Neurotechnology in National Security and Defense: Technical Capabilities, Ethical Considerations

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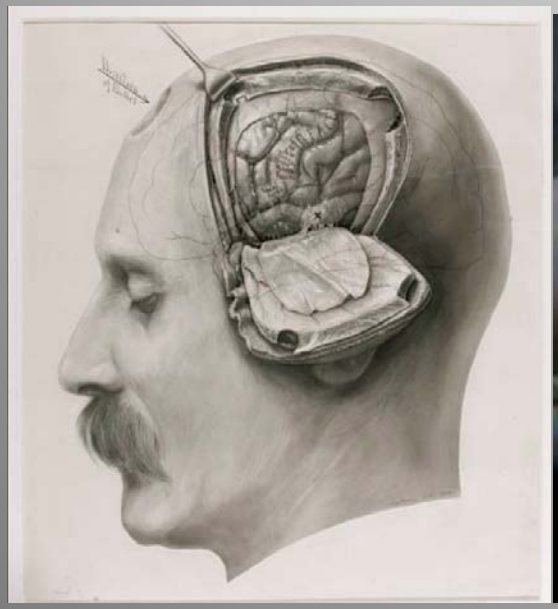
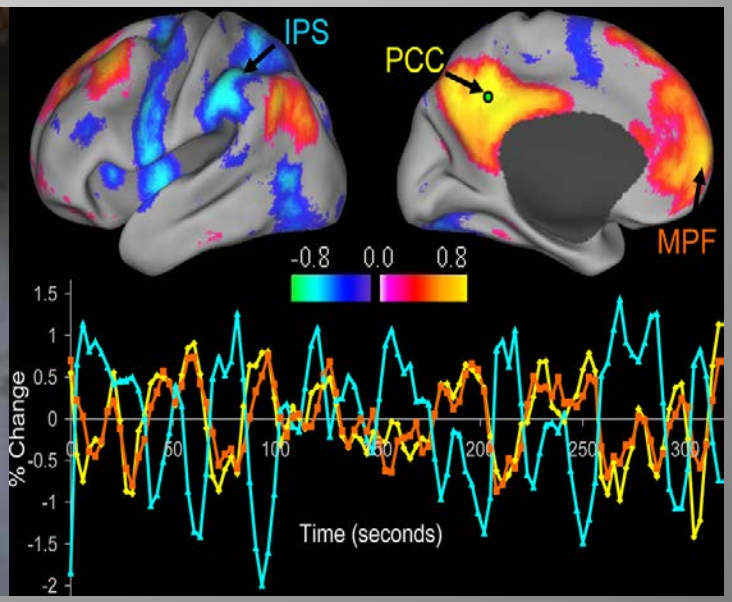
Neuroscience…

Has made huge leaps by using technology to study and understand how nerves, nervous systems and brains are structured and function.





Neuroscience and Technology (NeuroS/T)… Puts the brain at our fingertips

Potential…

- **To harness and engage neuroS/T in convergent, multi-disciplinary approaches to study, define, predict and influence human ecologies**

- **Affect human activities on individual, group and populational levels**
- **To affect human relations on local, regional and global scales**
- **Influence postures and conduct of national security and defense agenda(s)**

Engaging NeuroS/T as a "Weapon"…

A.) *n*. (Old English) 1) "a means of contending against another " and 2) "…something used to injure, defeat, or destroy"

