance and availability due to the inability of existing implementation processes to maintain high rate of change as the occurring events. OC, when applied correctly, could lead to a new breed of developers, who experienced combat operations prior to their development assignment [130], and development processes that emphasize progress through experimentation instead of overly-structured and elaborated processes [131]. The frustration [11, 97, 101, 132] from ineffective development of technologies [133] and unaffordable use of resources [134] had already moved to this direction [130], but without an appropriate understanding of the NA in military organizations such attempts may remain hopelessly misdirected [102].

In addition to the need to cope with higher rates of environmental change, the notion of OC should be applied in perceiving and anticipating slow changes within organizations and in their competitive landscape that may inflict operational and technological surprises [18, 100, 126, 135, 136]. The application of OC-inspired processes could lead to better scrutiny and awareness of deficient paradigms that lead to the development and implementation of unfit C2 systems.

OC and the Design of Future C2 Systems

The design of future C2 systems should take into account several aspects of OC. A review of existing C2 systems may lead to a conclusion that certain system concepts are incompatible with the natural processes of world constitution and may disrupt the ability of operators to develop, in parallel and independently, their own unbiased world constitution. This deficiency is of utmost importance as the current state in C2 systems may force the unmitigated NA on all the system's users and inhibit their ability to avoid it and enlighten others. Furthermore, in the case of technological failure, operators may be unable to recover as their own world constitution became incomplete or wrong. Other C2 systems may suffer from the inability to frame and reframe structures of meaning while remaining in concert with other interpretations of the same reality. This situation may lead to the proliferation incompatible C2 systems that lack the power of unity and sharing. Last, some C2 system concepts are not context-sensitive in the sense that they were designed and implemented in a one-size-fits-all approach. Such approach falls short in providing specialized context-situated tools and visualizations to specific users and for this reasons may inhibit their effectiveness instead of enhancing it [102].

Summary

This paper introduced the notion of OC as a thematic lens that integrates and extends existing concepts associated with C2. The notion of OC was refers to intentional individual and collective efforts to obtain unbiased knowledge of semi-static and dynamic aspects of the constitution of the world and the natural attitude of individuals, societies, or cultures. It would be

both appropriate and beneficial to conclude this paper General (Ret.) McChrystal's advice to his officers in his introductory guidance to COIN operations:

Learn, share, and disseminate information and intelligence quickly. Question your assumptions. Do not think that you have it 'right'. If a tactic works this week, it may not work the next. . . . the most effective asset we have is a thinking, well-trained Soldier, Sailor, Airman, or Marine [6].

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“Collective C2 in Multinational Civil-Military Operations”

Organized Cognition: Theoretical Framework for Future C2

Research and Implementation

Quebec City, QC, Canada

June 21-23, 2011

Ronnen I. Paytan

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Command and Control



Information Denial	Information Influence	Information Corruption	Information Destruction			
Operations Security	Deception	Psychological Operations	Electronic Warfare	Cyber Warfare	Physical Destruction	
Cultural Influence Operations	Diplomacy	Other Influence Operations	Covert Operations	Limited Conflicts	Large Scale Campaigns	Total Wars

Historical Perspective: C2 and the Human Factor (1/2)



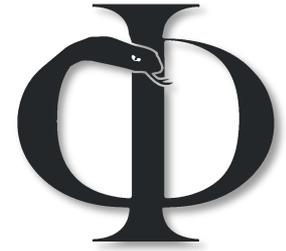
- **Coup d'Oeil**

- An essential virtue in battle champions: “**quick recognition of a truth that the mind would ordinarily miss or would perceive only after long study and reflection**” (Clausewitz, 1832) or “**seize, as it were, with a glance, the advantages or disadvantages which may arise from the situation of ground or troops, and to single them out from all other objects**” (Bismarck, 1855).
- There is no deterministic way, other than **testing commanders in battle**, to identify a-priori individuals who possessed Coup d'Oeil.

- **Ace Factor**

- A quality possessed by a “tiny minority [who] tends to **run up large scores at the expense of the less gifted majority** (Spick, 1988).
- Approximately **40% of all aerial combats** from WWI to the end of the Korean conflict were **won by roughly 5% of fighter pilots** (Spick, 1988).
- Nearly **80% of all lost aerial combats** in Southeast Asia between 4/3/1965-7/27/1967 were **associated with pilots unaware of being attacked** (Attincilo, 1967, 1968, 1969).
- There is no deterministic way, other than **exposing pilots to air fights**, to identify a-priori individuals who possess the Ace-factor.

Historical Perspective: C2 and the Human Factor (1/2)



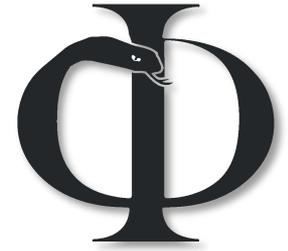
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Historical Perspective: C2 and the Human Factor (2/2)



- **Situational Awareness (SA)**

- Coined as a concept aiming to explain **the essence of the Ace Factor** (Spick, 1988).
- Canonized as the measurable ability associated with the “**perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future**” (Endsley, 1988).
- Extended from aviation to general tasks and from the individual to the communal levels and has been **considered a key factor of effective C2**.
- Considered **ill-defined concept** that “**does not point to or bring extra psychological constructs beyond those already available**” (Patrick & Morgan, 2010).

