The Quantified Soldier:
Using Brain Networks to Enhance Future Ops

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Pervasive Technology

Future Soldiers
Pilot Induced Oscillation (aircraft-pilot coupling)
Futuristic Predictions of Future Ops
How can technology adapt to the Soldier?

How do we deliver the right info at the right time?
How can technology adapt to the Soldier?

Measuring brain networks to quantify Soldiers
Brain regions have specialized processing
Functional brain networks share information (top down view)
Structural brain networks provide the “wiring” (side view)
Measuring brain networks to quantify Soldiers

Question #1
Do structural brain networks capture learning?

Question #2
Do functional brain networks reflect our social networks?
We developed a method to examine segments of structural connections: the local structural fingerprint.
Across 200+ people, can we use fingerprints to identify individuals?

Yeh, Vettel, et al., 2016
Fingerprints capture personal identity
100% classification accuracy across 17,398 tests

Fingerprints reflect genetics, but mostly learning

Identical Twins
Fraternal Twins
Siblings
Unrelated

Yeh, Vettel, et al., 2016
Measuring brain networks to quantify Soldiers

Question #1

Do structural brain networks capture learning?

Yes!
But what timescale?
Collegiate baseball players & age-matched controls

Muraskin et al., 2016
Across participants, 5 structural subnetworks emerged

- Module 1
- Module 2
- Module 3
- Module 4
- Module 5

Muraskin et al., 2016
Experts had stronger connectivity between 2 modules

This overlapped with functional differences!

Muraskin et al., 2016
Short-term Learning: Visuomotor Sequences

- Naive participants
- Brain data every 2 weeks
- 4 time points of structural networks

Kahn et al., 2016
Subjects learn the task at different rates

Structural connections in the visual cortex capture these learning differences

Kahn et al., 2016
Question #1

Do structural brain networks capture learning?

Yes!
Both long and short timescales
(decades & 6 weeks)
Measuring brain networks to quantify Soldiers

Questions

Can we detect/predict learning differences in military tasks?
If so, how do we adapt training?
Will “misuse” occur? Using it to exclude rather than adapt?

Question #2

Do functional brain networks reflect our social networks?
Research has identified functional brain networks that process social pain and self-related thinking

Schmaelzle et al., 2017
Participants differed in the amount of functional network activity

- Social Pain
- Self-related Thoughts

This related to differences in their social networks (derived from online media)

Schmaelzle et al., 2017
Participants with increased connectivity were more susceptible to peer influence a week later.

Risk-taking
Risk-averse

Social Pain
Self-related Thoughts

Wasylyshyn et al., under review
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Question #2
Do functional brain networks reflect our social networks?

Yes!
And brain networks predict susceptibility to peer influence
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Questions

Can we detect social influence on non-social decisions?
If so, how do we determine good or bad influence?
Can we use this info to build cohesive teams?
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Thanks!
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