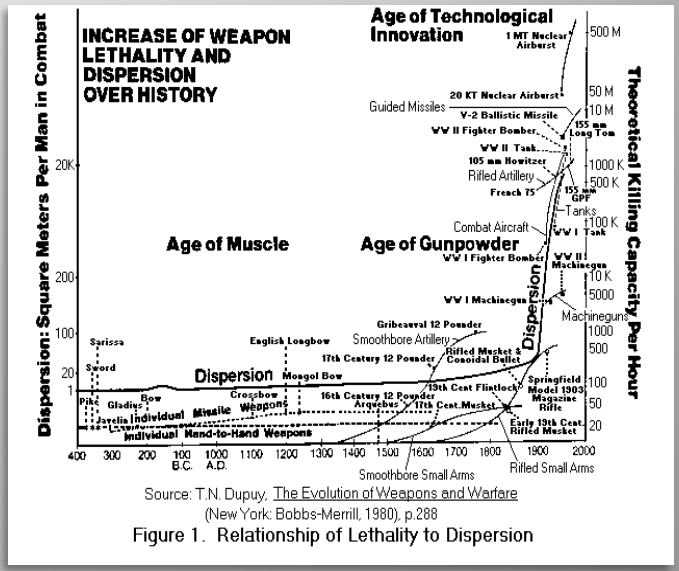
and

B.) An agent that…

1) *mitigates aggression and fosters thoughts and feelings of affiliation or passivity*; 2) incurs burdens of morbidity, disability or suffering and in this way "neutralizes" potential opponents, or 3) induces mortality

Weapons

- “Soft”
  - Economic leverage(s)
  - Intelligence
  - PSYOPS/MISO
- “Hard”
  - Physical influence/deterrence tools
    - Chemicals
      - Drugs and other chemical agents
    - Biologicals
      - Microbes
      - Toxins
    - Devices
      - Neurotechnologies
      - Hybrid “cyborg” systems (Biological ‘drones’)



Source: T.N. Dupuy, The Evolution of Weapons and Warfare (New York: Bobbs-Merrill, 1980), p.288

Figure 1. Relationship of Lethality to Dispersion

NeuroS/T for NSID
Assess- Access- Target

- **Assessment Technologies**
  - Neuroimaging
  - Neurophysiological recording
  - Neurogenomics and genetics
  - Neuroproteomics
  - Neuro-cyber informatics

- **Interventional Technologies**
  - Cyber-linked neurocog manipulation
  - Novel pharmaceuticals
  - Neuromicrobiologicals
  - Organic neurotoxins
  - Neurotechnologicals

NeuroS/T Battlespace Applications

- Intell, Surveillance and Recon
  - NEURINT
    - Assessment of neuro-psychosocial factors in narratives, individual, and group expressions and activities
  - Brain Assessment and Access Approaches and Bio-tracking
    - fMR/MEG and brain recording applications for DecDet
    - Neuropharmacologics for affiliative enhancement
    - Brain stimulation for cognitive alteration
    - Tiered integrated tracking and access networks (TITAN): indwelling devices for intentional identification and access

NeuroS/T Battlespace Applications

- **Operators /Warfighters**

  Neuro-enablement

  - **Advanced neuro-psychopharmacologics**
  - **Computational brain-machine interfaces**
  - **Closed-loop brain stimulation approaches**
  - **Neuro-sensory augmentation devices**

Combat Operations

Novel Neuroweapons *(Drugs & Bugs...)*

In-close pharmaceuticals and organic neurotoxins

- **Ultra-low dose/high specify agents for use in targeting diplomatic/local culture "hearts and minds" scenarios***

High morbidity neuro-microbiologic agents

- **Neuro-microbials with high neuro-psychiatric symptom clusters for public panic/public health dis-integrative effects**
- **Gene-edited microbiologcals with novel morbidity/mortality profiles**

Nano-neuroparticulate agents

- **High CNS aggregation lead/carbon-silicate nanofibers (network disrupters)***
- **Neurovascular hemorrhagic agents (for in-close and population use as "stroke epidemic" induction agents***

Combat Operations, Cont'd

Neuroweapons... *(Devices)*

Neurosensory immobilizing agents

- High output sensory stimulators (UAV, drone, insect borne)

Trans- and intracranial pulse stimulators

- Neural network disrupters ("confusion generators"; Hand held, UAV, drone and insect-borne)

