Using verbal fluency to identify Alzheimer's Dementia

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Background

Alzheimer's disease (AD):

- **Most common** dementia with **no cure**
- **Affects memory and language.**
- **Caused by the degeneration** of the **aging brain.**
- Involves **temporal lobe damage, where semantic information is stored.**
  - ➢ *Because AD's onset is **gradual**, it would be helpful to have a test that reveals the **early stages of dementia…***

Verbal fluency:

- A widely used measure to assess **cognitive processes** following **neurological damage**.
- **Semantic** fluency: requires words in a **given category,** e.g., food or animals.
- **Letter** fluency: requires words starting with a **certain letter,** e.g., F or S.
- **Discrepancy = Semantic fluency > letter fluency**.

Verbal fluency in Alzheimer's disease:

- **Semantic fluency is affected more by AD** than letter fluency. (Discrepancy gets smaller.)
- BUT **semantic fluency is also affected more by typical aging** than letter fluency.
  - ➢ *Will this **semantic-letter discrepancy** help to **differentiate** Alzheimer's Disease from typical aging?*

Acknowledgements

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References

- **Becker et al. (1994). The natural history of Alzheimer's disease: description of study cohort and accuracy of diagnosis. *Archives of Neurology*, 51(6), 585-594.**
- **DementiaBank: https://dementia.talkbank.org/access/**
- **Gordon, J. K., Young, M., & Garcia, C. (2018). Why do older adults have difficulty with semantic fluency? *Aging, Neuropsychology & Cognition*, 25(6), 803–828.**

Methods

Participants

- **Dementia group (DG)** data from **DementiaBank** (Becker et al., 1994); mostly early AD
- **Typical aging group (TAG)** data from **previous study** (Gordon *et al*., 2017)
- Two group's ages and tasks are matched:

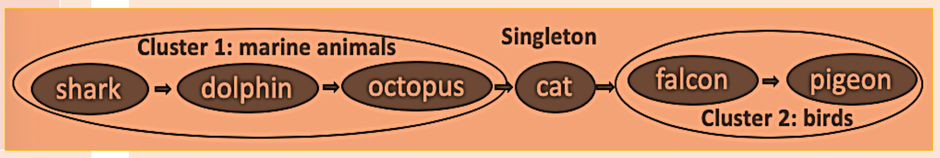
		DG (n=134)	TAG (n=66)
Age	Mean (range)	71.1 (49-88)	70.2 (49-89)
Educ	Mean (range)	20.0 (8-30)	16.8 (10-23)
Sex	Male (%)	53 (39.8%)	29 (43.9%)
	Female (%)	80 (60.2%)	37 (56.1%)
Diagnosis	Possible AD	15	N/A
	Probable AD	94	
	Vascular	4	
	MCI	17	
	Other	3	

Tasks & Procedure

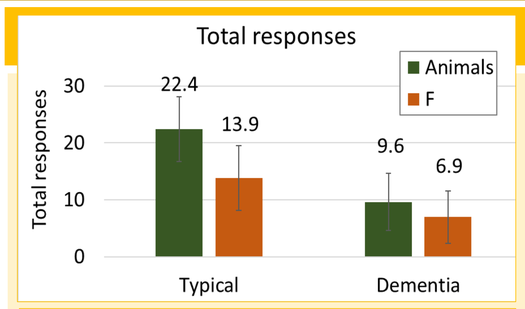
- Semantic fluency: **Animals** (60 seconds)
- Letter fluency: **F** (60 seconds)

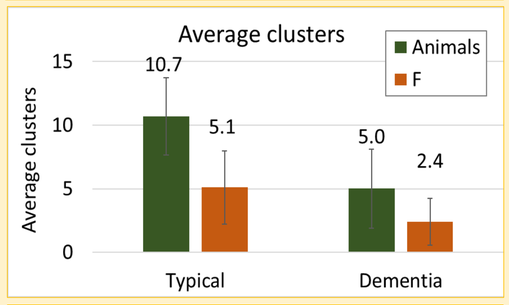
Outcome measures

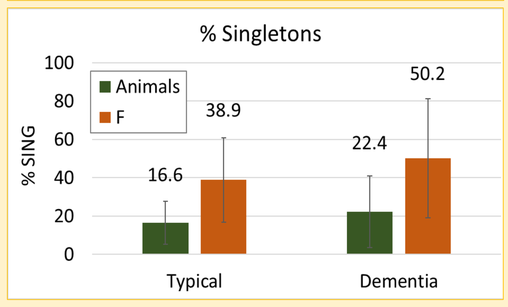
- **Total correct responses** for both tasks
- **Average errors** per person (% errors
- **Average clusters** per person (% singletons)
  - ➢ **Cluster**: words belonging to the same category
  - ➢ **Singleton (SING)**: words outside a cluster
- **Absolute (SF-LF) and relative discrepancy (SF/LF)** between semantic and letter fluency