- **Observe, Orient, Decide, Act (OODA)**

- Stemmed from the **fast decision making cycles** required in **combat aviation** and evolved later to the realm of **C2** (Boyd, 1986, 1987, 1996).
- Winning requires **execution** of **OODA** loops **faster** than the **competition** thus forcing it to **react** while **denying** it **sufficient time** for **planned** actions (Boyd, 1986, 1996).

Historical Perspective: C2, Technology, and the Human Factor



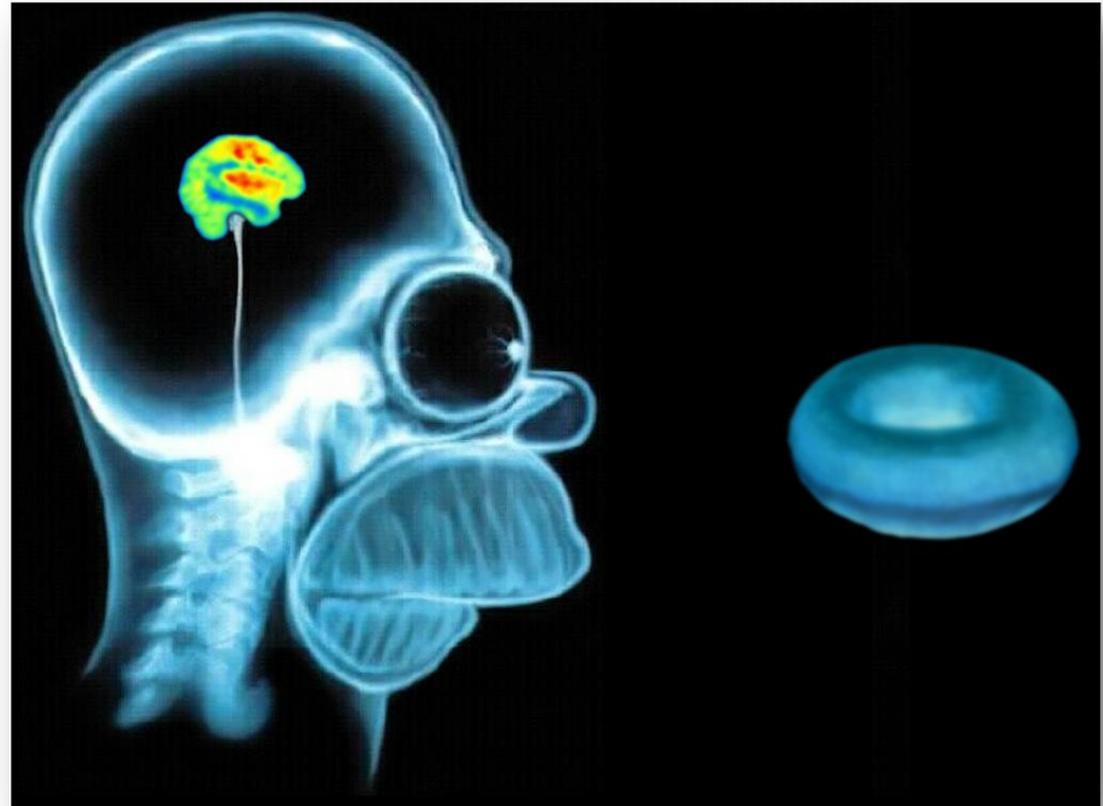
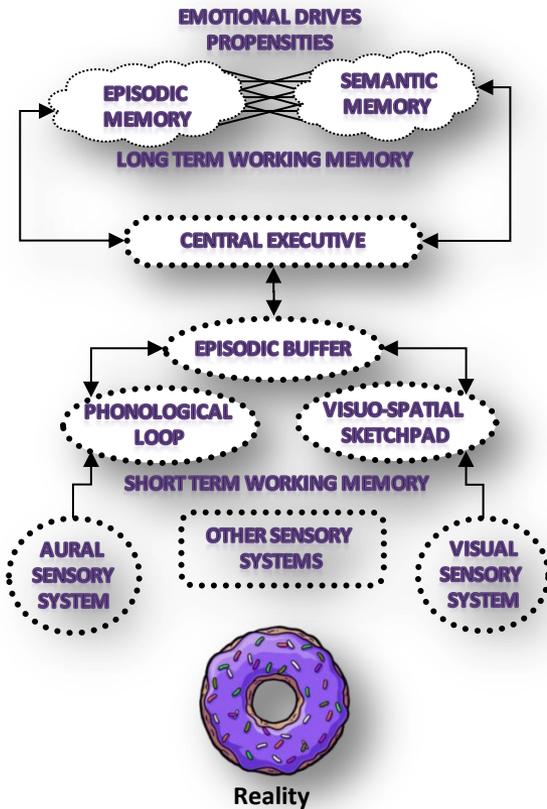
- Due to the professional tendency to think and display behaviors within strict structured contexts, computerized environments overwhelm and **impair** the natural ability of human operators to **adjust** to changes, survive technical malfunctions, handle complexity, reason, and make sense.
- The **variety of embodiments** (natural, remote, or conceptual) require **specialized user interfaces** for operators who are physically located in combat environments or interact remotely with command shelters
- **Imperfections in communications** and information systems put operators in doubt whether their information was **updated and accurate**
- **Oversimplification** of the battlefield's complexity, induced by **technologically-tunneled thinking** and amplified by **technologically-enforced groupthink**.
- Institutional and technological constraints led to **prolonged development and deployment cycles**, thus, the adaptation of C2 procedures and technologies often **lags behind** the changing environments and limits the effectiveness of C2 in operations

