Ladies and gentlemen,

we are living in an uncertain world – this word is true with respect to many aspects. It is uncertain in terms of probabilities – no one can tell how the future exactly will look alike. But it is also uncertain because we still face violence, terrorism and war in many regions of this world.

Since ancient times, the nature of war has not changed. As Clausewitz put it, war is conducted as a means to make the opponent give up his own will and act like we want him to do. And - as he concluded logically – once you decided to fight, you have to apply all forces up to the ultimate level of violence to achieve your goals.

Even though its nature has not changed, the goals of modern wars have. In ancient times we fought for territories or resources. The reason is pretty simple: the economies strongly depended upon resources like metals, coal or oil and a large territory guaranteed sufficient supply, thus assuring the wealth of a nation.

However, the needs of modern economies changed dramatically. Information and knowledge are their very basis nowadays. Still there is classical war fighting but to the better part, modern wars turned to be a battle for information and knowledge.

But there is a principle difference:

Once you take away resources or territory, your opponent will not be able to use them anymore. Information instead can be shared without losing quality by simply copying it.

Hence, for the goals of modern wars you face a twofold problem: make your opponent release his information and secondly, prevent him from using it himself. But how can someone be held from using an information he already has and knows of?

A first answer could be: destroy all copies of the information except for the one you possess. But the solution is not that obvious: Often you do not know how many copies exist and where they are. Thus, a more sophisticated method is needed to disable the power of specific information. One means is to discredit the information and to blur its contents by embedding it into a mesh of untrue statements and alternative facts.

How could this be done? For an answer we have to look a little bit deeper into the concepts of information and truth.

The term "information" has many facets and definitions. One of the simplest ones reads "data that contains something new for the recipient". Consequently, the term "information" is often used as a synonym for "data". E.g. "information processing" is then mainly a processing of data.

Here is how a simplified data processing procedure works:

A data acquisition unit (DAU), i.e. a sensor, is used to receive signals from the environment (the raw data). Already at this point it is important to mention that the DAU filters data since sensors typically cover only a limited range within a spectrum of values. The raw data thus already processed by the sensor is fed into a Data Processing Unit (DPU) which generates some output called "information" via some kind of output device. As a result, the information is processed at least two times and may be the output device adds another step by certain restrictions.

Let us now transfer this simplified scheme to living beings, e.g. humans.

Here is our sensor suite, known as the five senses seeing, listening, smelling, tasting and touching. Some pretend to have a sixth one but I didn't find an icon for that so I neglected it. And as we said, our sensors are limited in range and spectrum: we cannot see any kind of electromagnetic radiation, we do not hear all frequencies of air waves, we do not smell every substance and so on. This input is transferred via our nerves to a 1.2 kilogramm biological data cruncher which processes this data in unparalleled speed and complexity. And the output is a full-HD, 3D, true-color, stereo model of the world that surrounds you. We all are running a wide-scale model of the world in nearly real-time. This is virtual reality at its best and it has been invented not today but hundreds of thousands of years ago.

How does the data cruncher work? This is still under examination, however a simple algorithm can be identified that seems to be implemented. It should be mentioned that our data cruncher is still running on operating system 1.01 – no update available so far and only few software patches. So the algorithm reads:

1. Incoming data from the sensor suite are true.
2. Exception: if incoming data produce severe contradictions in the model, replace by internal data.

For OS 1.01 this made a lot of sense:

imagine you encounter a sabre tooth tiger. It would be no good idea to sit back and try to analyze whether this could be an illusion, created by a concurring tribe intending to keep you from its territory. It would be much better to take immediate action.

However, living in a world with limited resources, a being cannot afford to invest large amounts of energy in something which is obviously only a failure of the sensor suite. Thus, false data are neglected, and this means: we do not see the world how it is but how we think it should be.

We are the descendants of those who ran or fought and the same schemes are still working within us, all others have been eaten.

This simple algorithm is responsible for the fact that our senses can be cheated so easily. The encounter of an ancient operating system with modern technology will therefore create an awful lot of problems. One of them is this one: how can we tell

true data from false, when everything coming in via our sensors is true? And remember: there is no other way for input to the data cruncher except for the five senses so far.