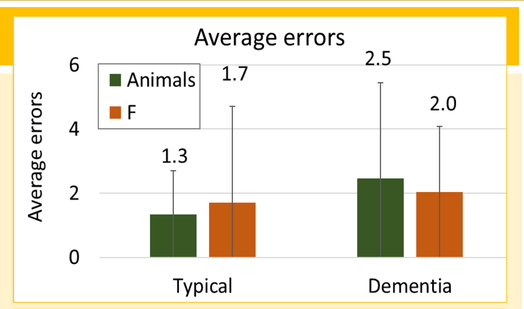
Results

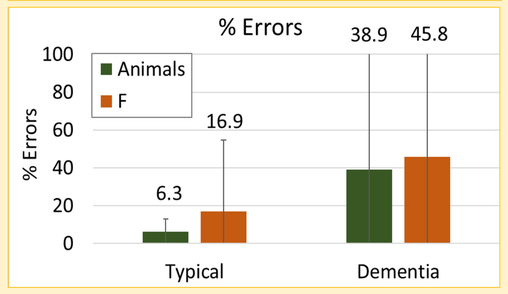


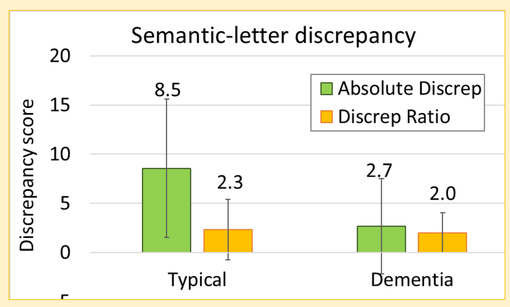




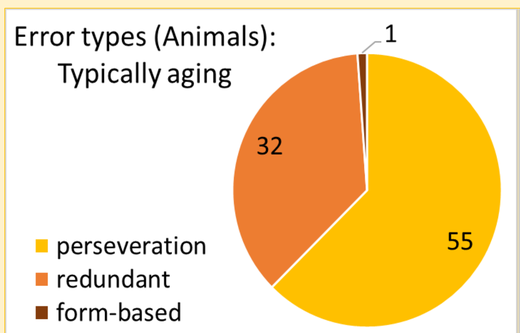
Analysis	Effect	F	*p*
Two-Way ANOVAs			
Total Correct Responses	**Group**	**324.5**	**<.001**
	Task	**80.8**	**<.001**
	Group x Task	**28.7**	**<.001**
Number of Clusters	**Group**	**211.3**	**<.001**
	Task	**174.6**	**<.001**
	Group x Task	**27.0**	**<.001**
% Singletons (unclustered / total items)	**Group**	**12.2**	**<.001**
	Task	**124.4**	**<.001**
	Group x Task	1.2	.270
% Errors	**Group**	**20.8**	**<.001**
	Task	1.7	.193
	Group x Task	.1	.806
One-Way ANOVAs			
Absolute Discrepancy (SF – LF)	**Group**	**47.3**	**<.001**
Discrepancy Ratio (SF / LF)	Group	.7	.395