IW

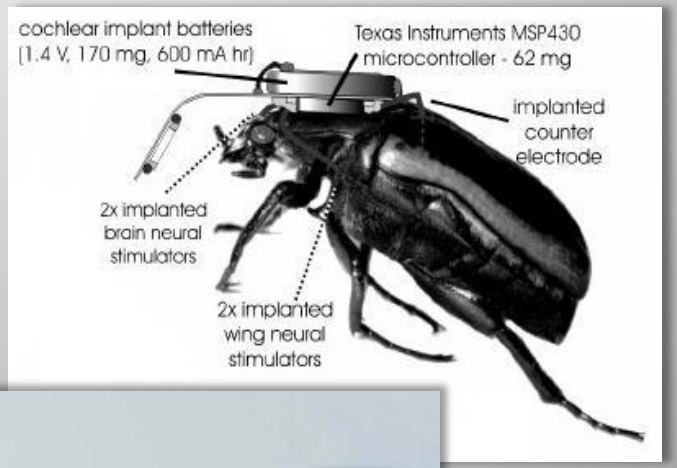
"Neuro-Ops" Altered Reality Tactics

- Cortically-coupled neural temporal function alteration ("time warpers")
- Pharmacologic+neurostimulation-induced cognitive-emotional disruption*

Mixed Intell-Combat Ops

Neuro-modified “Cyborg” systems

- “DARPA Beetle”



- Dragon flEYE

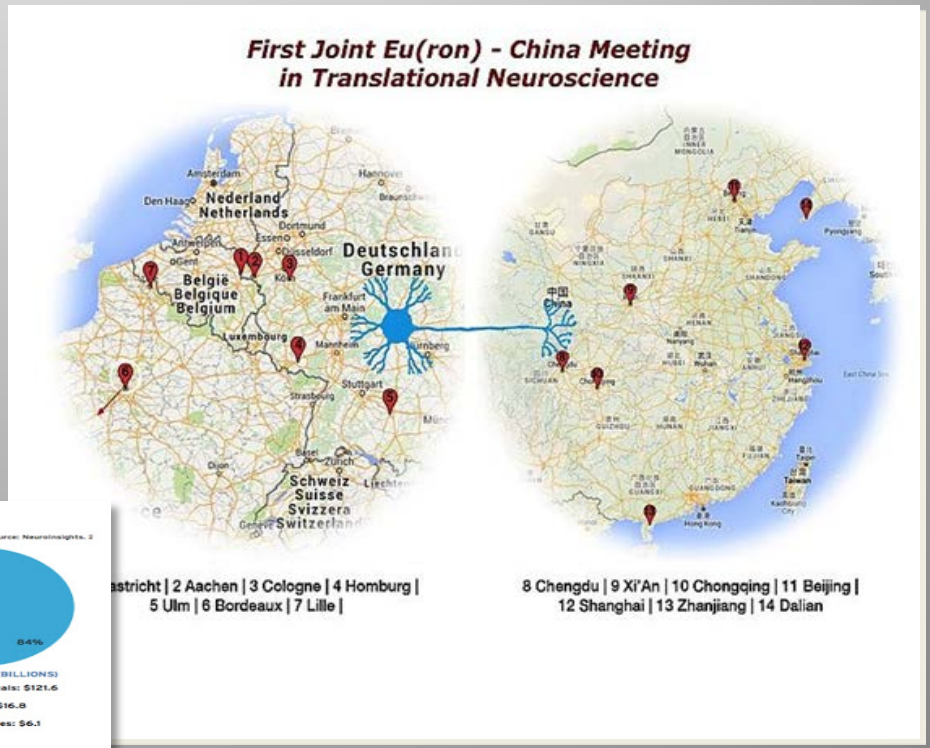
NeuroS/T in NSID

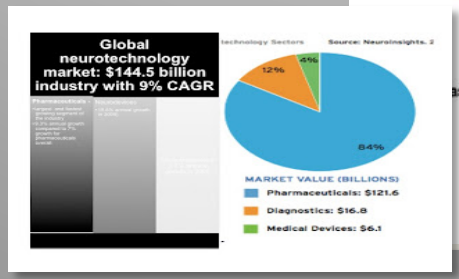
- Relative facility of NeuroS/T
  - "Off the shelf"
  - Dedicated efforts
  - Nations and independent actors
- Recognition of viability of use
  - Variety of applications

