

Brain Security and Cognitive Warfare: Unveiling Insights from *Ghost in the Shell*

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Abstract:

The classic Japanese sci-fi manga *Ghost in the Shell* depicts a world where people are cyber-enhanced and can connect directly to the network, making cyberattacks on the brain a significant threat. With advances in neuroscience enabling increasingly precise control of brain inputs and outputs via BCI, threats to the brain are becoming a reality. In response, NICT has initiated long-term research on brain security through collaboration between the Cybersecurity Research Institute and CiNet.

In the first half, we revisit the various brain-related threats depicted in *Ghost in the Shell* and provide an overview of the background of brain security research as well as global research trends in this field. We also introduce the initial considerations of brain security research at NICT.

In the second half, we discuss cyberattacks designed to influence human cognition through cyberspace. While the integration of cyberspace and physical space promotes a human-centered society, there are concerns that cyberattacks could threaten people's safety and security in the physical world. Consequently, cognitive security against malicious influence on individuals has emerged as a key research issue in Japan. Our goal is to understand the impact of cyberattacks on cognition and propose methods to safeguard people's freedom

of decision-making.

Biographical information:

Daisuke Inoue obtained his B.E. and M.E. degrees in Electrical and Computer Engineering, and his Ph.D. in Engineering from Yokohama National University in 1998, 2000, and 2003, respectively. He joined the Communications Research Laboratory (CRL) in 2003, which was subsequently rebranded as the National Institute of Information and Communications Technology (NICT) in 2004. Over the past 20 years, he has been engaged in practical Cybersecurity research at NICT. Throughout his career, he has been honored with several awards, including the commendation for science and technology by the Minister of MEXT in 2009, the Good Design Award in 2013, the Asia-Pacific Information Security Leadership Achievements Award in 2014, the Award for Contribution to Industry-Academia-Government Collaboration by the Minister of MIC in 2016, the Maejima Hisoka Award in 2018, the Distinguished Paper Award at NDSS 2019, and the 16th Information Security Culture Award in 2020.

Haruka Suzuki is a technical research expert in the Cybersecurity Laboratory within the Cybersecurity Research Institute at the National Institute of Information and Communications Technology (NICT). She studied psychology at university and has worked as a security consultant for a security vendor since 2006. In 2018, she transitioned to a researcher role, and in 2021, she was seconded to NICT. In 2022, she earned a master's degree in informatics from the Institute of Information Security. Currently pursuing a Ph.D., her research focuses on the influence of emotions evoked by online disinformation on audience behavior and potential countermeasures. More broadly, her research interests encompass cybersecurity, psychology, and national security. She aims to investigate cyberattacks designed to influence cognition through cyberspace, clarify their effects, and propose effective protective measures.