Organized Cognition



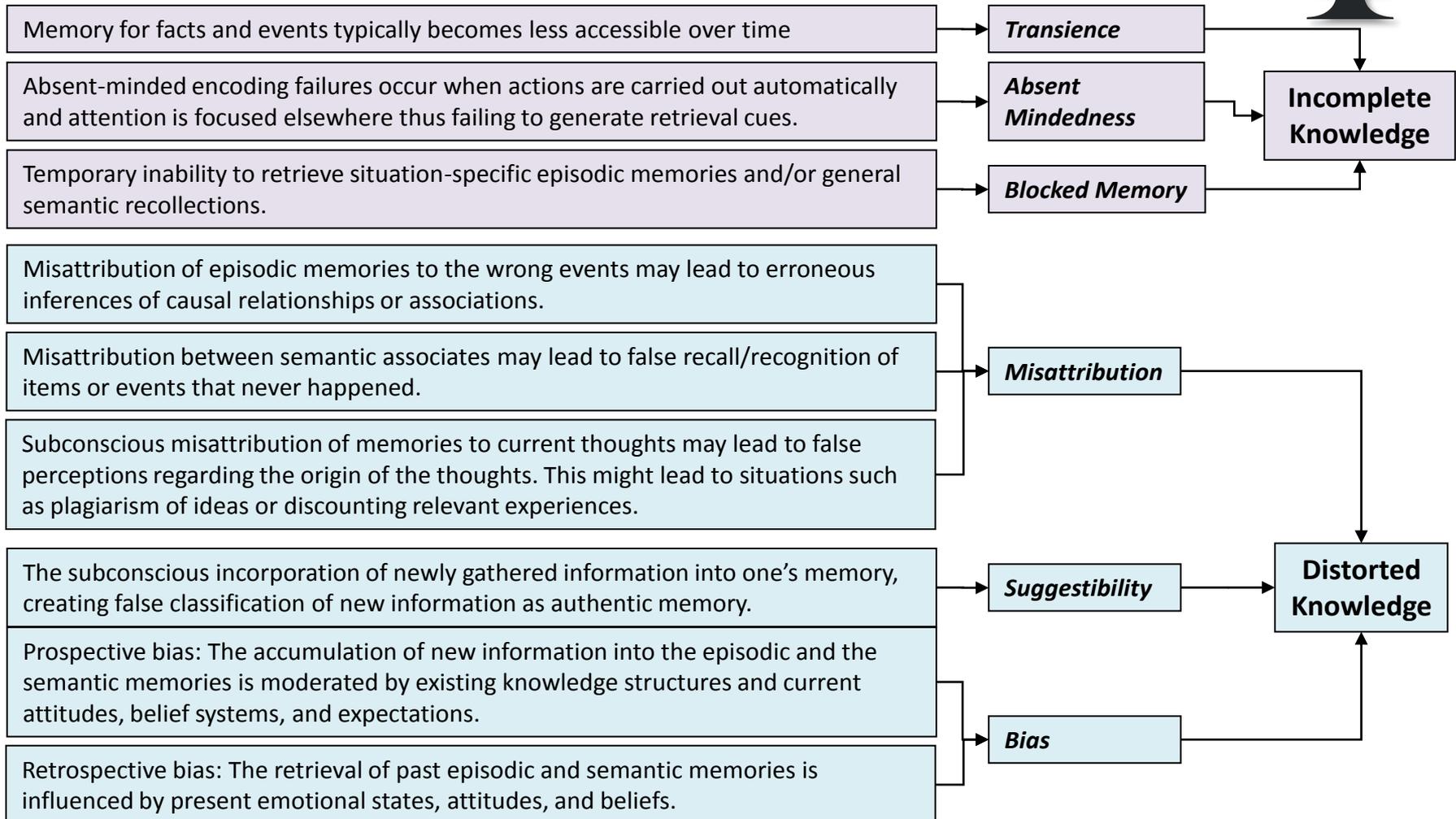
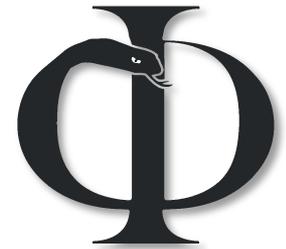
- The notion of **Organized Cognition (OC)** is a thematic lens for illustrating the concept of C2 as an intentionally coordinated interplay between **individual, social,** and **cultural** instances of **awareness, decisions,** and **actions partially-mediated** by **technology** within the (military) organizational context.
- OC is based on two key concepts focused on the **subjective** experience
 - **World Constitution**
 - **Natural Attitude**
- OC refers to **intentional individual** and **collective** efforts to **obtain unbiased knowledge** of **semi-static** and **dynamic** aspects of the **constitution** of the **world** and the **natural attitude** of individuals, societies, or cultures.

