Verbal fluency as a measure of lexical-semantic processing in psychotic disorders and schizophrenia

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CLINICAL LINGUISTICS WORKSHOP "INTERDISCIPLINARY LINGUISTIC AND PSYCHIATRIC RESEARCH ON LANGUAGE DISORDERS", 20TH NOVEMBER 2018

Overview

- Semantic fluency
  - Methodology
  - Schizophrenia
- Disproportionate deficits across different semantic categories
- Semantic fluency and neuropsychology
- Conclusions
- References

Neural Noise, Far-Spreading Activation, Hyperactivation…

- Spitzer (1997): increased effect of indirect semantic priming in tasks with short stimulus-onset asynchronies compared to non-FTD patients and HS

  milk – [*white*] – *black*

- Paulsen et al. (1996): semantic space analysis of animal fluency output
- Assaf et al. (2006): fMRI, overactivation of the semantic memory network

References:
Assaf, Michal et al. (2006). "Abnormal Object Recall and Anterior Cingulate Overactivation Correlate with Formal Thought Disorder in Schizophrenia". *Biol Psychiatry*, 59(5), 452–9.
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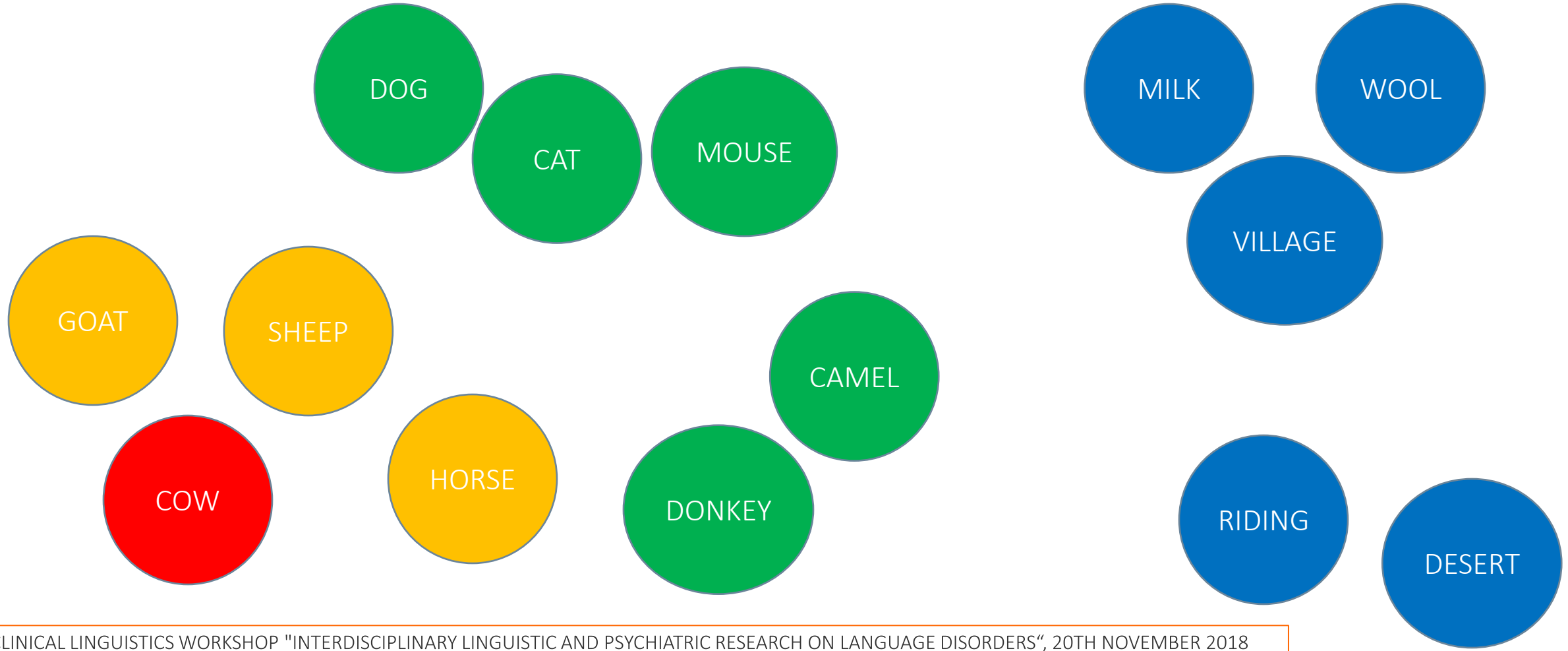
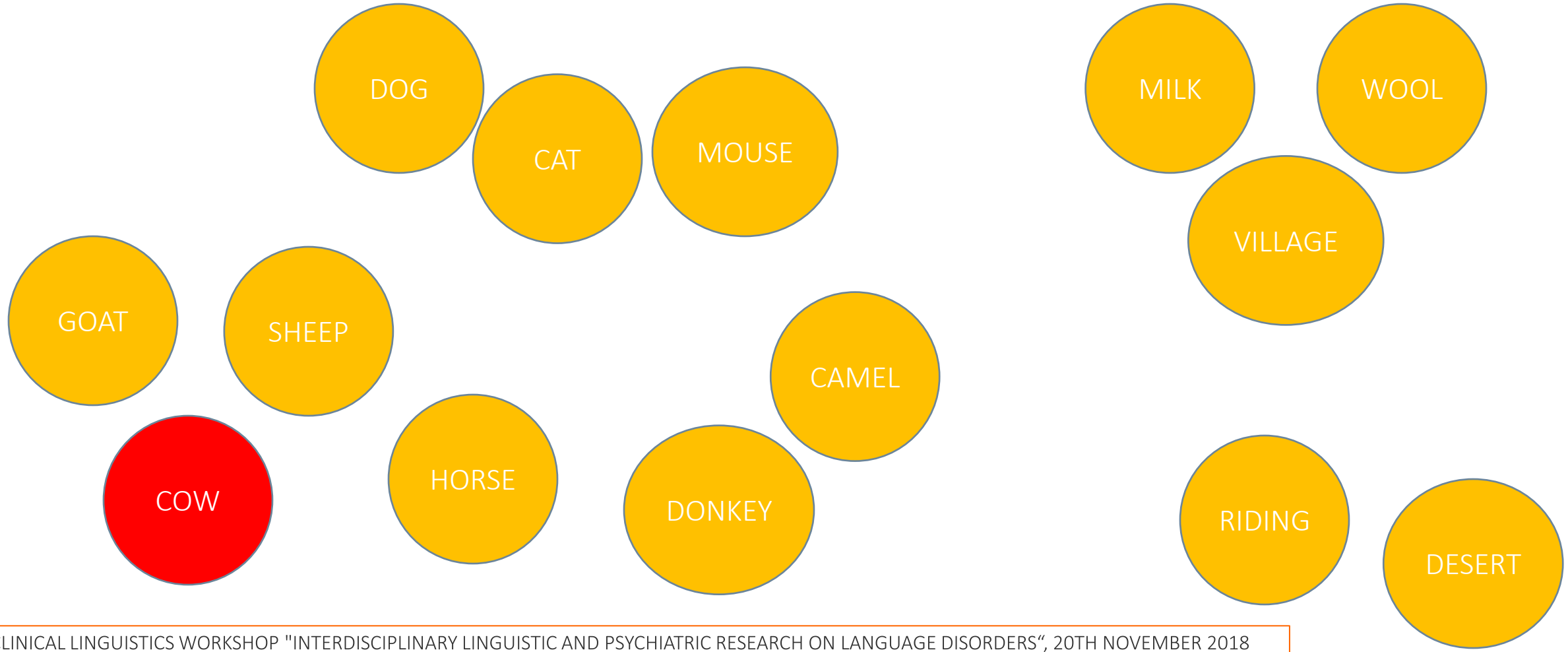
Neural Noise, Far-Spreading Activation, Hyperactivation…

