

# Referential vs. conceptual meaning in psychosis

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# Outline

1. Conceptual and referential meaning.
2. A study of referential meaning.
3. From referential to conceptual meaning.
4. Semantic similarity measures in Chilean-Spanish.
5. Relation between referentiality and lexical-conceptual meaning.
6. Semantic similarity measures in a larger German dataset.

# Conceptual and referential meaning

Two distinct components in the meaning of any utterance:

- ❖ Lexical-conceptual meaning: used for describing entities. Relies on our semantic knowledge (e.g., *CAT*).
- ❖ Referential meaning: how conceptual meaning is related to entities in the real world. Depends on grammar and the distinctions it mediates, e.g. specificity (*A cat, that cat, the cat*), or co-reference (*her, it*), or both (*her cat*).

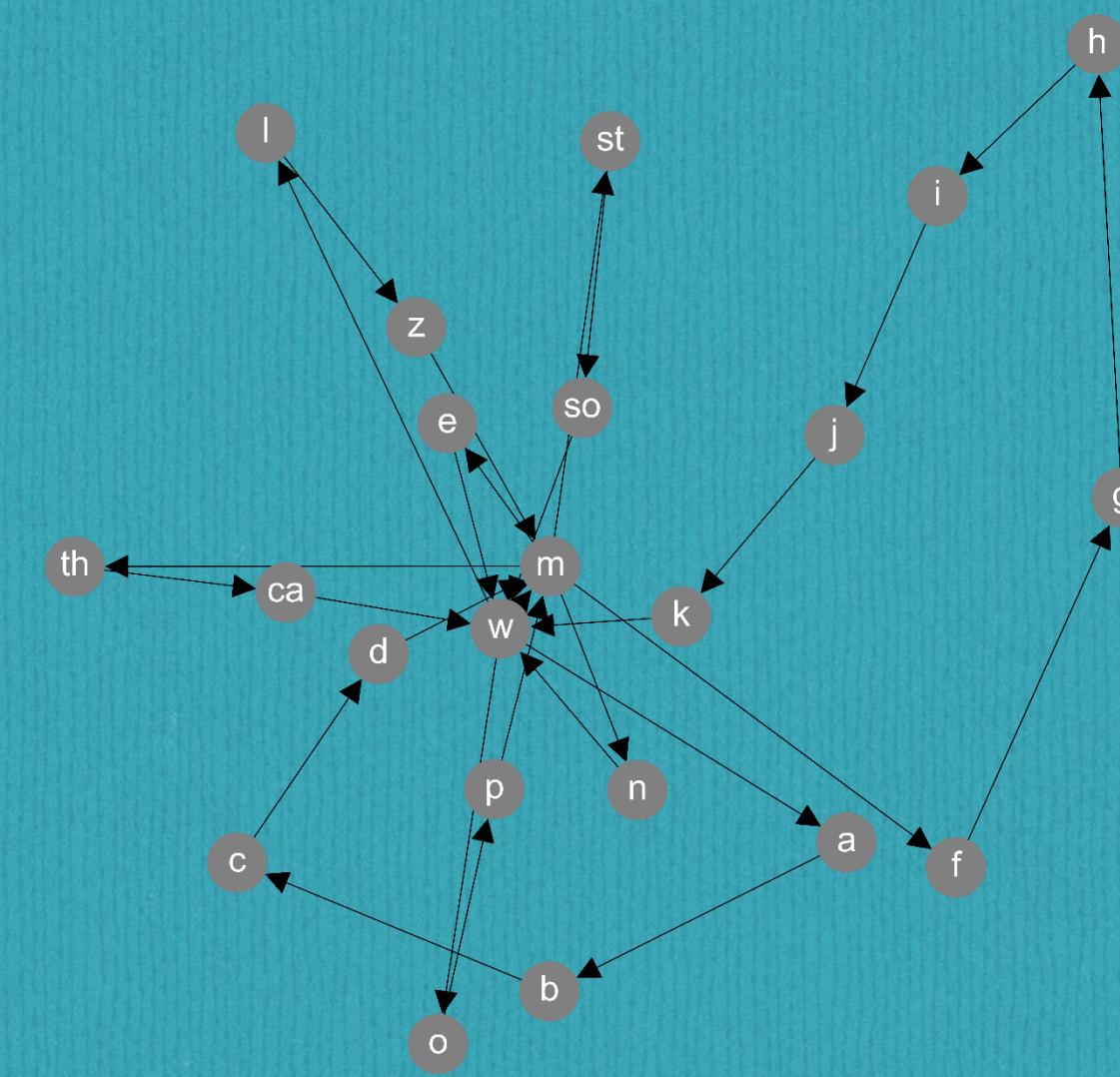
How could these two components be related in psychotic discourse? (if they are)