- Lack of commitment to NeuroS/T RDT does not preclude others' RDT initiatives
  - May augment it
  - Difficulty of global surety

NeuroS/T on World Stage

- Global NeuroS/T Economic Predictions 2020
  - China
    - Predicted 60-68% increase in RDTE by 2025
  - Russia
  - India
  - Iran
  - N.Korea
  - South America

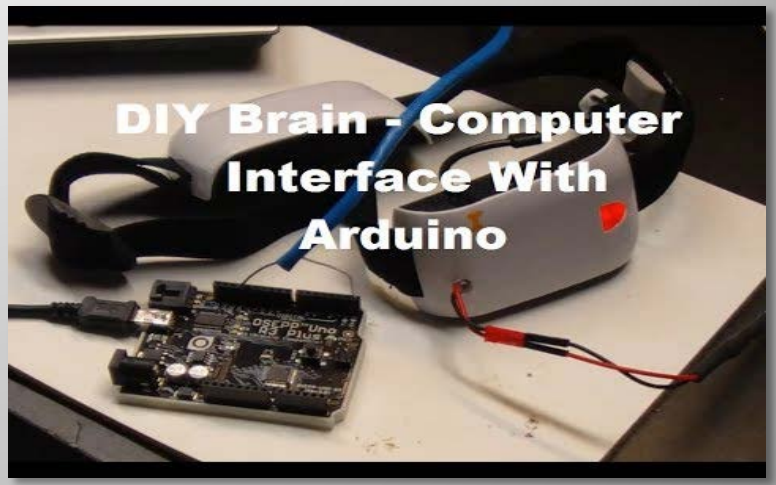


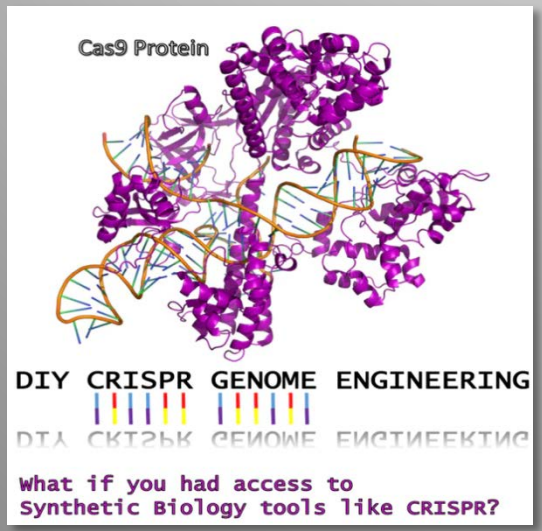


NeuroS/T on World Stage

Do-It-Yourself NeuroS/T...

- "Neuro-biohacking"
  - "Influence vector"
  - State-influenced
  - Non-state actors





NeuroS/T in NSID

Access and manipulate neural systems/brains to
"…*win minds and hearts*".

What we can do is provocative…

What we should do (and how we should do so) remains an issue.

NeuroS/T Superspeedway

- Multiple lanes
- Multiple vehicles
- Rapid pace
- Big Prizes
- Risks & Hazards

Are there “Race Rules” and/or Restrictions?

