



Unique functional fingerprints through the lifespan

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McGill University and the Douglas Mental Health University Institute are situated on traditional **Kanien'kehà:ka** Territory.















Functional connectome fingerprinting (FP)



| Fingerprinting – Healthy participants | | |
|---------------------------------------|--------------------------|--|
| Study | Population | Main Findings |
| Finn (2015) | | |
| Airan (2016) | | |
| Amico (2018) | Young adults Children | Fingerprinting is accurate across time and modalities, particularly when restricting to the |
| Demeter (2020) | Middle-age | frontoparietal and default mode networks |

Finn (2017)

What about the many functional changes in aging?



Research question

Are the **individual fingerprints changing** during the **aging** process?

Methods – Population and measures



18-87 years (50.39 avg)

Inclusion criteria

- Cognitively unimpaired
- Aged between 18-87
- No neurological/psychiatric conditions



Methods – Procedure



Objective & Hypothesis – 1A

Objective

1A Characterize the stability of the functional connectome fingerprints in aging

Hypothesis

1A Fingerprints should be stable in younger adults but decrease with age





Methods – Analysis Plan – 1A

Objective 1A : Stability of the fingerprints across ages





Results – Objective 1A



Within-network

Rest – **Task** (n = 483)



Between-network

Rest – **Task** (n = 483)



Results – Objective 1A



Within-network



Rest – Movie (n = 463)

Between-network

Rest – Movie (n = 463)



Results – Objective 1A



Within-network Task - Movie (n = 496) Task- Movie (n = 483) 31.1% V 80.6% (26.9 - 35.3)(77.2 - 84.1)50.3% 86.5% (45.8 - 54.9) (83.5 - 89.5)6.7% (4.4 - 9.0)26.4% (22.5 - 30.3)79.9% D A (76.3 - 83.6)D A 94.2% D M 89.4% (92.1 - 96.2)(86.6 - 92.2) D M 96.6% 25.3% (95.0 - 98.2)(21.3 - 29.2)87.5% 91.3% (84.5 - 90.5)(88.9 - 93.8)90.3% 96.6% W (87.6 - 93.0) (95.0 - 98.2)100 200 300 400 500 500 100 200 300 400 0 Count Count

Unique patterns of functional connectivity across tasks are relatively well preserved during the lifespan, particularly between-network and in the DMN

Between-network

Methods – Analysis Plan – 1A

Objective 1A : Stability of the fingerprints across ages







Results – Objective 1A

Within-network Rest – Task (n = 483)





Results – Objective 1A





Fingerprint metrics slowly change nonlinearly in parallel across the lifespan within...

Results – Objective 1A

Age



Between-network Rest – **Task** (n = 483) 0.4-Correlation coel elatior 54 ve Aat 50 year Aae Age 0.25 49 years

... and between networks

... using different pairs of tasks (not shown)

Objective & Hypothesis – 1B

Objective

1B Determine which brain regions contribute to the fingerprints during the lifespan

Hypothesis

1B Frontoparietal and defaultmode network should contribute most





Methods – Analysis Plan – 1B





Results – Objective 1B





Features predictive of fingerprints vary drastically depending on small variations of the sample selected

Results – Objective 1B





... even if we find our expected results when dividing the sample arbitrarily!

Discussion

This project highlighted that:

- Inter-individual differences (i.e., unique patterns of functional connectivity) remain across the lifespan
 - (1A) Identifiability is high through the lifespan across conditions, most networks, etc.
 - (1A) Fingerprint strength and alikeness coefficient slowly change in parallel over the ages
 - (1B) No "one-region-fits-all" across individuals to predict functional fingerprints across the lifespan

Caution when using group-level FC measures in aging research



Villeneuve Lab

Imagerie multimodale du vieillissement cérébral Multimodal Imaging of the Aging Brain

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