# Referential meaning

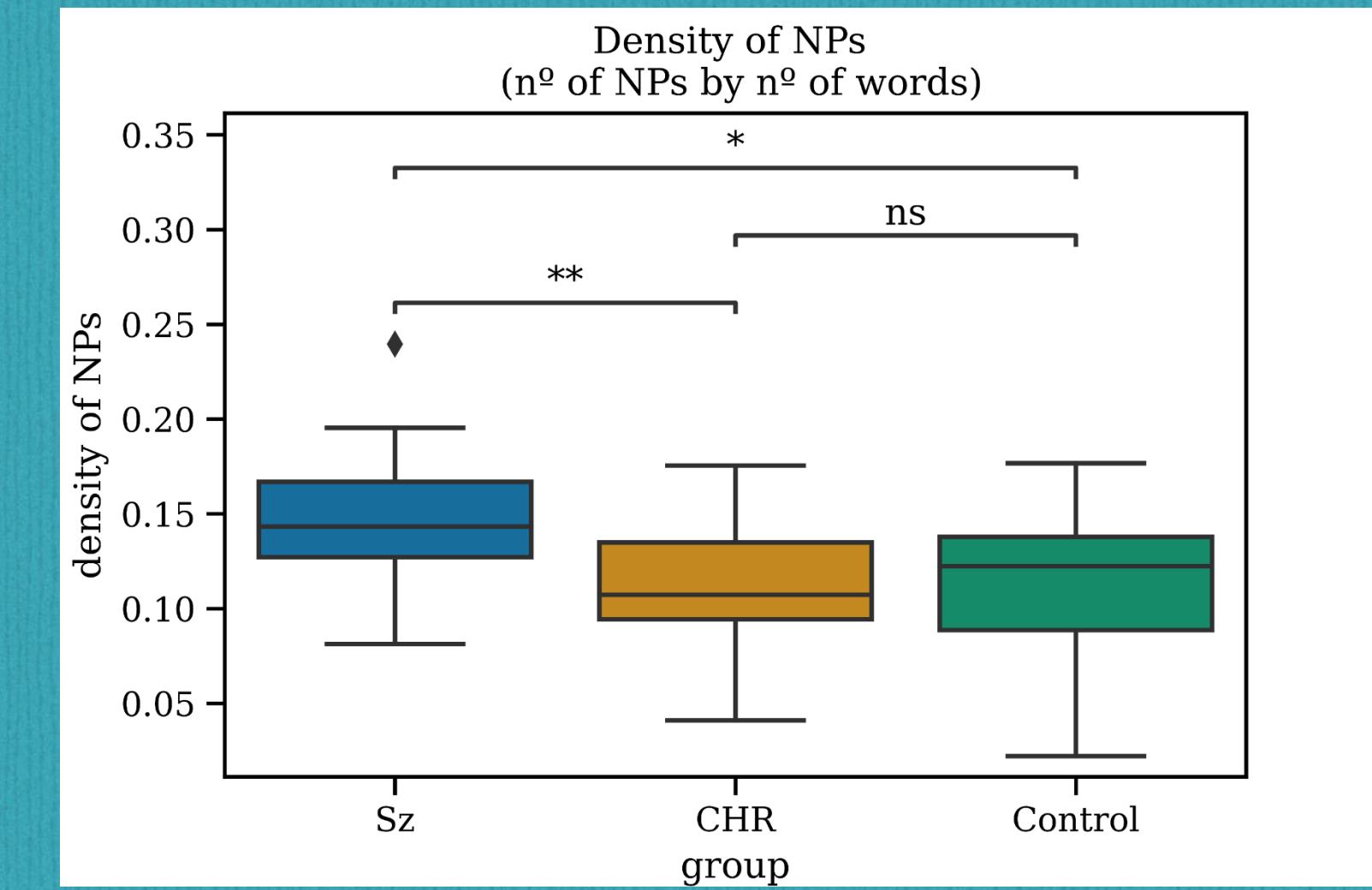
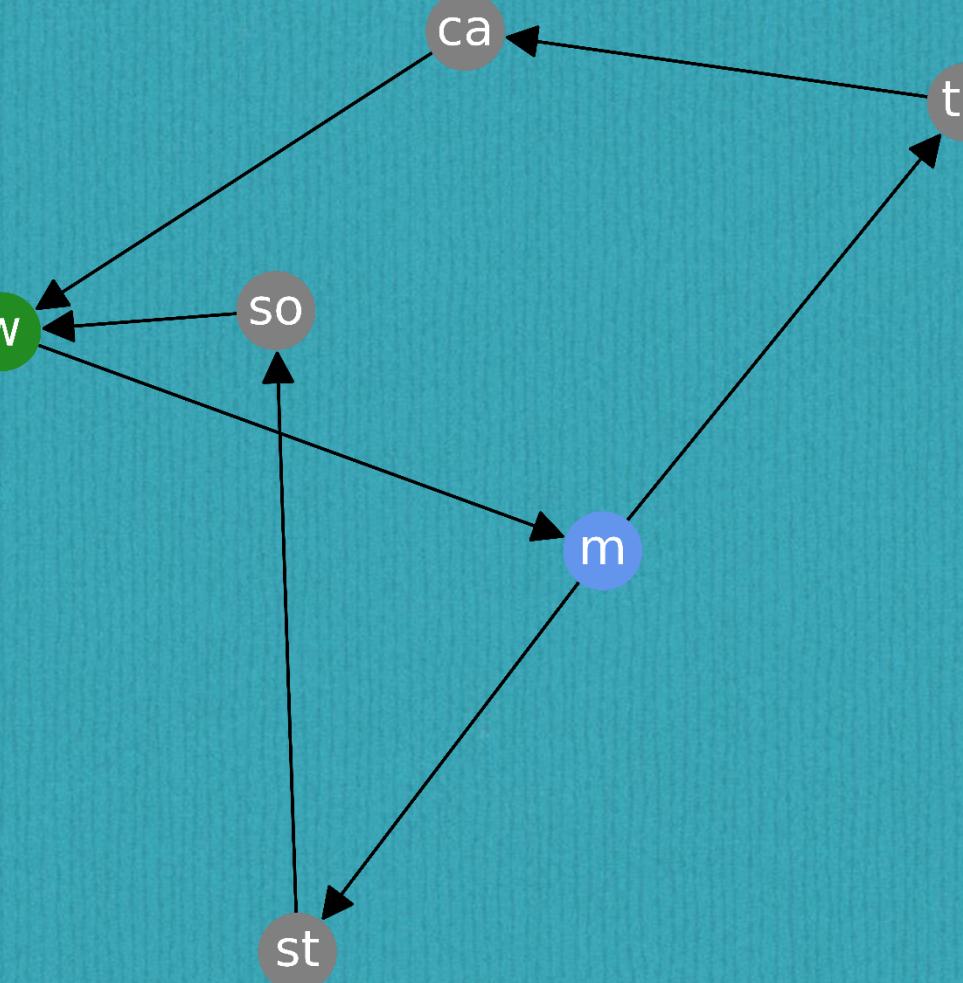
- Referential meaning has long been found to specifically deteriorate in individuals with Sz, with unclear reference making discourse difficult to follow (Rochester and Martin, 1979; Docherty et al. 1996).
- Anomalies of pronominal reference are prominent (McKenna and Oh, 2005; Watson et al., 2012).

# A study of referential meaning

A



B



- *Control over reference in speakers with SZ.*
- 60 Chilean Spanish speakers (20 Controls, 20 CHR, 20 SZ).
- Clinical interviews with 909.2 words on average.

## LANGUAGE AND PSYCHOSIS SUPPLEMENT

### Coreference Delays in Psychotic Discourse: Widening the Temporal Window

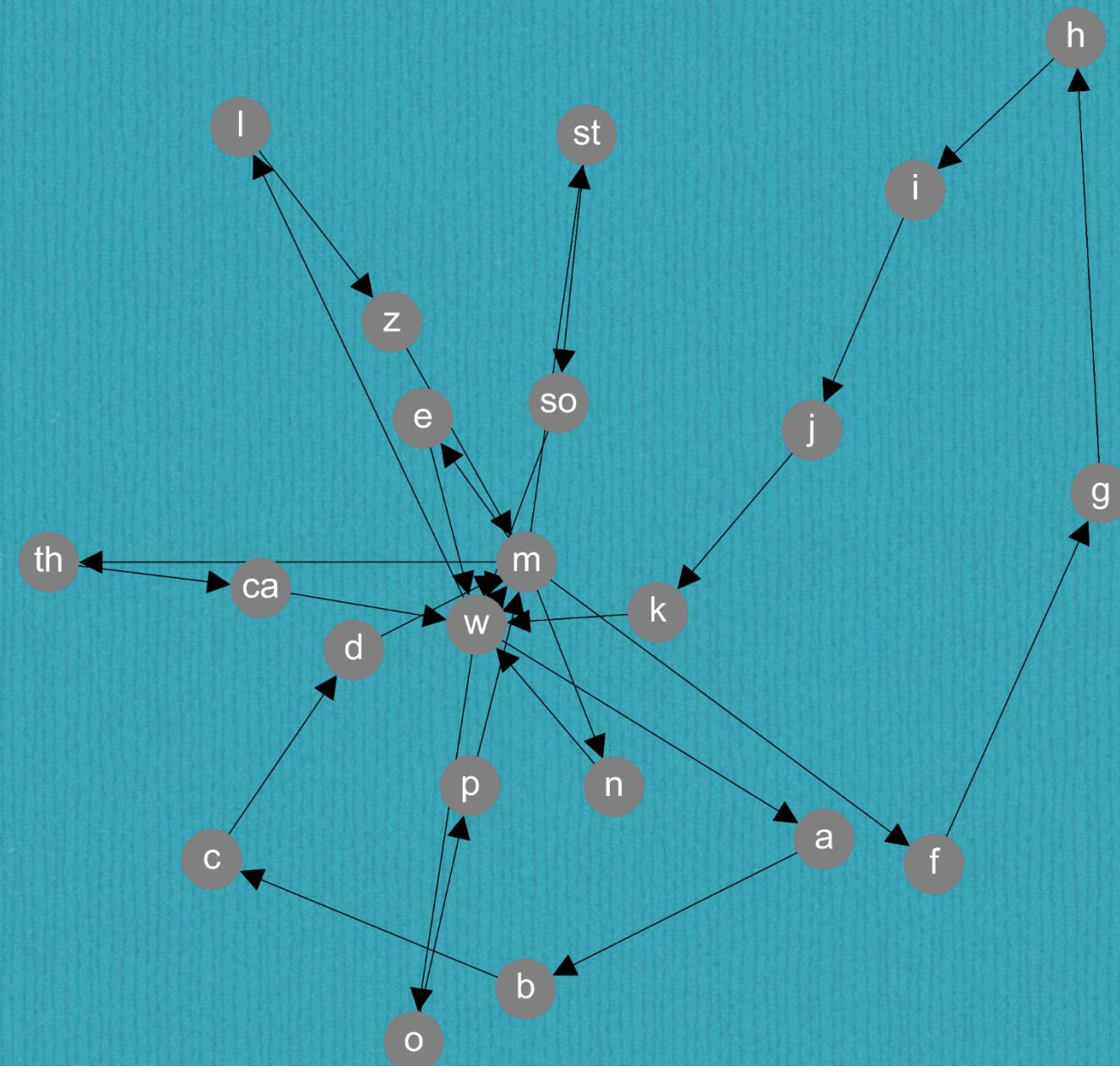
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<sup>3</sup>Millennium Nucleus to Improve the Mental Health of Adolescents and Youths (IMHAY), Santiago, Chile; <sup>4</sup>Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