HEALTHY SPEAKERS

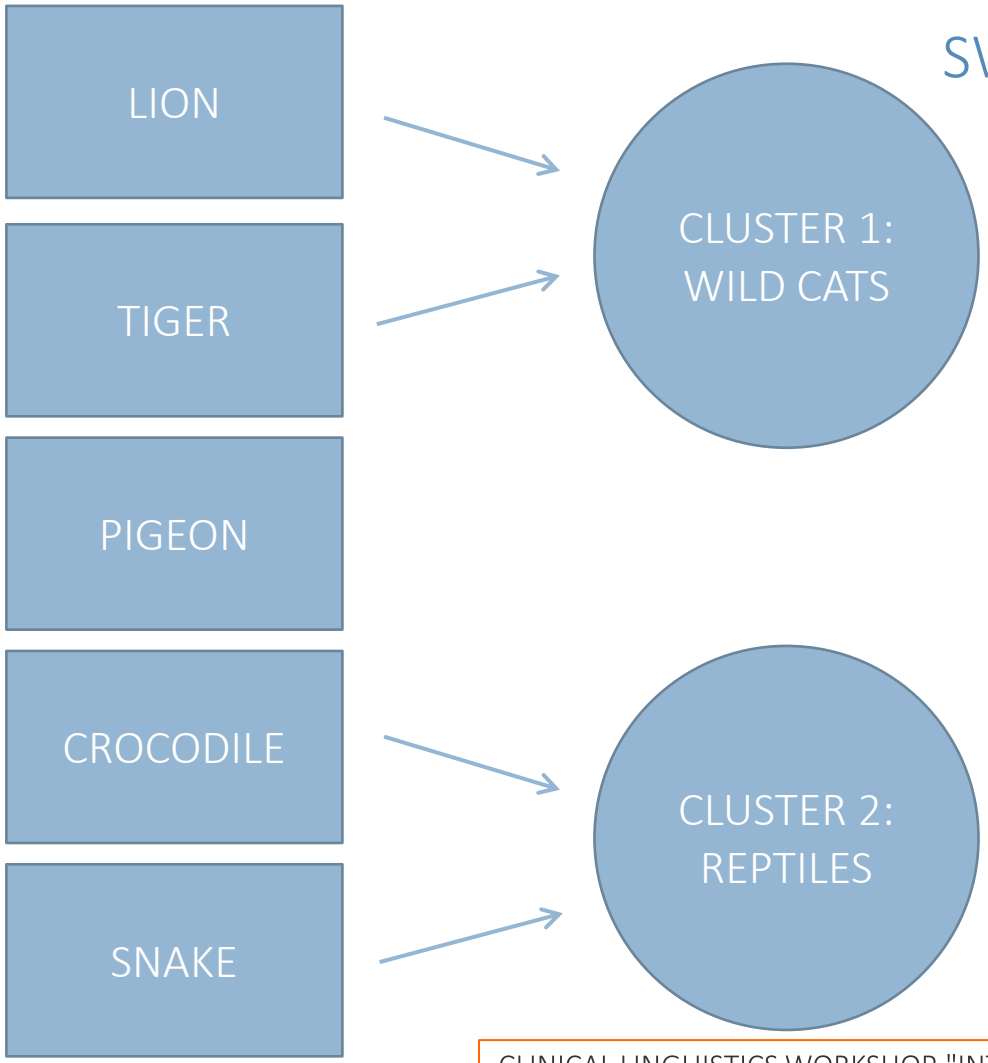


Neural Noise, Far-Spreading Activation, Hyperactivation…

SCHIZOPHRENIA PATIENTS



Semantic Fluency



SWITCHING = 6 total words – 4 clustered w. + 2 clusters = 4

References:
Troyer, Angela K. et al. (1997) “Clustering and switching as two components of verbal fluency: evidence from younger and older healthy adults”. *Neuropsychology*, 11(1), 138–46.
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Semantic Fluency in Schizophrenia