Equivalents of Retention and Protention



Model inspired by Baddeley, A.D., D. Chincotta, and A. Adlam, *Working memory and the control of action: Evidence from task switching*. *Journal of Experimental Psychology: General*, 2001. **130(4)**: p. 641-657. Baddeley, A.D. and J.D. Larsen, *The phonological loop unmasked? A comment on the evidence for a "perceptual-gestural" alternative*. *The Quarterly Journal of Experimental Psychology*, 2007. **60(4)**: p. 497-504. Baddeley, A.D. and R.H. Logie, *Working Memory: The Multiple Component Model*, in *Models of working memory: Mechanisms of active maintenance and executive control*, A. Miyake and P. Shah, Editors. 1999, Cambridge University Press: Cambridge, UK. p. 28-61.

Limitations of Retention and Protention

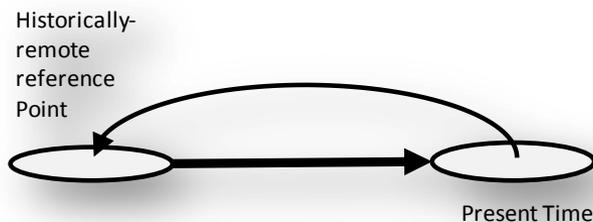
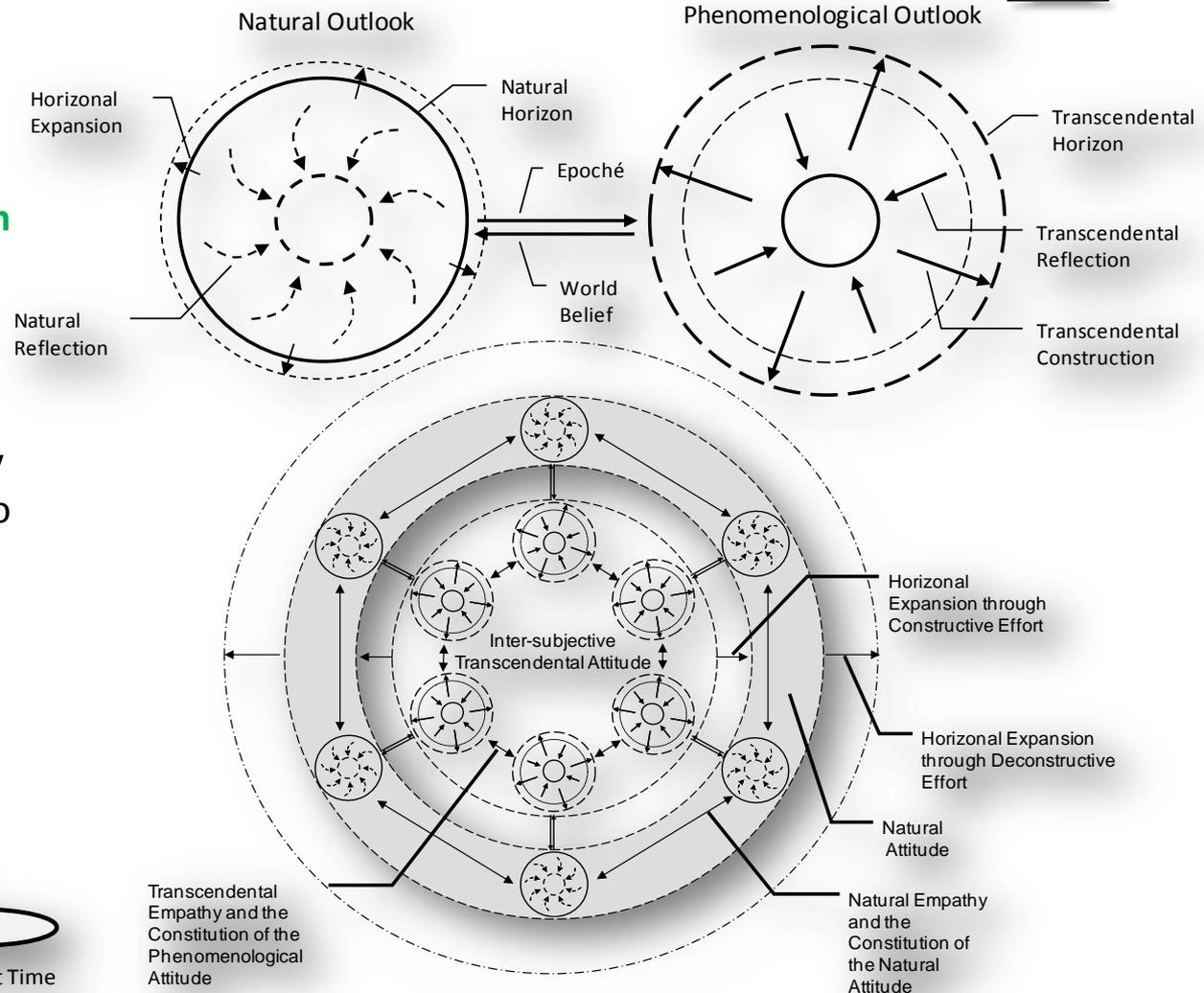


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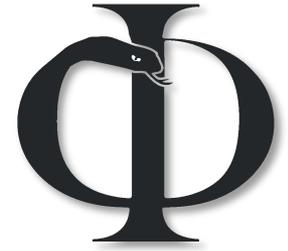
Natural Attitude



The regularly-occurring WC of the daily life is contained and confined within the horizons of the known. The **collection of all that is commonly known in a professional society or a culture** is broadly referred to as the **Natural Attitude (NA)** or the Common Sense of that society or culture. While many aspects of the NA are visible to the dwellers of a particular culture, some basic aspects remain unnoticeable and therefore unquestionable.