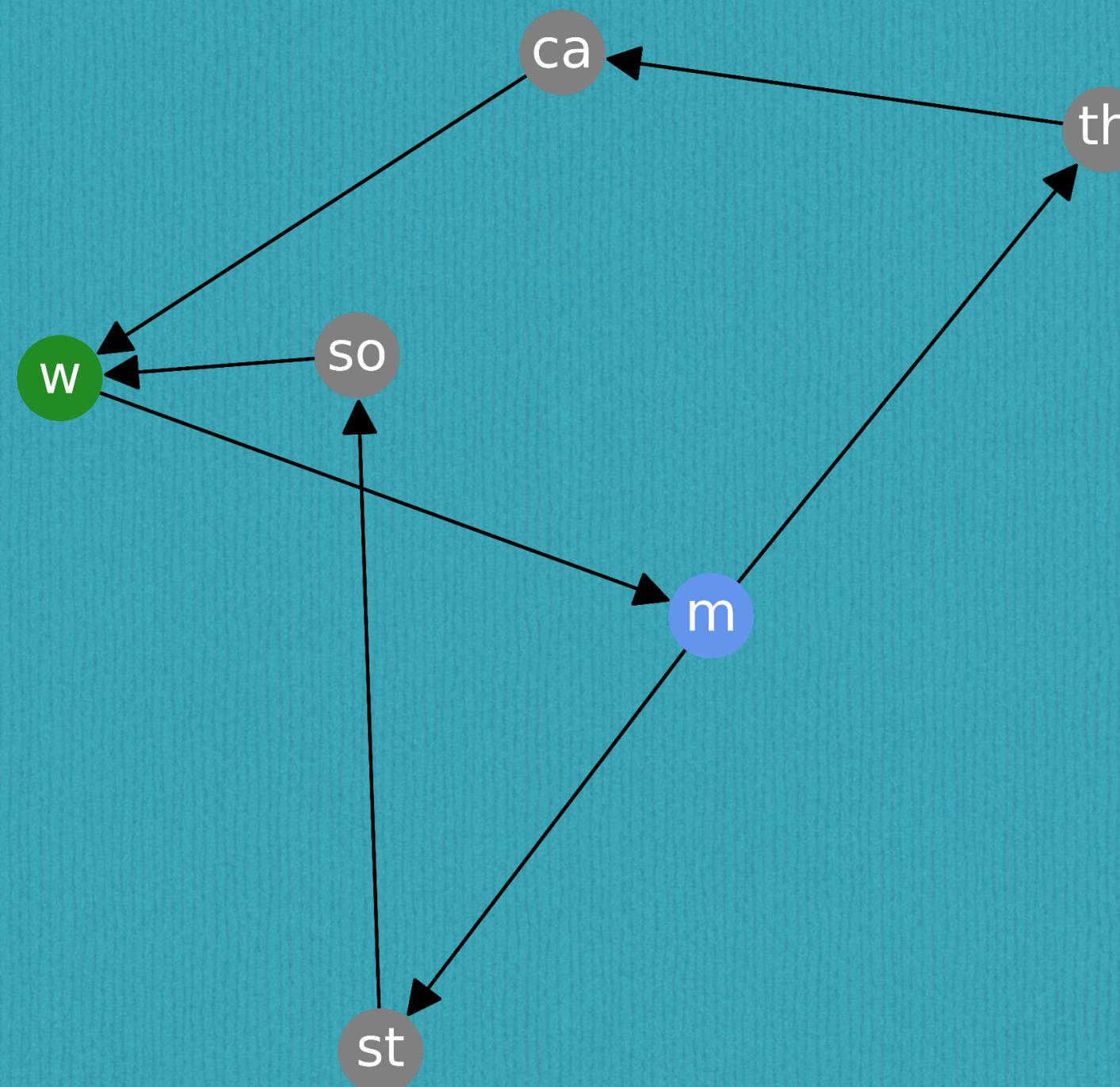
# A study of referential meaning

A



There was [a man] on [the street] waiting for [someone].  
Later, [a woman] met [him]. Although [they] went to [a cafe],  
[she] seemed to be busy.