By the way: the German word for perception is "Wahrnehmung". Its direct translation would read "taking for true".

What is truth? In philosophy, there are three major theories of truth:

1. the theory of correspondence,
2. the theory of consistency, and
3. the theory of consensus.

What is behind that?

The theory of correspondence states that a fact, a statement or a hypothesis is true when there is a corresponding object in reality, or as the philosophers say, in the ontological background. This is how engineers or physicists work: they create a theory and they look for the correspondence in the real world. Typically, this is an iteration: you make an observation, create a hypothesis, design an experiment, alter your hypothesis depending upon the outcomes and so on until your hypothesis fits to your observations. This could be a time-consuming activity, not appropriate for situations where immediate action is necessary. However, this theory of truth seems to fit to the first step of our algorithm, trying to create a virtual model of reality.

In the theory of consistency, there is no ontological correspondence needed at first glance. A statement is termed true when it fits neatly into an already existing system of statements or hypotheses without producing contradictions. This is how mathematicians typically work: they set up a system of axioms and try to find statements that could be derived from the axioms. If the axioms are true, any conclusion based on them is true as well. Only for the nerds: in any system of axioms, statements exist whose truth cannot be proved – this is Gödel's theorem.

Nevertheless, this theory seems to fit to step two of our algorithm. If the contradictions to our model of the world exceed a certain threshold, the incoming data are neglected and replaced by an internal representation. And here is the feed-back to reality: once tagging your perceptions as false, you will not see the world how it is but how your model tells it should be.

A third model for truth is still to come and it is the simplest but in mind the most problematic one: it is the theory of consensus. It states that a fact or statement is true if we all – or let us say a critical amount of people - agree that it is true. This is how religions work: some basic statements are made and they are immunized against criticism by tagging them as absolutely true. Anything that does not fit to these basic statements must then be false even though there could be ontological evidence for the contrary.

If we all agree that the has been created only some 6000 years ago, e.g. all the findings of Darwin or the 65 million year old bones of dinosaurs must be fake and we will fight the facts by all means.

Having said all this, we can go back to our primary question on how to prevent someone from using information he already has. The answer is: shatter his believe in the truth of the information and replace it by alternative facts using the simple algorithm of his data cruncher.

Any of the three theories of truth will provide an access:

Visual or acoustic input could be created that seems to correspond to real events. This has already been done in the past, e.g. by electronic warfare or stealth measures. But how about a statesman or a general talking to the troops via video stream looking and sounding so real but only being an avatar? Propaganda has been used since ancient times. But now modern technologies now provide the capabilities to create a comprehensive and realistic picture of a world that does not exist.

These capabilities could be used to insert facts into our internal representation of the world with low-level contradictions. Step by step our view of the world could be changed gradually so that contradictions stay below the critical threshold. Alternative facts replace real perceptions until our picture of reality is blurred and it becomes more and more difficult to tell the truth from false impressions and our internal pointers will show the wrong direction.

Especially for time-critical situations where decisions have to be made the resources for intensive inspection of given information are sparse this could fatal.

As soon as a critical amount of believers is reached, the alternative view on the world will be a wide-spread consensus and it will be hard to turn the wheel back. Imagine a war-room full of colonels and generals with a common opinion and resulting plans for operation. Let two young lieutenants find a flaw in the data. Will they speak up or will they contribute to the consensus?

Our modern technologies bear the extreme danger to make us lose contact with reality. This is true not only in wartimes by applies for everyday life as well. We urgently need to find strategies to tackle the uprising problems that come with the information age. And we need to find methods to protect us from corrupted data in a wide range of applications.

May be by the end we all have to realize that there is an old truth that helps:

Thou shalt not bear false witness against thy neighbour (book of Exodus).

Here are some messages to go:

➢ Our perception of reality strongly relies on the input to our senses. This input is fed into our internal representation of the world.

- ➢ This near real-time simulation can be corrupted easily due to mechanisms created by evolution; modern IT provides powerful tools to spoof or interrupt our contact with reality.
- ➢ We need to develop robust strategies to tell real from alternative facts. This applies to every-day life as well as to warfighting.

Thank you for your patience. I'll be happy to take your questions.