OC , Coup d'Oeil, and the Ace Factor

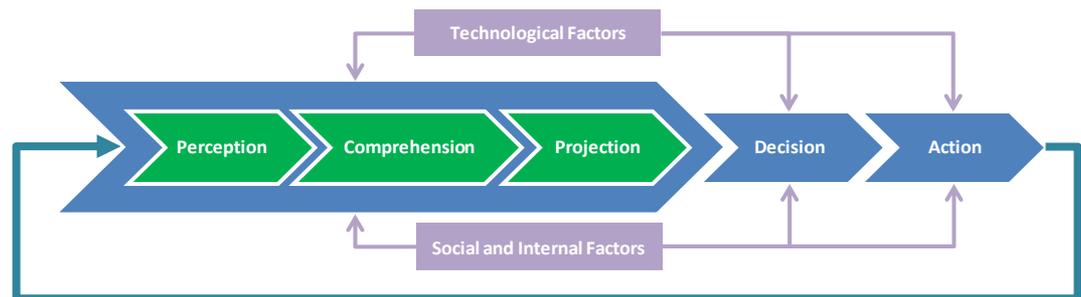


- Coup d'Oeil and the Ace-factor **cannot** explain the phenomenon of **exceptionally gifted operators**.
- Coup d'Oeil and the Ace-factor may refer to a natural ability to **inhibit protentions, enhance** the living experience of the **present time**, and **reconstitute** the world without heavy reliance on the NA.
- Exceptionally gifted operators may **frame** and **reframe** their WC **without** complete reliance on the **NA** while being aware of its existence.
- Further research required.

OC and SA



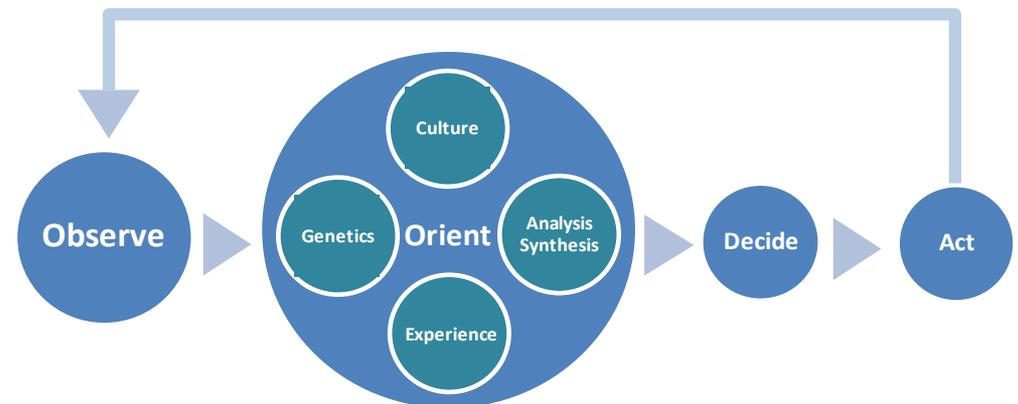
- SA started as the **essence** of the **Ace Factor**
- SA assumes existence of an **ideal representation** of a **reality** that its knowledge would support correct decisions and actions in a timely manner.
- SA focused on the level of **congruence** between **individual** and **NA-based** framed **representations** of the **reality** within **given contexts**.
- The common interpretation of SA refers to the **measurable ability** to adjust the **natural WC** and **operate within** the **NA** through **technologically-supported representations** of the **reality**.
- Since the relationship between an **actuality** and its **conception** depends on the **NA** that shaped the conception, the concept of SA **cannot transcend** the NA and remains **confined** within its **horizon**.
- Further research required.



OC and OODA



- OODA emphasized the need for
 - **unbiased interaction** with the **situation**
 - **short decision-action cycles**
 - **decentralized organizations**
- Boyd's motives for **omitting** the **historical scale** of the **semi-static** structures of NA remain unknown.
- The **missing** link between OODA and the concept of OC is the **awareness** of the **unnoticeable** flow of the **NA** and its powerful affect on the WC of individuals and societies.
- Further research required.

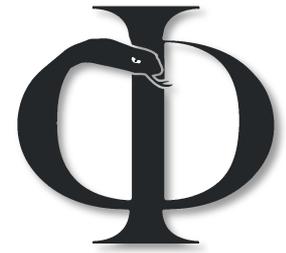


OC in the Development and Deployment of C2 Technologies (1/2)



- How we do it today?
- **Outside** the operational NA
 - Planned by **non-operators**
 - Triggered by **technological** and **operational opportunities/necessities**
 - **Slower** than the events
 - **Not** always **relevant**
- **Within** the operational NA
 - **Sporadic** changes triggered by **operational necessities**
 - Sometimes **following** the events and **relevant**.