B

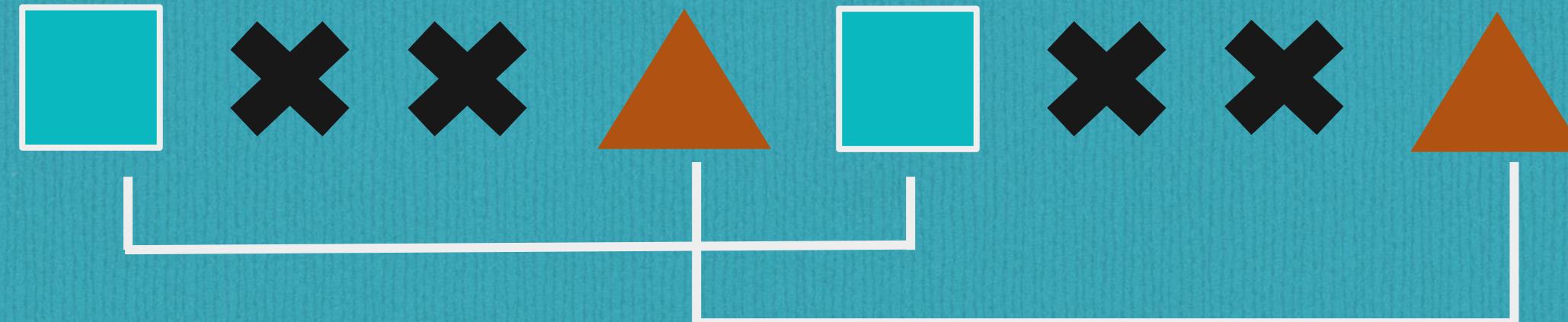


Recurrent entities: in color

Non-recurrent entities: in gray

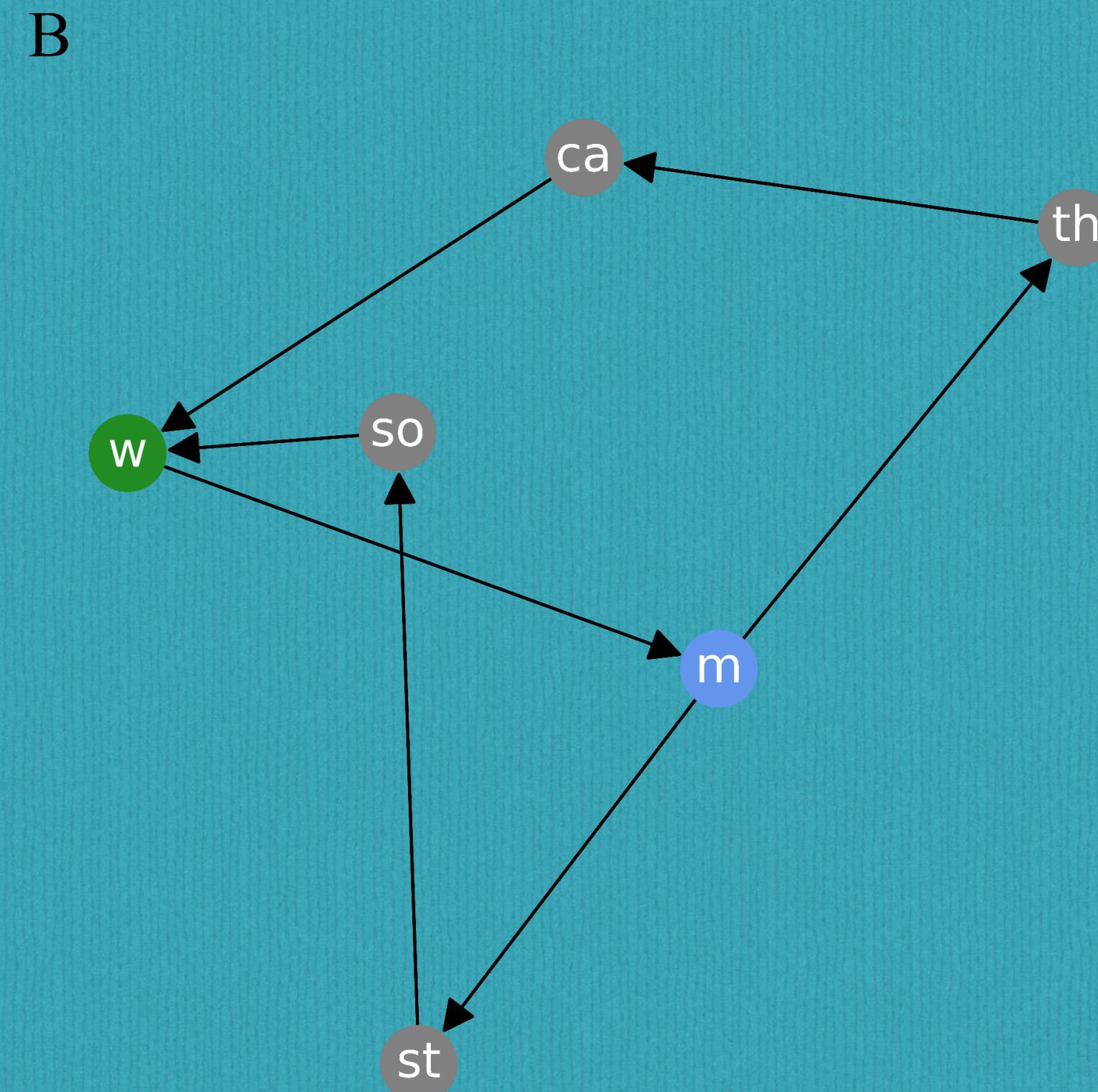
# A study of referential meaning

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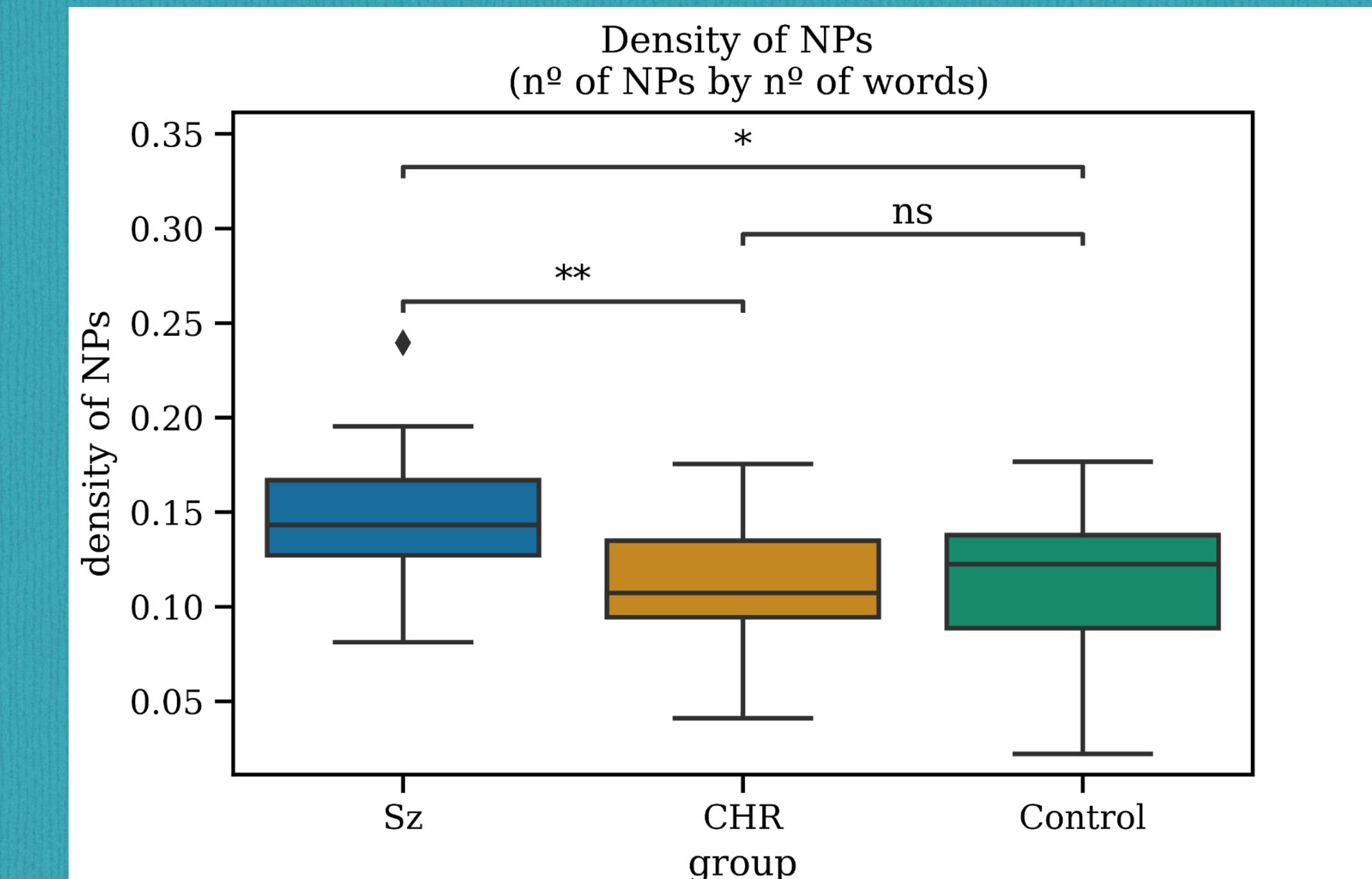
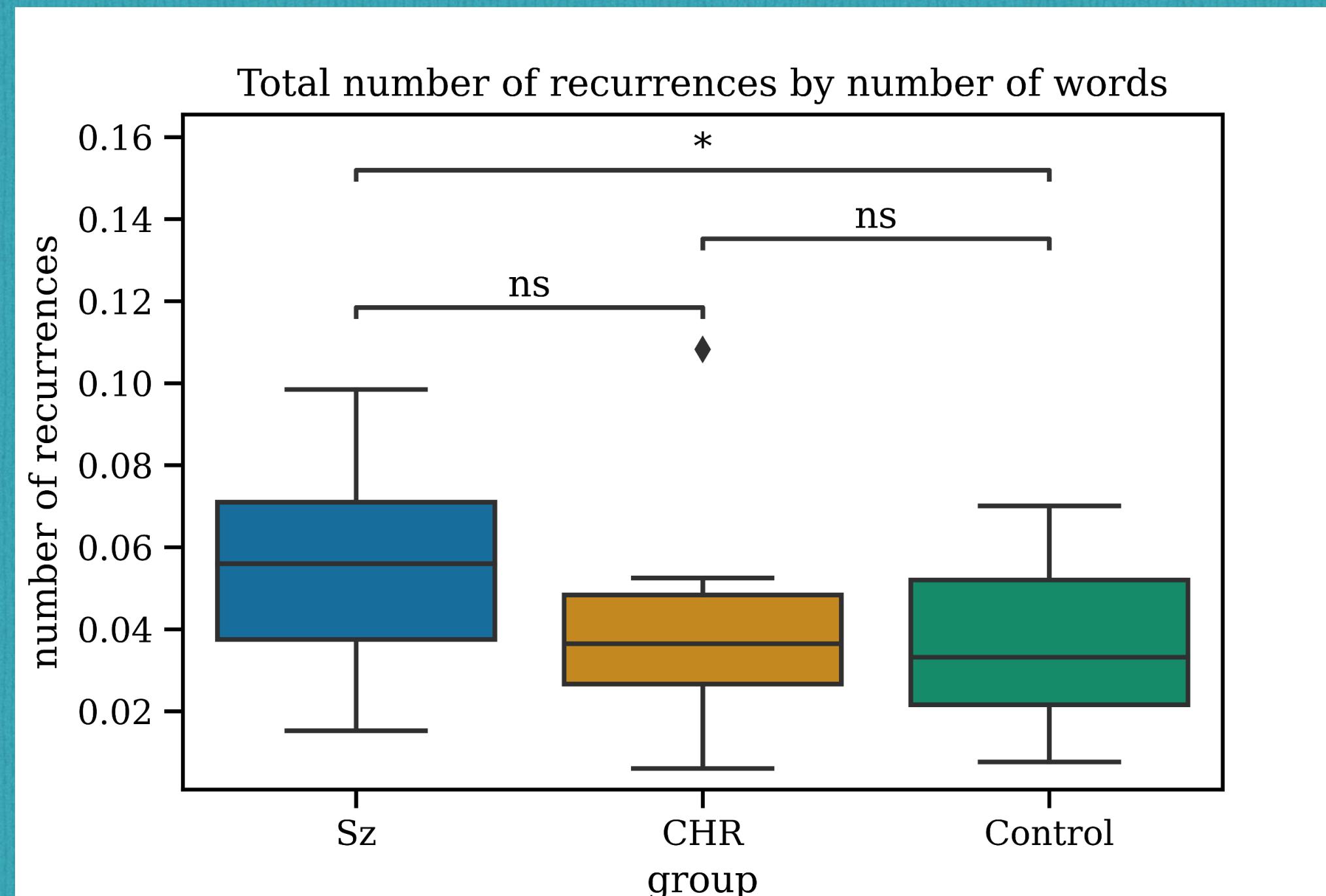


Topological distance:

number of nodes (NPs) between a recurrent entity and itself.