Neuroethico-legal Issues & Risks

Technology-focal

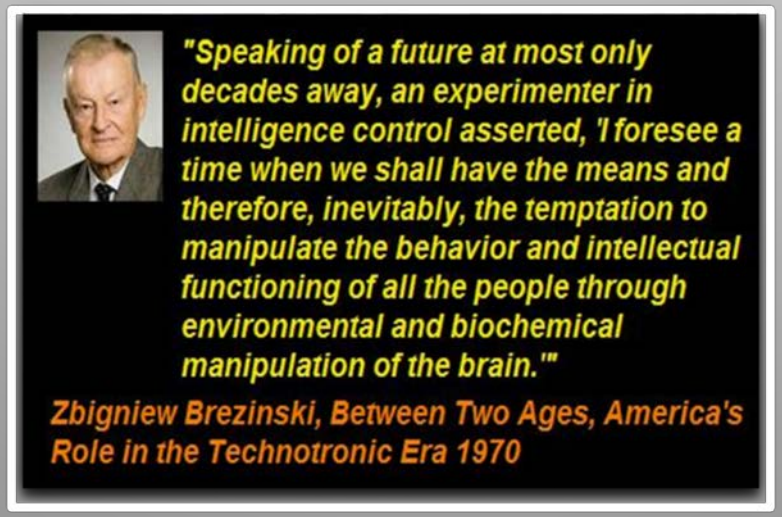
- Unknowns of frontier science/technology
- Capabilities, limitations
- Runaway and Wexelblatt effects

Ethico-legal

- Inviolability of “mind”/”self”
- Protection vs privacy
- Mitigation vs manipulation
- Validity, reliability, admissibility
- Norms, pluralization, diversity

ON-RAMP:*Operational Neurotechnology Risk Assessment and Management Paradigm*

1. Evaluate neuroS/T capabilities/limitations
2. Evaluate parameters of possible use
3. Assess benefit-risk-harm parameters
4. Frame within contexts of application



Navigating and "Winning"

ON-RAMP:

- **Identify risk-threat-harm scenarios that evolve from specified events**
- **Craft strategies for preemption, preparation, response, and amelioration**
- **Examine (setting, exploring, and exploiting) conditions at the operational level, across all elements, and the physical, cognitive and informational domains**
- **Create strategies that are relevant, durable, and can be targeted for demographics and psychographics in the face of severe cultural impact**
- **Identify/plan a robust framework to remain effective and adaptive – *and ethically sensitive and responsive* - to a changing environment as risks and society co-evolve.**

Contingencies and Exigencies

1. Technical rectitude of any/all neuroS/T in NSID
2. Situational variables germane to NSID use
3. Evaluation and/or revision of ethical concepts to guide such use
4. Frameworks for establishing/executing ethical engagement

What Ethics?

- "Civilian"
  - S/T?
  - Bio-Medical?
- Military?
  - *Jus in bellum/jus ad bello?*
  - *Jus contra bellum(?)*
- Global relevance?

Neuroscience, Neurotechnology and Neuroethics

With increasing knowledge comes great power…

…With great power comes great responsibility

Measure Twice; Cut Once

The Future…

Is in Our Hands

SMA Whitepapers

- **Giordano J. (ed.) A *Biopsychosocial Science Approach for Understanding the Emergence of and Mitigating Violence and Terrorism.* Department of Defense; Strategic Multilayer Assessment Group- Joint Staff/J-3/Pentagon Strategic Studies Group (March, 2016).**

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- **Giordano J. (ed.) *Leveraging Neuroscience and Neurotechnological (NeuroS/T) Development with Focus on Influence and Deterrence in a Networked World*. Department of Defense; Strategic Multilayer Assessment Group- Joint Staff/J-3 (May 2014).**

- **Giordano J., Casebeer W, DiEuliis D. (eds.) *Topics in Operational Considerations on Insights from Neurobiology on Influence and Extremism.* Department of Defense; Strategic Multilayer Assessment Group- Joint Staff/J-3 (April 2013).**

- **Giordano J. (ed.) *Topics in the Neurobiology of Aggression: Implications for Deterrence*. Department of Defense; Strategic Multilayer Assessment Group- Joint Staff/J-3 (February 2013)**