OC in the Development and Deployment of C2 Technologies (2/2)

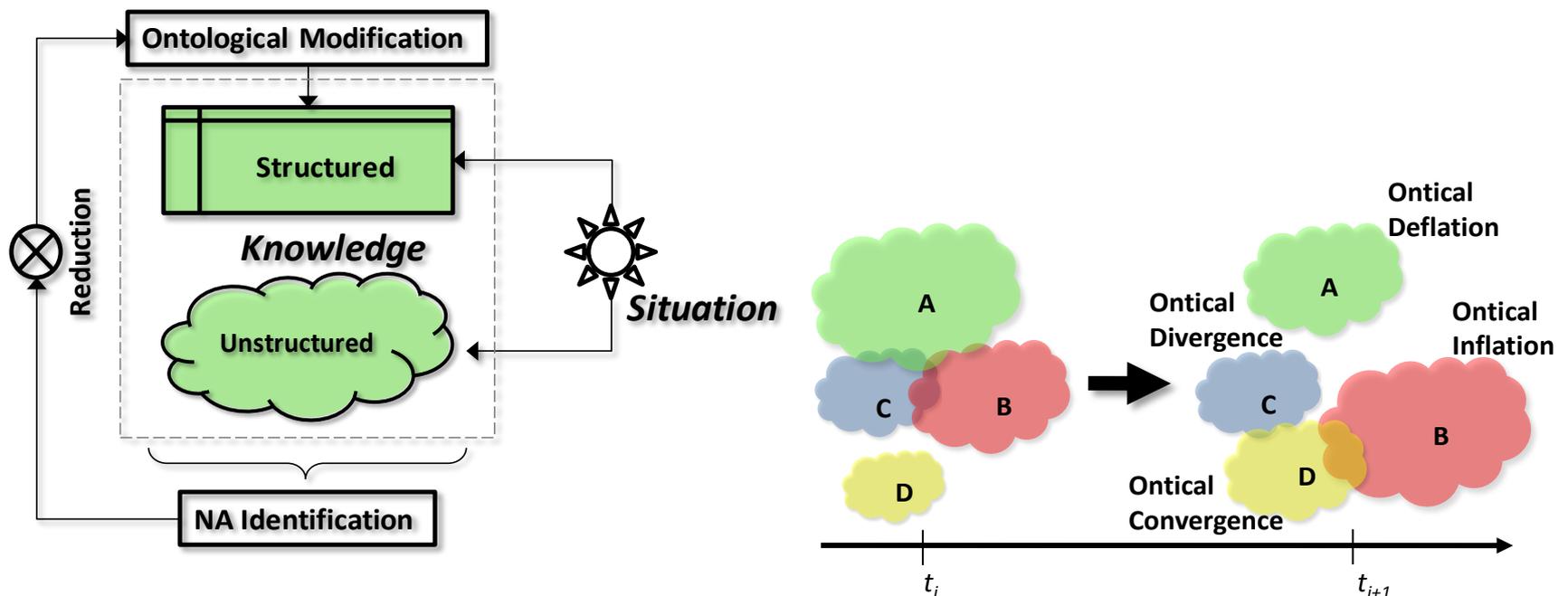


- How can we do it tomorrow?
 - Maintain **higher rate** of **change** closer to the **occurring** events by operating concurrently **within** and **outside** the operational NA.
 - Apply managers, designers, and developers who experienced **operations** prior to their **development** assignment.
 - Development processes that emphasize **progress** through **experimentation** instead of speculative, overly-structured, and elaborated processes.
 - Gain understanding of the **NA** in **military organizations**.
 - Perceive and anticipate **slow changes** within organizations and in their competitive landscape that may **inflict** operational and technological **surprises**.
 - Further research required.

OC and the Design of Future C2 Systems (1/2)



- Support **mitigation** of the **NA**
- Support multiple structures and semi-structures of meaning while remaining in concert with other interpretations of the same reality
- Further research required.



OC and the Design of Future C2 Systems (2/2)



- **Compatibility** with **natural world constitution**
- **Specialized context-situated** tools and visualizations
- **Recovery** after **technical failure**
- Further research required.