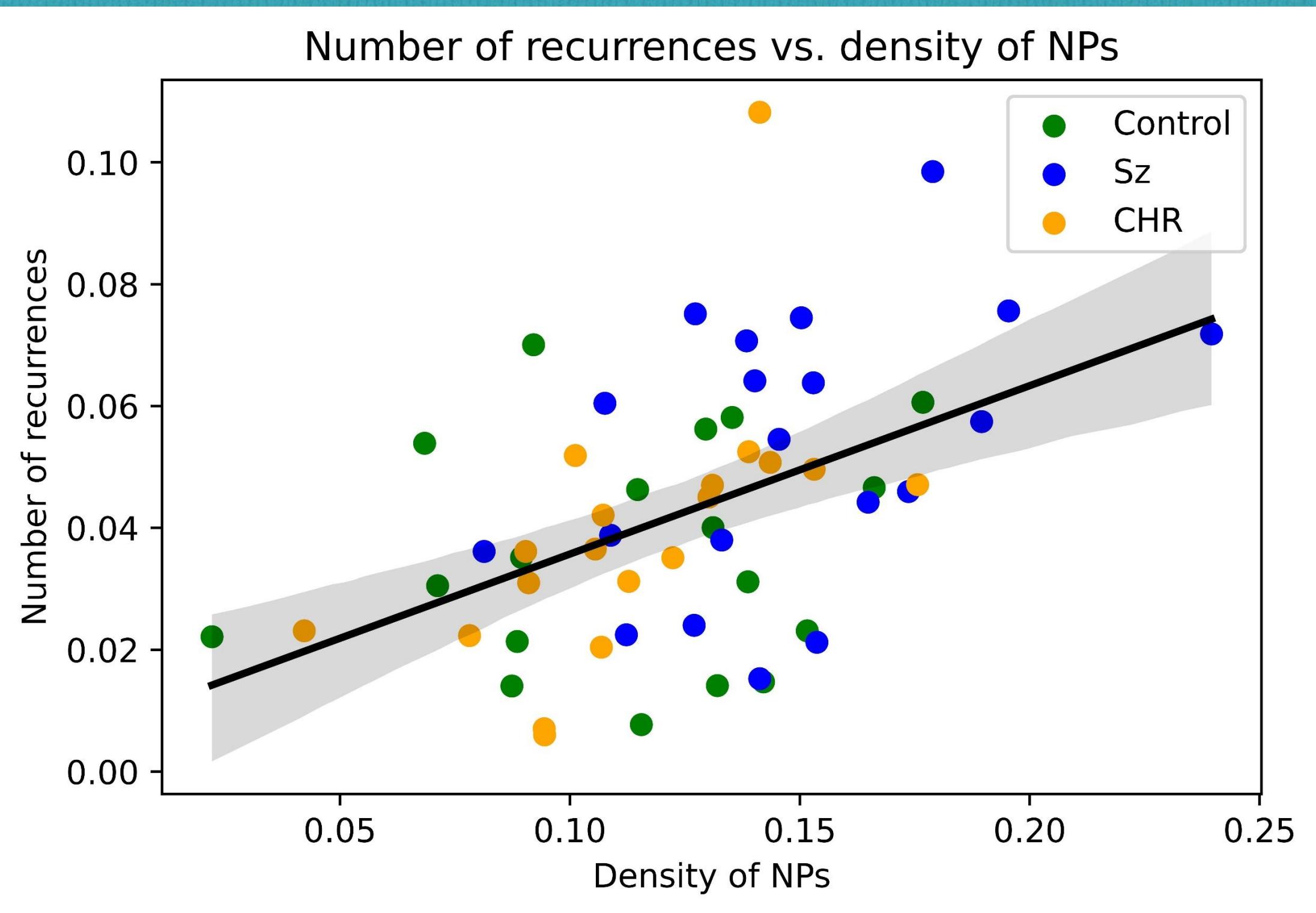
# Number of recurrences and NPs



Total number of recurrences: sum of the degree of the nodes that represent the recurrent entities.

