The OODA Loop: WHY TIMING IS EVERYTHING

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Warfare is undergoing a shift of a historic magnitude. As countries invest more heavily in technology for the battlefield, countries without AI in their arsenal will find it increasingly difficult to compete.

It may seem like a stretch to claim that AI will soon become a prerequisite for military success, but the nature of how AI will reshape the battlefield makes this prediction all too real. While humans will continue to provide high-level input, machines will take over the decisions involved in planning and execution. With this new development brings a new type of conflict in which actions and reactions occur at near-instantaneous speeds, and the time required for the OODA loop—the decision cycle of orient, observe, decide, and act—will be reduced to nearly zero.

A fast, efficient decision-making process has long been recognized as crucial to the success of military operations. Accordingly, the concept of the OODA loop has been a key part of U.S. military strategy for roughly 70 years. Coined by United States Air Force Colonel John Boyd during the Korean War, this idea states that decision-making occurs in a four-step loop.

The first step, observation, involves an entity observing their surroundings and any occurring events or changes. For example, a pilot may see or hear an approaching plane.

In the second step, orientation, the entity processes the observed information, feeding it through their own previous knowledge and experience. In the orientation phase, the pilot will ask themselves such questions as "Is the approaching plane an enemy plane or a friendly non-combatant?" and "Do I have a clear shot?"

The third step, deciding, is when the entity settles on what they believe to be the best course of action, given what they have observed and analyzed, such as the pilot choosing to open fire on the other plane. The final stage of the loop, act, is taking the action that has been decided upon by the entity.

Boyd had observed that American F-86 aircraft were winning a majority of their dogfights against the Russian-made MiG-15s, despite the latter being stronger and more maneuverable aircraft. Despite their disadvantages, the F-86s provided a wider field of vision than their Russian counterparts, along with hydraulic controls that were easier and quicker to use. Boyd concluded that these advantages were key to the American victories, as they allowed the American pilots to shorten their OODA loop in the observing and acting phases. This strategic opportunity not only allowed the American pilots to act/react more quickly with better information, but also to outpace and thereby disrupt the OODA loops of their adversaries.

As Harry Hillaker, chief designer of the F-16, wrote:

The key is to obscure your intentions and make them unpredictable to your opponent while you simultaneously clarify his intentions. That is, operate at a faster tempo to generate rapidly changing conditions that inhibit your opponent from adapting or reacting to those changes and that suppress or destroy his awareness. Thus, a "hodge-podge" of confusion and disorder occur to cause him to over- or under-react to conditions or activities that appear to be uncertain, ambiguous, or incomprehensible.

In essence, the faster the OODA loop, the greater the advantage a military force can have over its opponents.

Currently, however, there are limitations on the OODA loop. Humans cannot go through these steps instantly. Observing one's surroundings, processing information, making decisions, and taking action require precious time, even under ideal conditions, so there is a limit on how short the OODA loop can become. Human processing and reaction time can vary based on outside factors such as fatigue, blood glucose levels, emotional state, and more. These factors can add significantly to the time it takes to complete an OODA loop and thus lead to poorer outcomes in decision-making. For example, one widely publicized study found that judges' likelihood of granting parole correlated most strongly with how long it had been since they had last eaten[1]. Furthermore, a human can typically hold, at most, only a few variables at one time in conscious thought. Choosing focus can often affect survivability: How many pilots have been so focused on getting their own "kill" that they were shot down by an unseen attacker? Despite how essential human cognition, reaction time, and decision-making are to combat, these processes are all imperfect and easily compromised.

Machines suffer from none of these flaws. They can process information and react to it nearly instantaneously. Machines are also less easily impacted by outside factors. AI can take in and process wider ranges of information than any human being ever could—holding thousands of variables in "conscious" thought at once—and then use that information to make to make logical and tactical decisions that they can execute almost instantly. Furthermore, machine intelligence can take the form of easily replicated software and run on inexpensive hardware, allowing deployment at scales sufficient to essentially enable an infinite supply of tactical, operational, and strategic decision-making.

Imagine an AI-powered autonomous drone rather than a human pilot in the dogfight described above. The observation step is about the same as a human; the autonomous drone uses different senses to "observe" the approaching plane, but the basic idea is the same. The orientation and decision phases, however, look very different. Rather than the limited information that a human may know and recall at any given time, the drone, in its orientation phase, has access to encyclopedic quantities of knowledge that it can analyze almost instantly. Using this analysis, it can then rapidly but accurately select the best course of action. In this way, the drone can move from noticing a plane to concluding it is an enemy that poses a threat to deciding it needs to be shot down, all with a speed beyond human capabilities. Its focus can be as divided as necessary. However, if another enemy combatant approached from behind while the drone was attempting to fire on the first plane, it could undergo another OODA loop to take evasive maneuvers without hesitation or distraction.

Many are still uneasy at the prospect of allowing AI to make the decision to fire. It is true that AI can speed up the OODA loop, even if introduced only partially into the decision-making process. It can augment intelligence by analyzing a vast quantity of data, boiling it down, and presenting it to humans in a simplified format. In this way, AI can give humans all the information they need to make optimal decisions while still leaving ultimate agency in their hands. Due to the speed of machines and the volume of information they can handle, the fastest—and therefore necessary—option will eventually be to remove humans from the loop entirely.

AI is not just a tactical advantage; sooner or later, it will become a necessity. Nations such as China, Russia, and many others are already investing heavily in AI. These countries will be making use of machine learning to tighten their OODA loops, regardless of whether their rivals do the same. Greater reliance on AI software is the only way to survive this new paradigm of warfare.

[1]*Danziger, Shai, Jonathan Levav, and Liora Avnaim-Pesso. "Extraneous Factors in Judicial Decisions." Proceedings of the National Academy of Sciences of the United States of America 108.17 (2011).*