Natural Embodiment – Disruptive Display

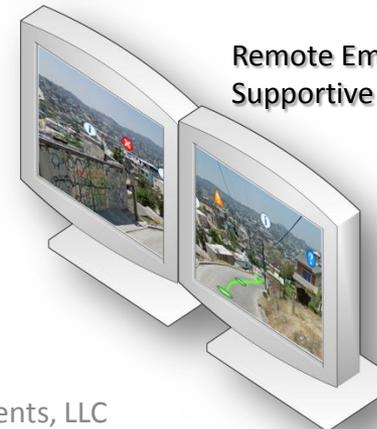


Natural Embodiment – Immersive Display

Remote Embodiment Disruptive Display



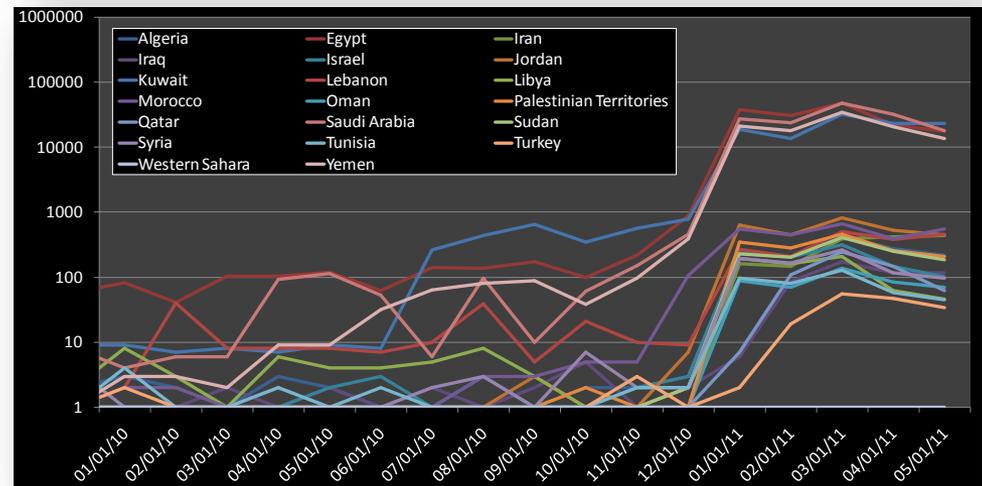
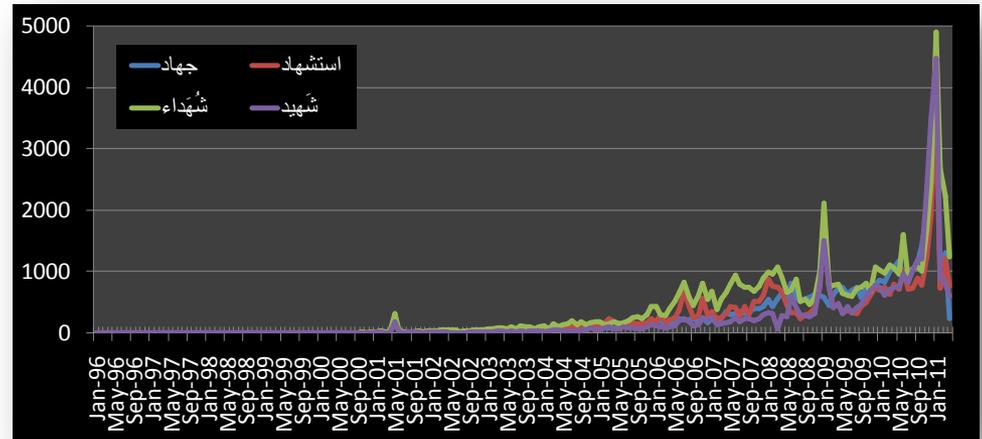
Remote Embodiment Supportive Display



OC in the Cyberspace

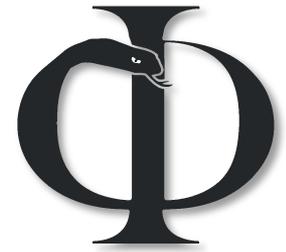


- The affect of the **NA** on the **Internet**
 - The **conception** of **freedom** and **privacy**
 - The **conception** of **access** to the **body** of **knowledge**
 - **Social networking** and **virtual life**
- The affect of the **Internet** on the **NA**
 - **Influence** and **counter-influence** operations
 - Data **manipulation** and **corruption**
 - The **power** of the indexing and search **services**
- Further research required.

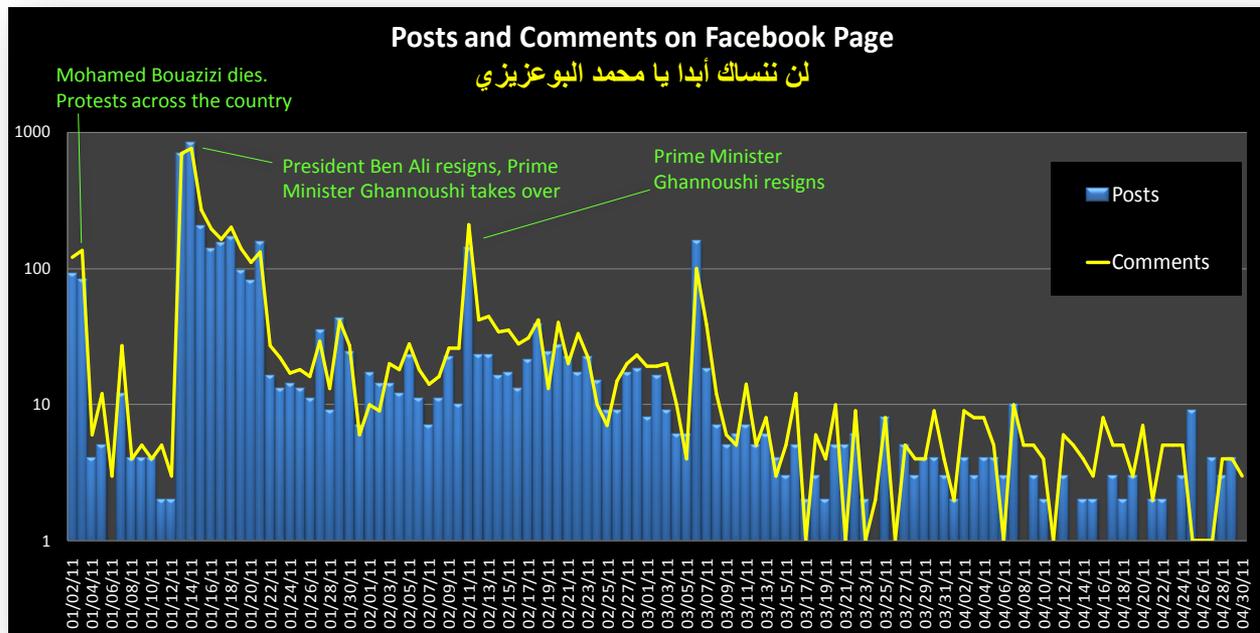


Morozov, E., The Net Delusion : The Dark Side of Internet Freedom. 2011, Philadelphia, PA: Perseus Books Group.