STUDY	SEMANTIC CATEGORIES	ILLNESS PHASE
Allen et al. (1993)	animals, body parts, fruits	chronic SH
Paulsen et al. (1996)	animals	chronic SH (early- vs. late-onset)
Robert et al. (1998)	animals, fruits	chronic SH
Laurent et al. (1999)	animals, fruits	parents and siblings of SH patients
Chen et al. (2000)	animals, food, transport	chronic SH
Giovannetti et al. (2003)	animals	first-episode psychosis
Phillips et al. (2004)	animals	early-onset SH and schizoaffective disorder
van Beilen et al. (2004)	animals	chronic SH, schizophreniform disorder, schizoaffective disorder
Bozikas et al. (2005)	animals, objects, fruits	chronic SH
Blessing et al. (2009)	animals, sports/fruits, food/clothes/flowers	first-episode psychosis
Becker et al. (2010)	animals	ultra high risk for psychosis
Rinaldi et al. (2013)	animals, fruits/vegetables	chronic SH
Chou et al. (2015)	*various*	first-episode psychosis
Berberian et al. (2016)	animals	chronic SH
Berto & Galaverna (2016)	body parts	chronic SH
Pauselli et al. (2018)	animals	first-episode psychosis

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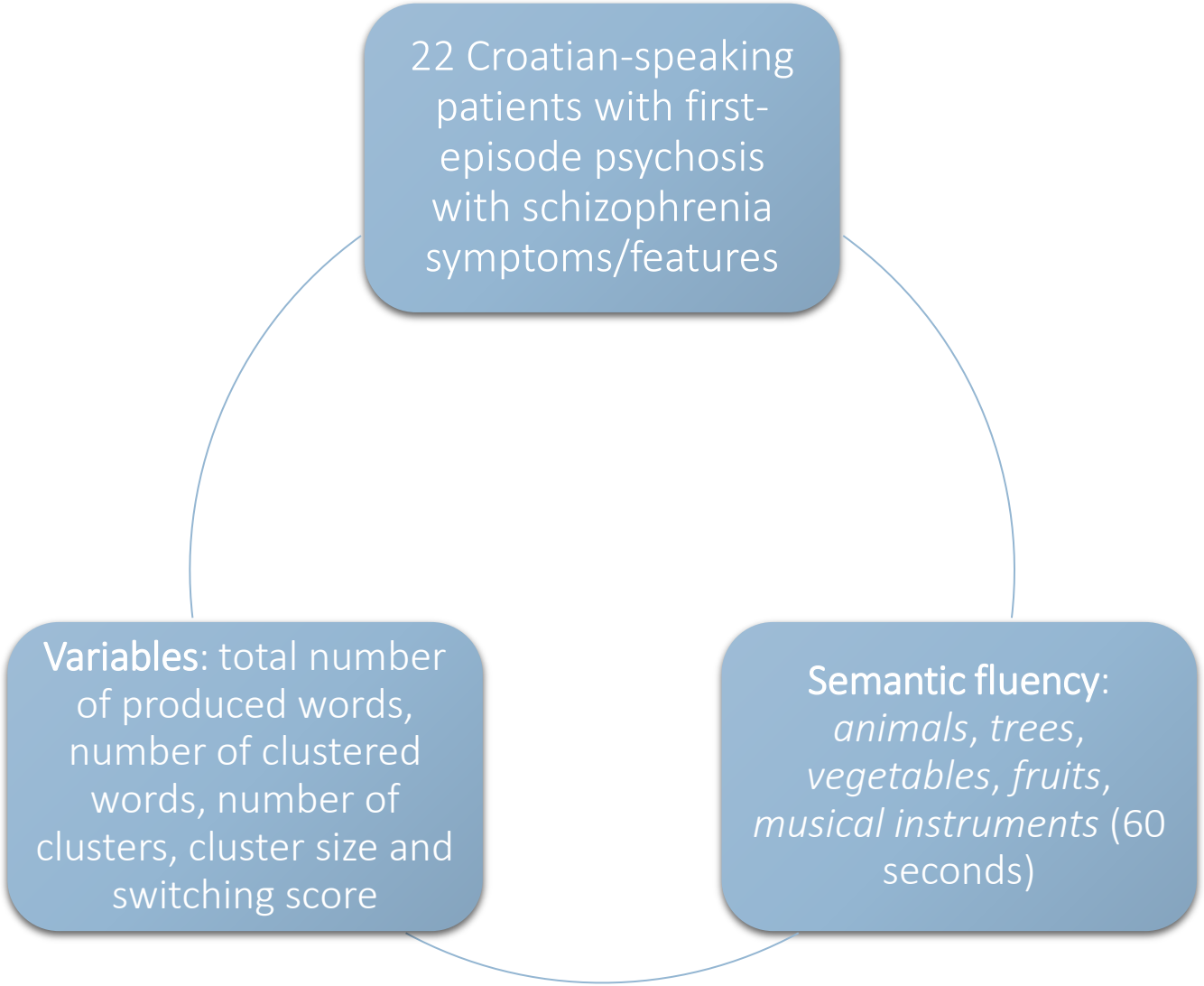
Clustering and Switching in Schizophrenia

