[MUSIC PLAYING] The Clausewitzian chess game started as a program for DARPA.

MIT Lincoln Laboratory wanted to develop a method for analyzing principles of war strategy that incorporated realistically messy aspects of warfare.

We had to figure out how to model this problem so that we could study how to balance flexibility versus predictability of a force, and distributed coordination versus centralization.

The result was Clausewitzian chess.

This effort was motivated by DARPA's larger effort to refine the concept of Mosaic Warfare, which looks at technology and capabilities as adaptable and pluggable pieces.

A mosaic approach enables a force to adapt its strategy mid-mission, substitute components after a loss, and deny the opponent the ability to predict your intent.

An interesting source of challenge is finding the most effective ways to combine or compose pieces for a given mission, even before you know all the details of that mission.

That's something you'll be able to explore in our implementation of the game.

The Clausewitzian chess game is based on ideas laid out by Carl Von Clausewitz, a Prussian general who wrote military theory in the 1800s, and that students in war colleges still read today.

Clausewitz discusses three key ways in which real war differs from ideal war-- fog, friction, and chance.

Fog is the idea that you don't necessarily know everything about your opponent's forces, or even your own.

Friction is the idea that things don't necessarily work the way you want them to or expect them to.

Orders are not followed instantly or exactly.

Chance is the idea that even without fog or friction, the outcome of your actions is still unpredictable.

These principles are incorporated into our game in various ways.

For example, you can't see the whole board at once, so you don't necessarily know what your opponent's pieces are.

And pieces don't necessarily do what you tell them to do.

There may be turns where you just can't move your knights. Another important concept is asymmetry.

In war, you're never trying to achieve the same thing as your opponent, and you don't necessarily know exactly what your opponent is trying to achieve.

In Clausewitzian chess, unlike in classical chess, you get randomly assigned a goal and you don't know exactly what your opponent's goal is, though you might infer it from their actions.

For example, the goal could be king capture or largest material advantage for three check chess.

The goal of this project was to develop an environment to study how people react to fog, friction, chance, and asymmetry situations where they're not used to encountering them, and we selected chess as a baseline environment rather than a more realistic war game for a few reasons.

It does not type after a particular time period, and therefore eliminates bias based on historical knowledge, and a lot of people, particularly in the military are familiar with chess, making training easier, but also emphasizing to them how much tactics can change, even when a little bit of fog or friction are introduced.

The data collected from studying how people play Clausewitzian chess will be used to determine what kinds of tactics and organizational structures work when you have different amounts of fog and friction, to teach people how to think differently in a context that is realistically messy, and to inform the design of future decision making gains.

We also wanted to study how machines could play this game.

Machine learning and artificial intelligence methods typically struggle when the costs and benefits of an action are delayed in time or obscured, such as what happens when fog and friction are involved.

However, there are enormous potential gains for creating automated tools to guide human decision making in uncertain situations.

A big challenge of Mosaic Warfare is ensuring that the added flexibility of the force confuses the enemy or that it confuses your own force. As you try the game, think about how its lessons do or do not translate to real world decision making.