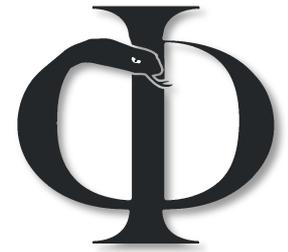
OC and C2 in Influence Operations (1/2)



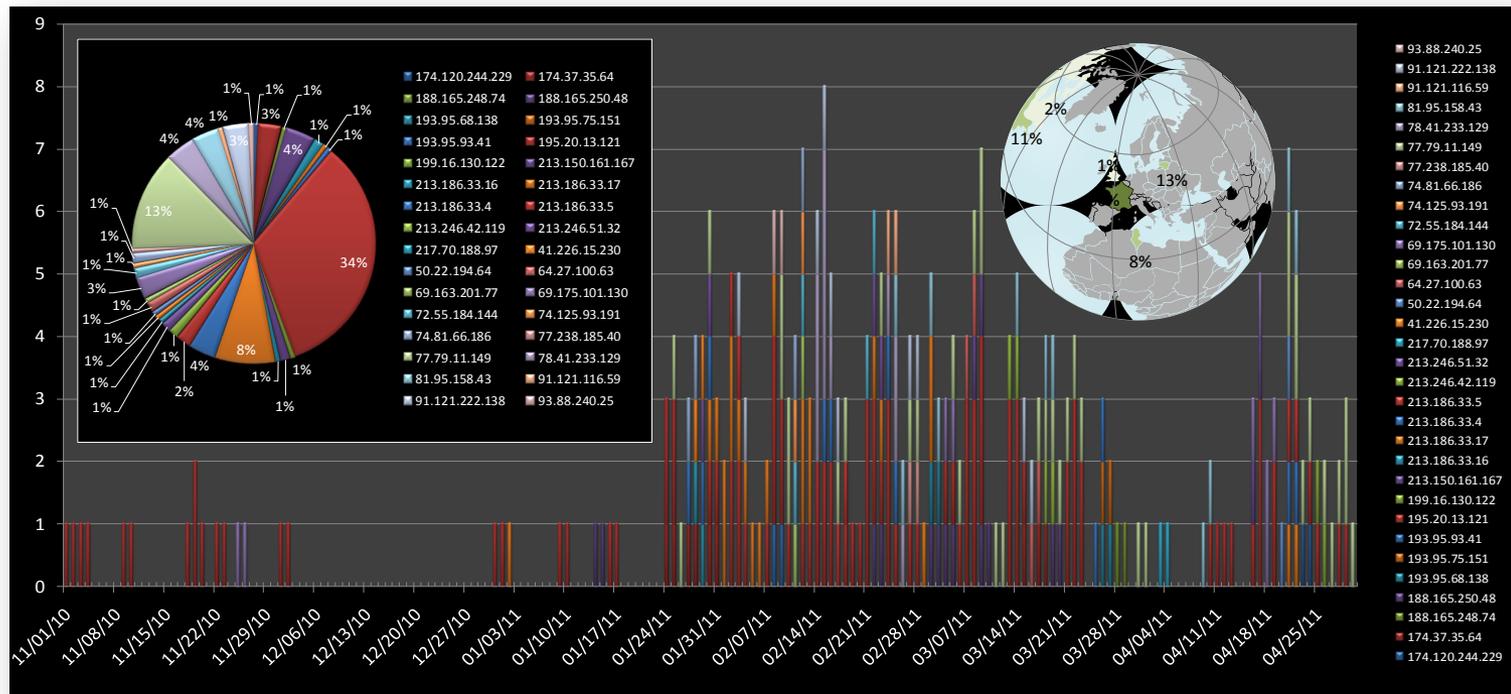
- **Mitigate** the **military NA** to ensure that organizational awareness, decisions, and actions **do not** lag behind the invisible changes of naturally-occurring and contemplated influence operations.
- OODA-oriented worldview is practically blind to **slow paced threats** and harmful **internal drifts**.



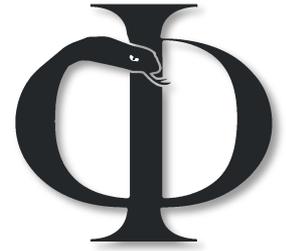
OC and C2 in Influence Operations (2/2)



- Initiate, execute, anticipate, and counteract **future influence operations** that may lead to or affect conventional conflicts.
- Conduct strategic **historical analyses** to determine what may be **unthinkable** in certain societies and could serve as a basis for a **strategic advantage**. Further research required.



Summary



- The notion of Organized Cognition (OC) refers to **intentional individual** and **collective** efforts to **obtain unbiased knowledge** of **semi-static** and **dynamic** aspects of the **constitution** of the **world** and the **natural attitude** of individuals, societies, or cultures.
- The notion of Organized Cognition (OC) enables
 - Improved **integration** and **extension** of existing C2-related concepts and constructs.
 - Awareness and possible mitigation of **basic problems** in C2 and C2-related concepts.
- Further **research required**.

Philosophical Instruments, LLC



Thank You!

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