	Number of clusters	Number of clustered words	Cluster size	Switching
Robert et al. (1998)	n/a	+	n/a	+
Giovannetti et al. (2003)	n/a	+	-	n/a
van Beilen et al. (2004)	-	n/a	+	-
Bozikas et al. (2005)	n/a	- (+)	n/a	- (+)
Rinaldi et al. (2013)	+	n/a	n/a	+
Berberian et al. (2016)	n/a	+ (+)	n/a	- (+)

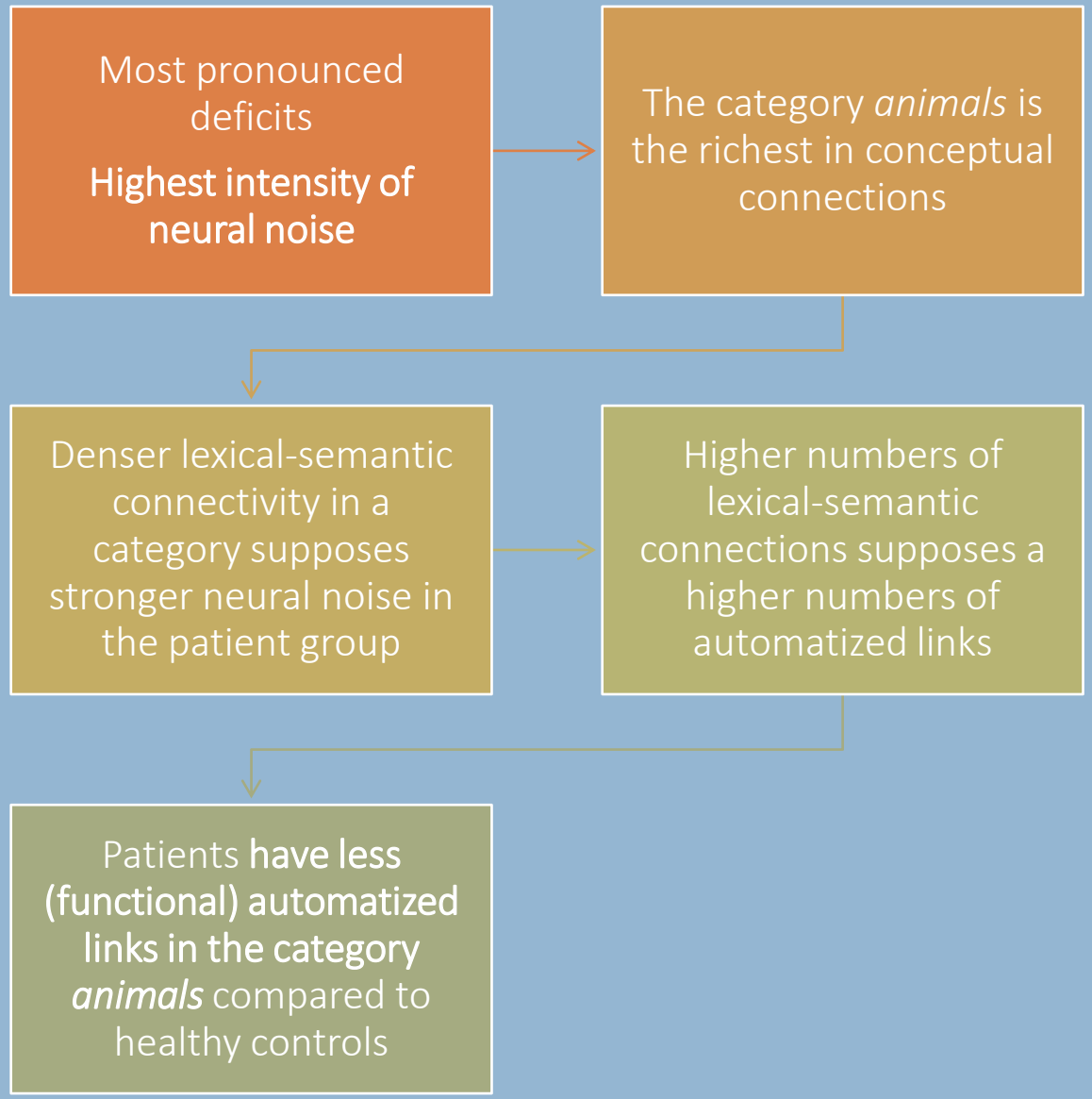


Disproportionate Deficits Across Different Semantic Categories in First-episode Psychosis I

Disproportionate Deficits Across Different Semantic Categories in First-episode Psychosis II

	N of clusters	N of clustered words	cluster size	N of independent words	switching
animals	-	+	+	-	+
vegetables	-	-	+	-	-
instruments	-	-	+	-	-
fruits	-	-	-	-	-
trees	-	-	-	-	-
aggregate	-	-	+	-	-

The Category *Animals*



VERBAL FLUENCY

(60 seconds)
Clustering and switching were calculated after Troyer (2000)[5] .

Semantic Verbal Fluency

- *Animals*
- *Trees*

Action Verbal Fluency

- *Things one can do in the house*

Phonological Verbal Fluency

- *K*
- *M*
- *P*

CANTAB® TEST BATTERY

(The Cambridge Neuropsychological Test Automated Battery)

Spatial Working Memory Task (SWM)

- Assesses visuospatial processing and strategy

Stockings of Cambridge (SOC)

- Requires spatial planning

Attention Switching Task (AST)

- Reflects cognitive flexibility and switching

Paired Associates Learning (PAL)

- Assesses visual episodic memory and learning

Delayed Matching to Sample (DMS)

- Assesses simultaneous visual matching ability and short-term visual recognition memory

Verbal Fluency and Working Memory Interaction

Methodology:

20 healthy subjects

Lexical-semantic retrieval was assessed by verbal fluency

The CANTAB® test battery was administered for assessing working memory

Verbal Fluency and Working Memory Interaction - Results

DMS was significantly correlated with the total number of produced words and the number of clusters in all VFs, but the correlation with switching was present only in action and phonemic VF

AST showed high significant correlations with all measures in *tree* VF, and medium significant correlations with TOT and NCL in action VF

SWM had high significant correlations with TOT and SW in action VF, high significant correlations with NCL in *tree* VF and medium significant correlations with SW in *animal* VF

SOC had medium correlations with TOT in overall semantic VF and NCL in phonemic VF

PAL showed systematically high correlations with SW in tree VF

Verbal Fluency and Working Memory Interaction - conclusions

Visual information recall is an **essential component of both automatic and less automatic lexical-semantic retrieval processes**