Significant correlation between density of NPs and number of recurrences: 0.48

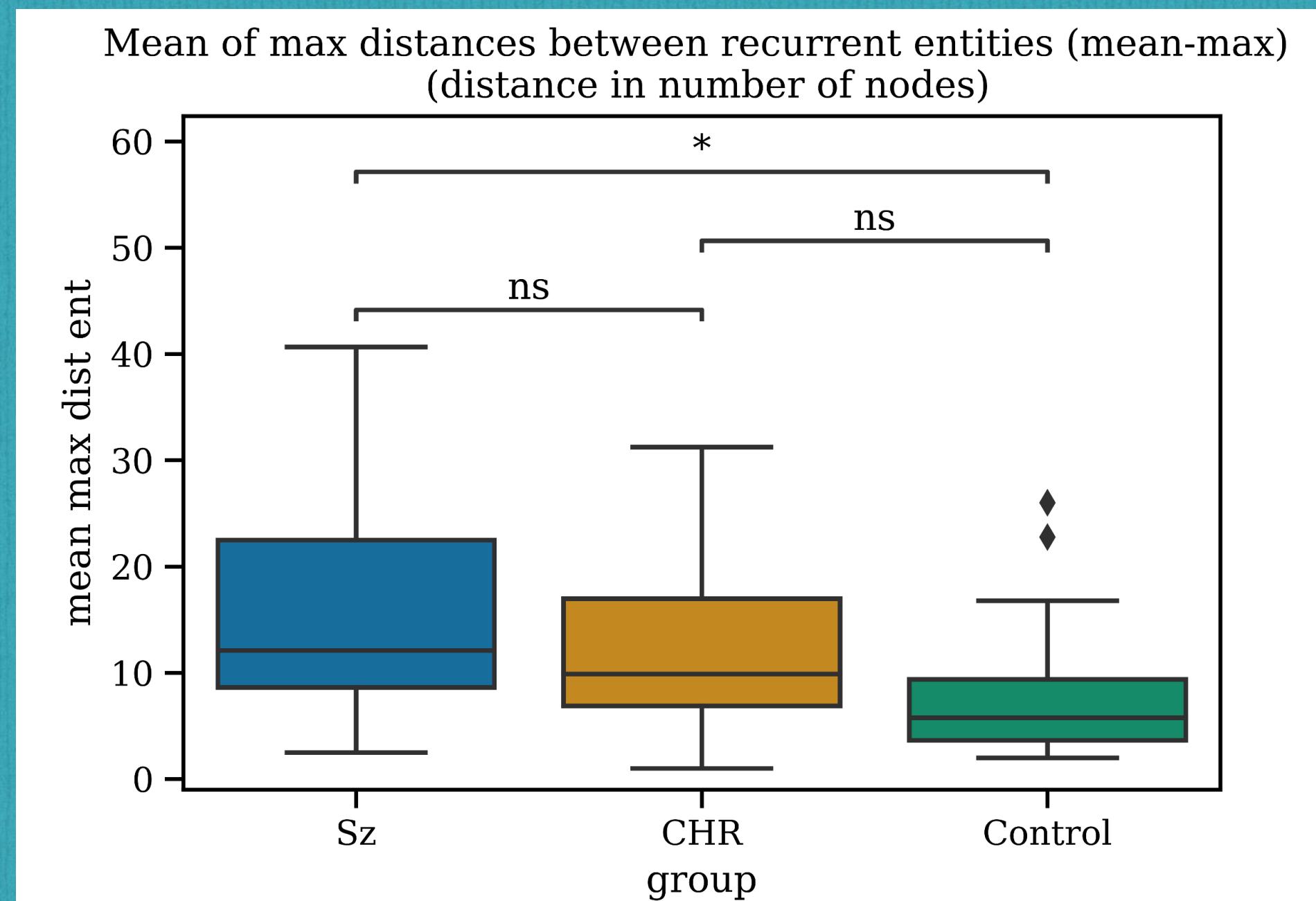
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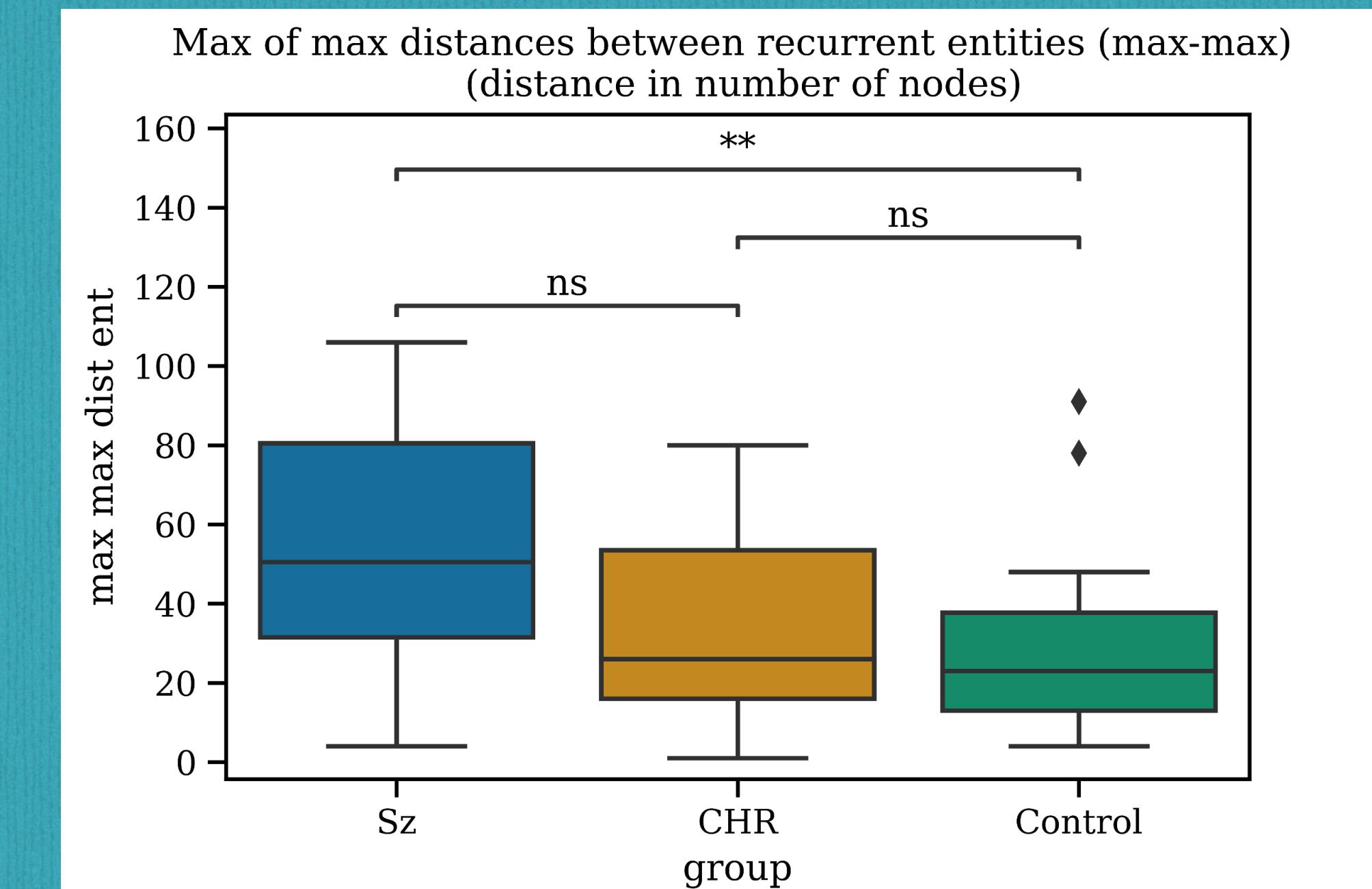
Significant correlation between density of NPs and number of recurrences: 0.43

# Topological distance



\* : p-value < 0.05

\*\* : p-value < 0.01



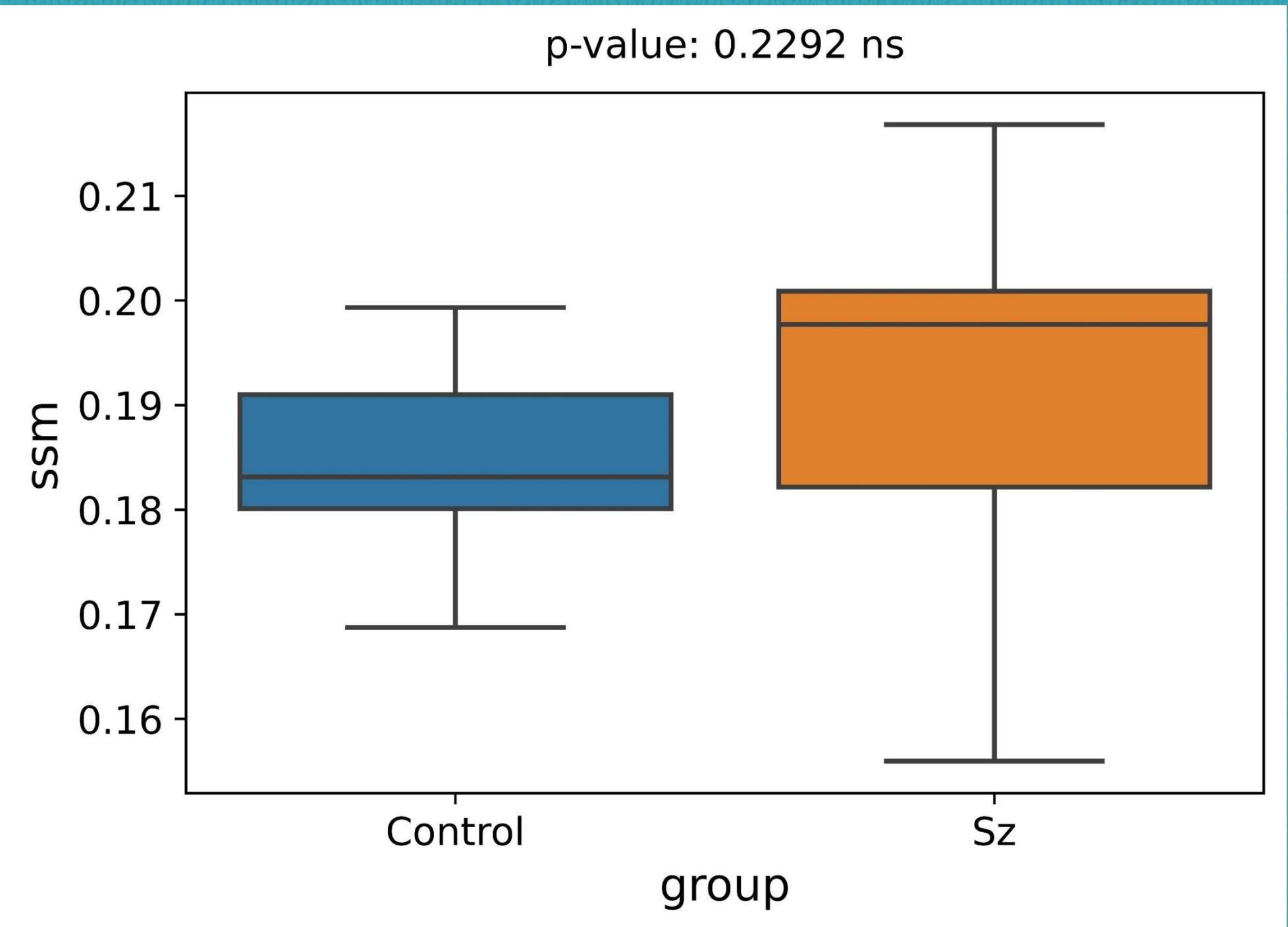
# Interim summary

- SZ produce more NPs (SZ>CHR; SZ>CON).
  - Mainly because there are ***more recurrences in total*** in SZ.
  - Correlation between total number of recurrences and density of NPs.
- This leads to the (topological) distance between a recurrent entity and its coreference being larger.
- This also means that the various recurrent entities interfere with each other, creating entanglement between referential threads.