- **Cabayan H. et al. (eds.) *National Security Challenges: Insights from Social, Neurobiological and Complexity Sciences*. Department of Defense; Strategic Multilayer Assessment Group- Joint Staff/J-3 (July 2012).**

Additional Information

- **Giordano J. Battlescape brain: Engaging neuroscience in defense operations. *HDIAC Journal* 3:4: 13-16 (2017).**
- **Palchik G, Chen C, Giordano J. Monkey business? Development, influence and ethics of potentially dual-use brain science on the world stage. *Neuroethics*, 10:1-4 (2017).**
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- **Tennison M, Giordano J, Moreno J. Security threats vs aggregated truths: Ethical issues in the use of neuroscience and neurotechnology for national security. In: Illes J, Hossein J. (eds.) *Neuroethics: Defining the Issues in Theory, Practice and Policy.* Oxford, Oxford university Press, 2017.**
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- **Giordano J, Kulkarni A, Farwell J. Deliver us from evil? The temptation, realities and neuroethico-legal issues of employing assessment neurotechnologies in public safety. *Theoret Med Bioethics* 15(3); (2014).**
- **Giordano J, Wurzman R. Neurotechnology as weapons in national intelligence and defense. *Synesis: A Journal of Science, Technology, Ethics and Policy* 2: 138-151 (2011).**
- **Giordano J, Forsythe C, Olds J. Neuroscience, neurotechnology and national security: The need for preparedness and an ethics of responsible action. *AJOB-Neuroscience* 1(2): 1-3 (2010).**

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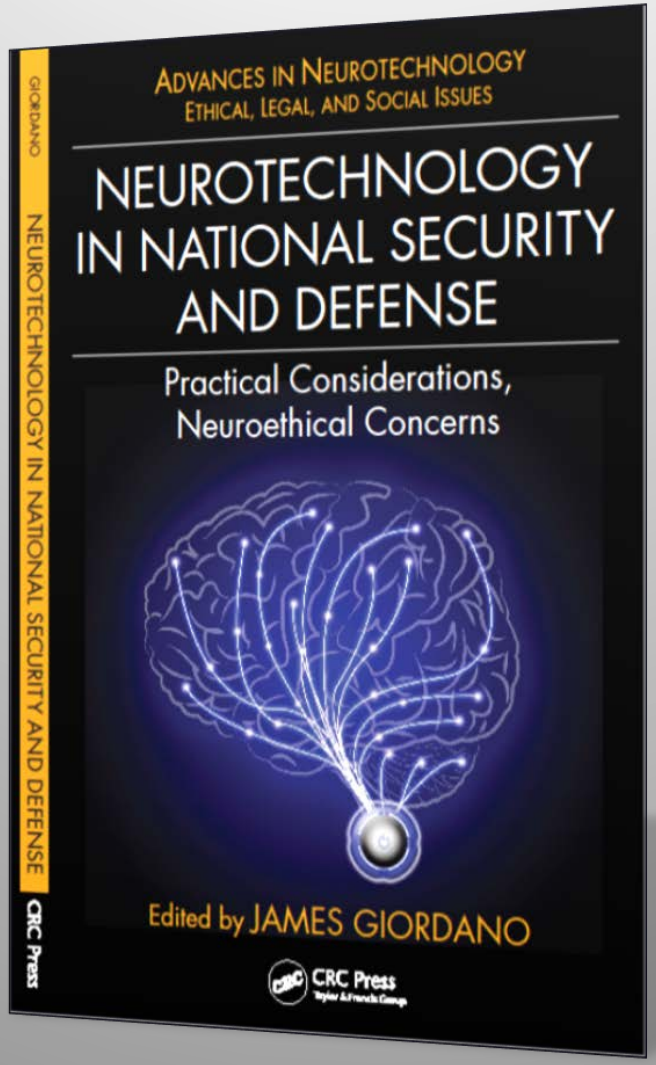
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