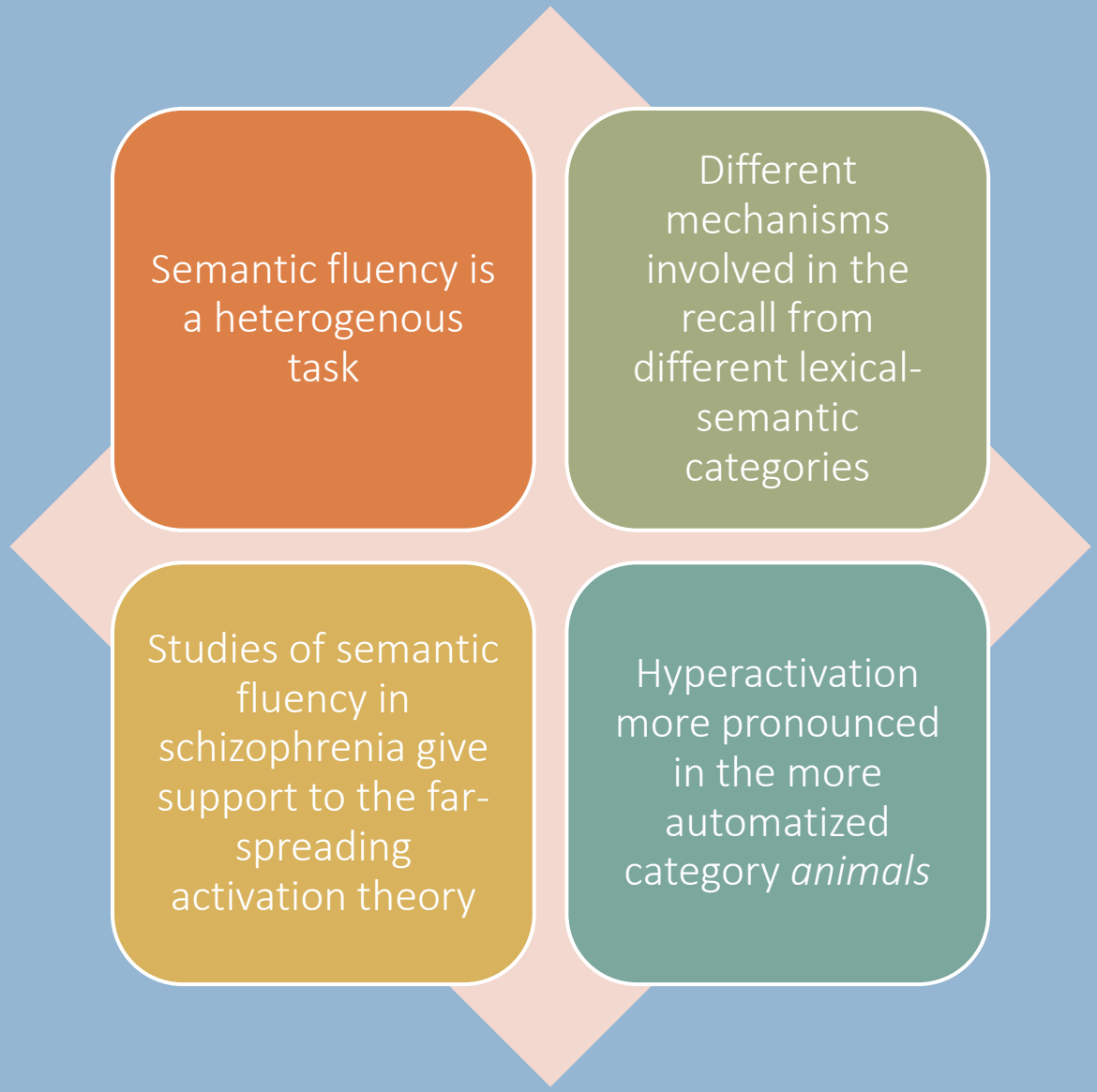
Visual information recall aids **clustering strategies in verbal fluency**, but is only limitedly related to switching

Retrieval in **lexical-semantic categories with less automatized links** (e.g. trees) is assisted by the **central executive**, specifically attention switching, and visual episodic memory retrieval. Retrieval in action fluency is assisted by spatial working memory and attention switching

Spatial working memory and specifically **spatial planning** are limitedly involved in **both automatic and less automatic** retrieval processes

Due to possibly considerable recency effects, **phonemic fluency tasks** should be administered a**fter semantic fluency tasks**, or specifically animal fluency

Conclusions



Future Research

Inclusion of psycholinguistic parameters such as imageability, abstractness/concreteness, frequency etc. in semantic fluency output analysis

More detailed description of the neuropsychological mechanisms underlying different semantic fluency tasks

Implications for our knowledge about the inner structure of the mental lexicon

Defining specific lexical-semantic deficits as a predictors of particular illness phases in first-episode psychosis

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