# Relation between referentiality and conceptual meaning

- Is there a relationship between these two concepts? Should there be a relationship between both kind of meanings?
- Increase in semantic similarity in First Episode of Psychosis (Alonso-Sánchez et al., 2022).
- Following Bleuler's conceptualization of "loosening of associations" (1908) in schizophrenia, many studies have explored NLP tools such as semantic similarity, with the prediction of a decrease of semantic similarity.
- But loosening of associations could predict the opposite: Increase in semantic similarity reflecting greater associativity between concepts, or a 'shrinking' semantic space.
- This would be consistent with data from Zhang (to appear) in Chinese, indicating increase in semantic similarity (see next talk).

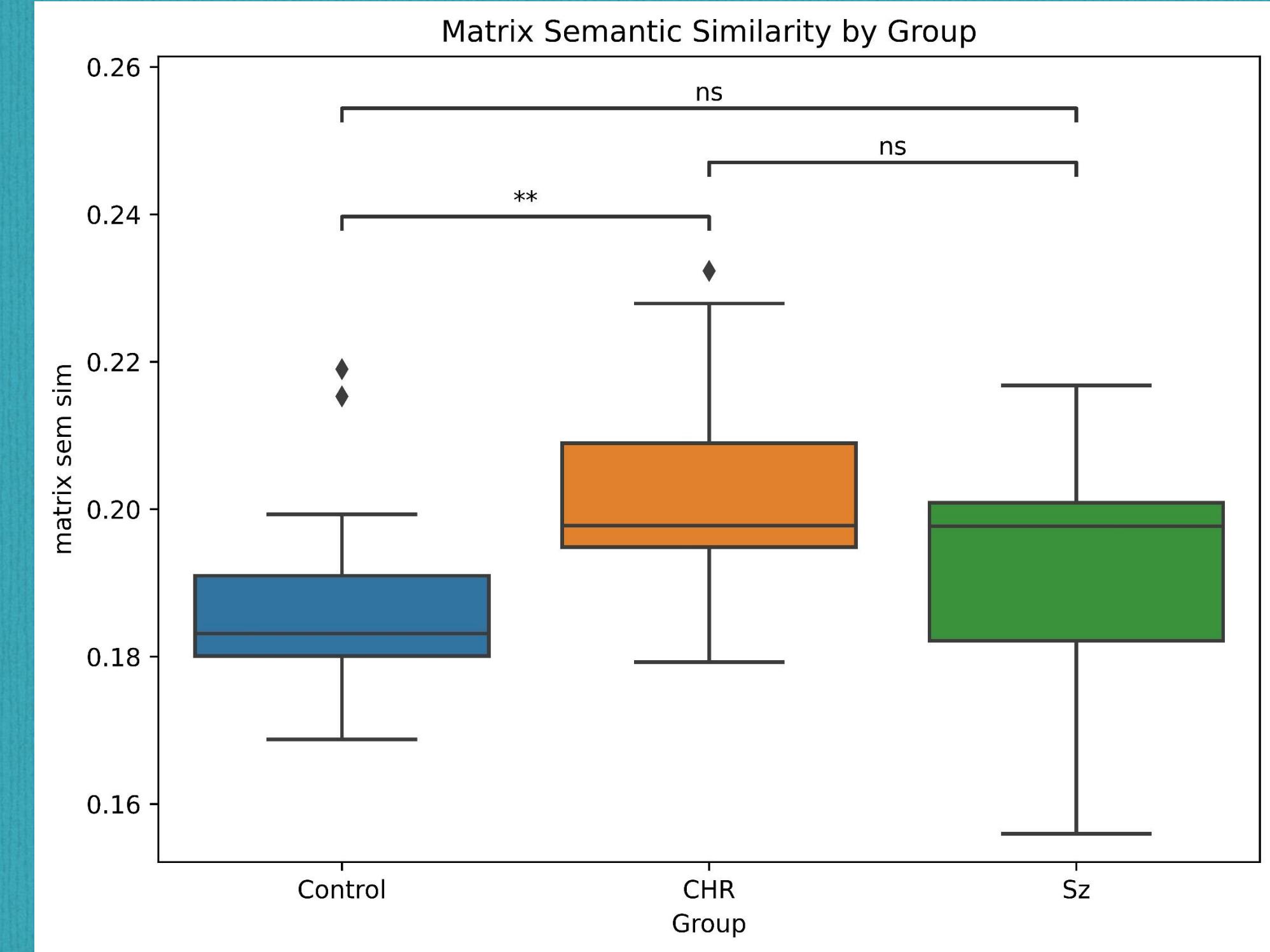
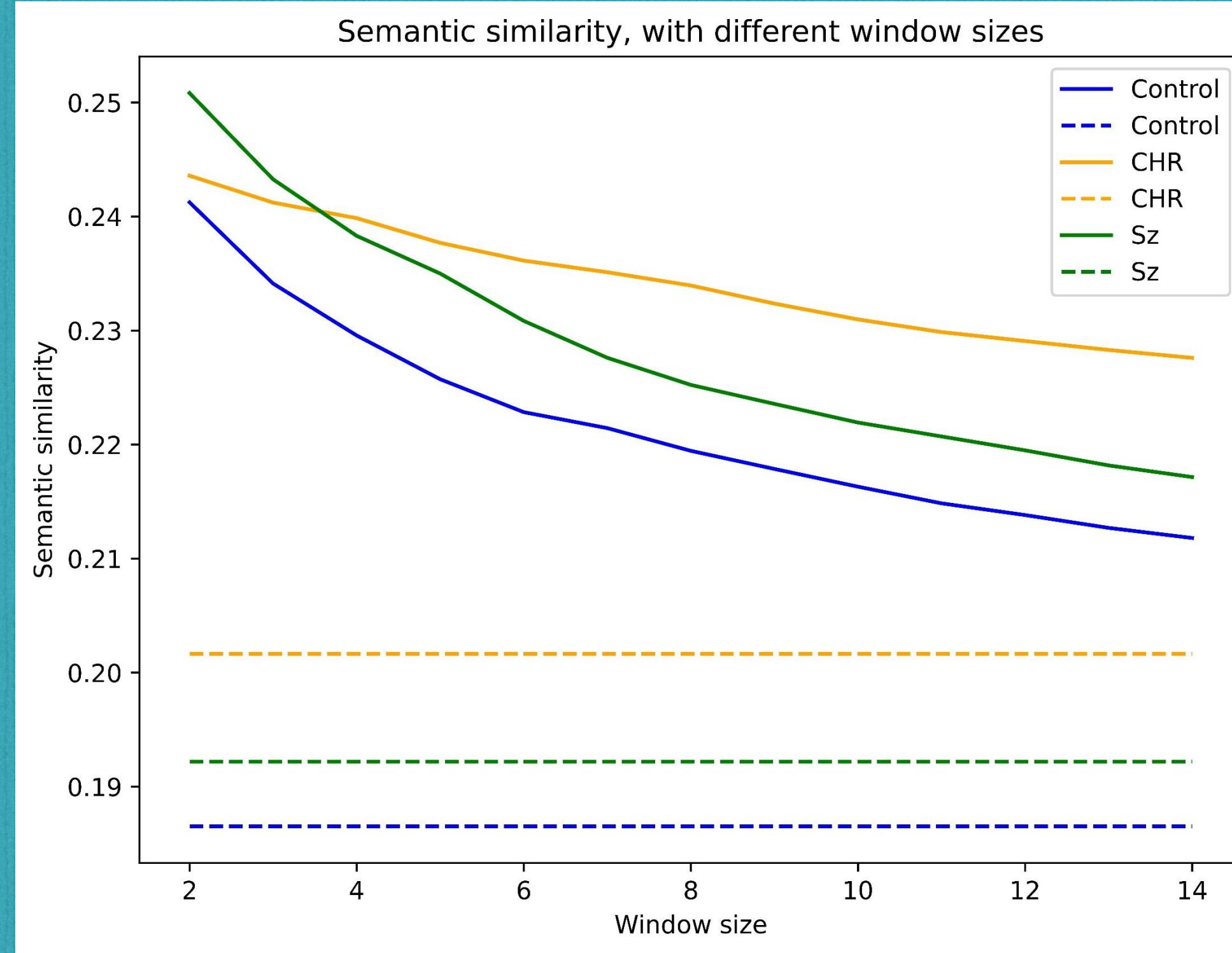
# Semantic similarity measures in this data



ssm: semantic similarity (from affinity matrix).