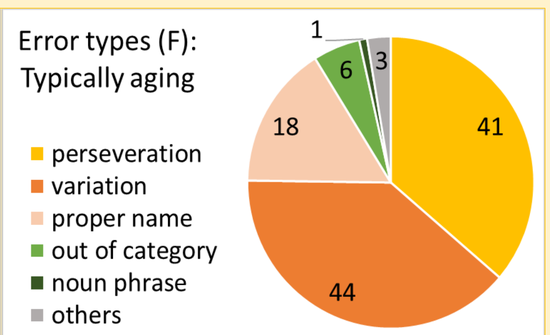


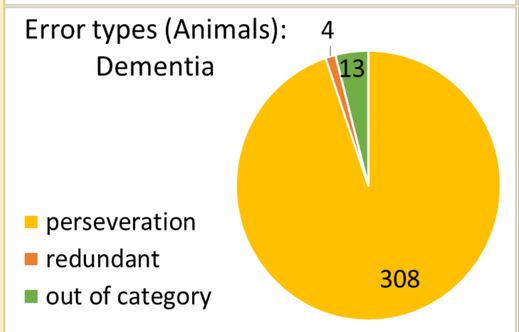


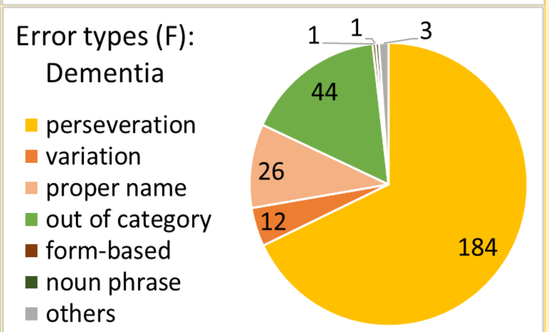


Continued Results

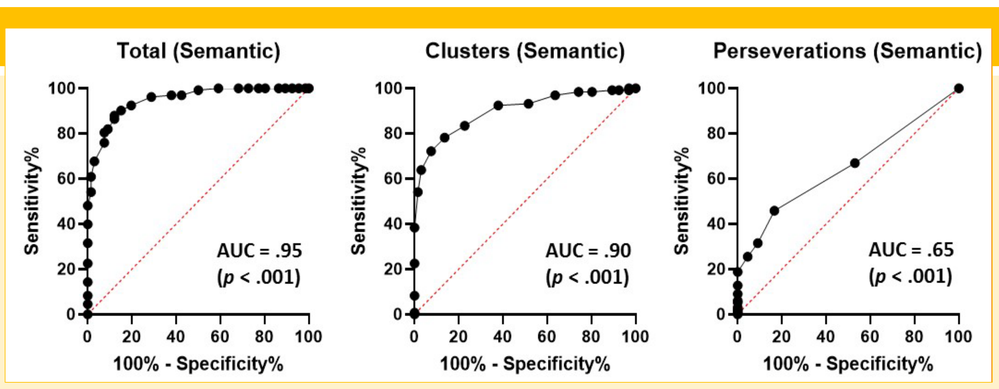


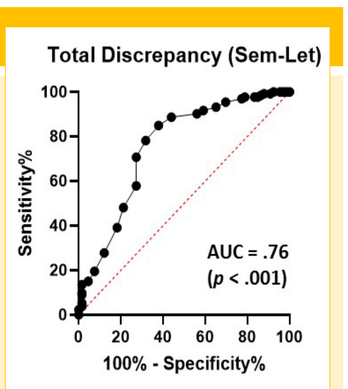






- **Most common** error type across tasks was **perseveration**, especially in SF**.**
- **DG** produced **more perseveration and out-of-category** errors than TAG.
- **TAG** produced **more redundant and variation** errors.





- Discrimination was **excellent** using **total responses or clusters** in **SF**, but **fair-to-good** in **LF**.
- Discrimination was **poor** using **error proportions** in **both tasks**.
- **Absolute discrepancies** showed **fair** discriminability, but **relative discrepancies** were **poor**.

Summary & Discussion

- **People with dementia** produced **fewer responses** overall, **fewer clusters**, and made **more errors** than the typically aging group.
- **Participants with dementia** were more likely to make **more severe errors** (e.g. out-of-category), reflecting that their cognitive processing and memory are affected.
- Both groups produced **more responses** and **more clusters** in **semantic** than letter fluency. However, the **semantic-letter discrepancy** was **smaller in participants with dementia** compared to typically aging participants.
- **Semantic fluency discriminates** people with dementia from typically aging adults **better** than letter fluency, particularly using absolute number of total correct responses.
- Using **relative numbers** (e.g. % singletons, % errors) is **less sensitive** since both groups seem to decline proportionally.
- When taking total number of items produced into account, people with dementia do NOT show a reduced semantic-letter discrepancy, counter to previous claims.
- **Verbal fluency in dementia shows similar qualitative patterns to typical aging.**