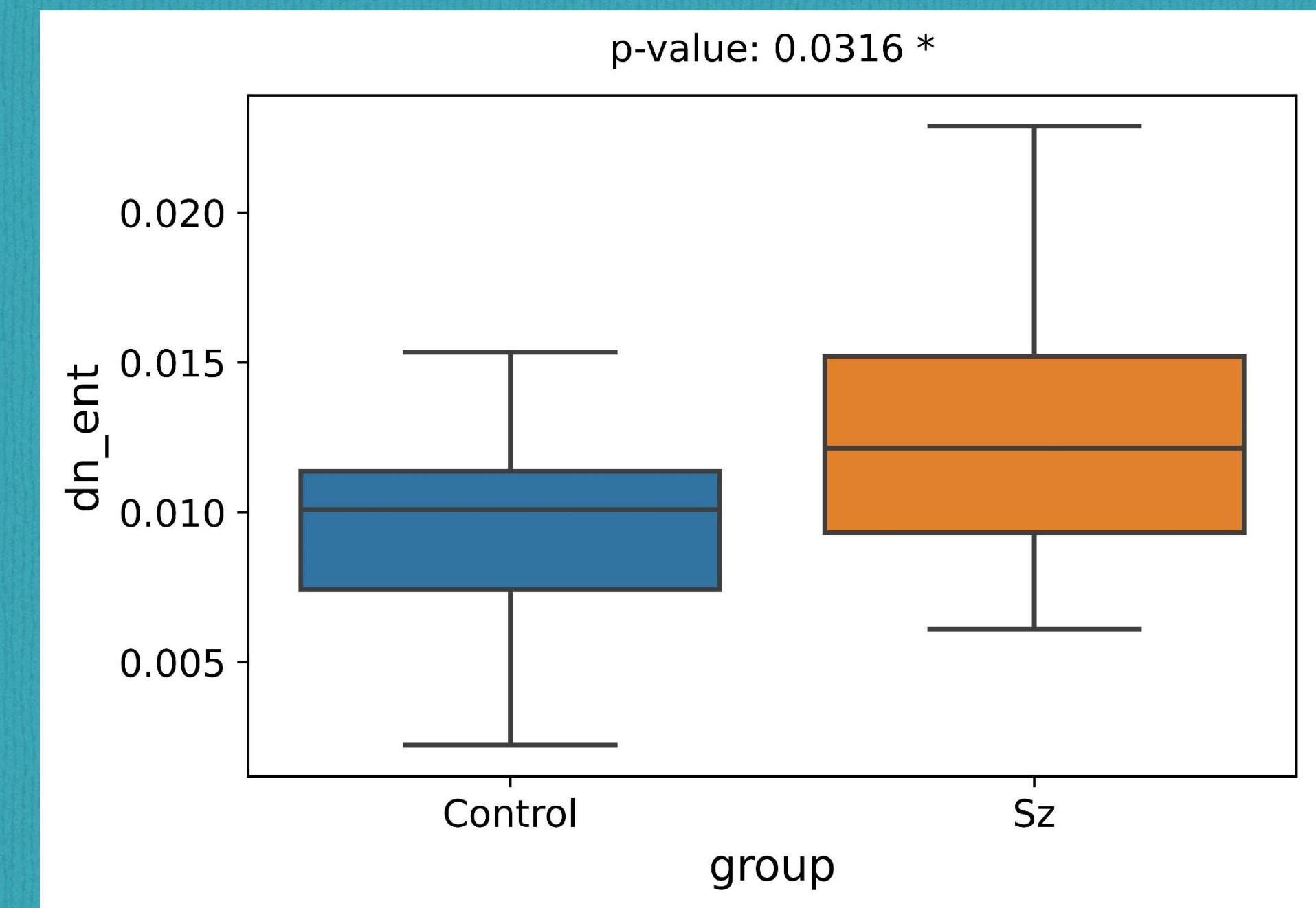
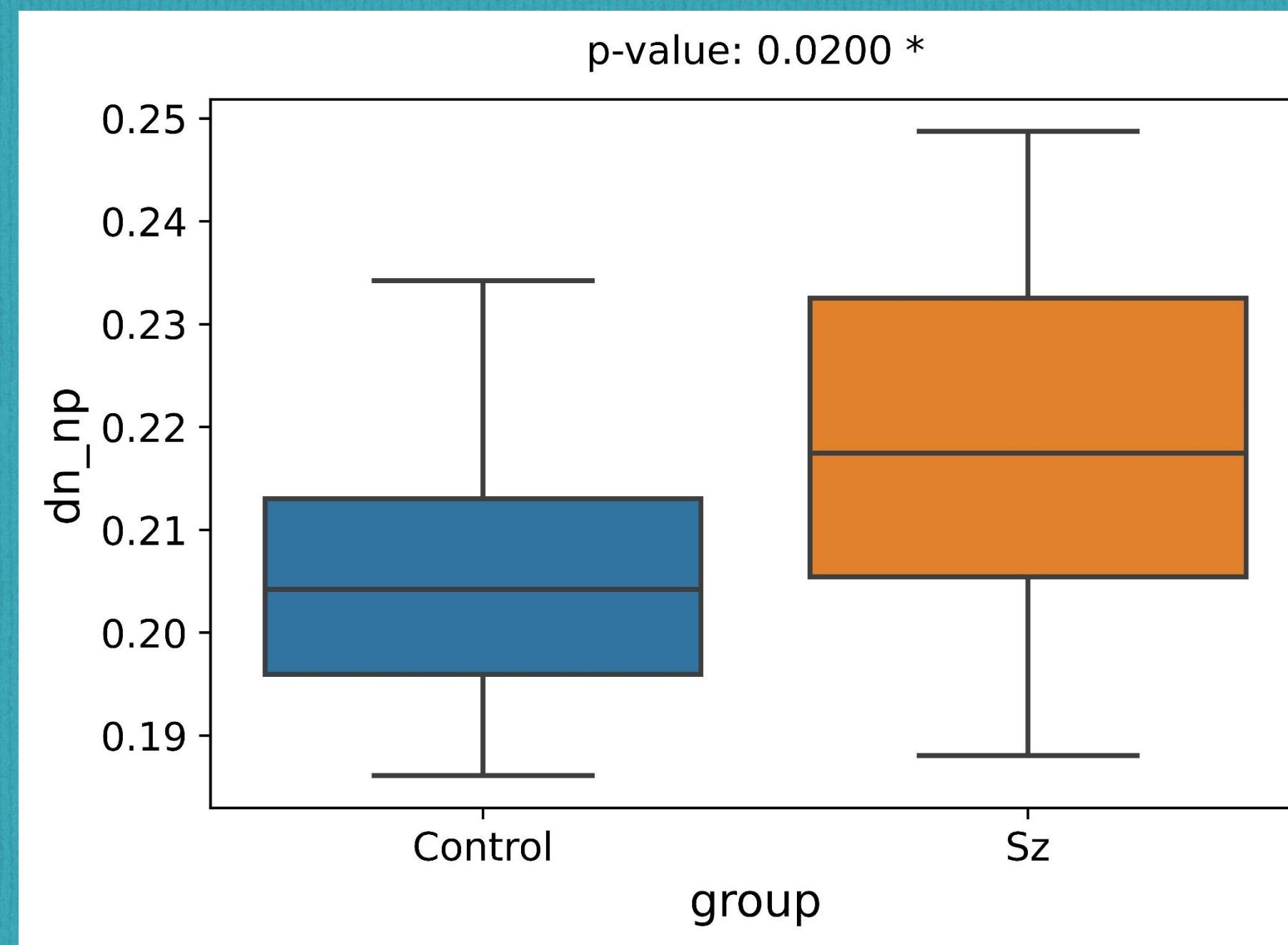
Non-significant increase in semantic similarity in Sz

# Semantic similarity using different windows

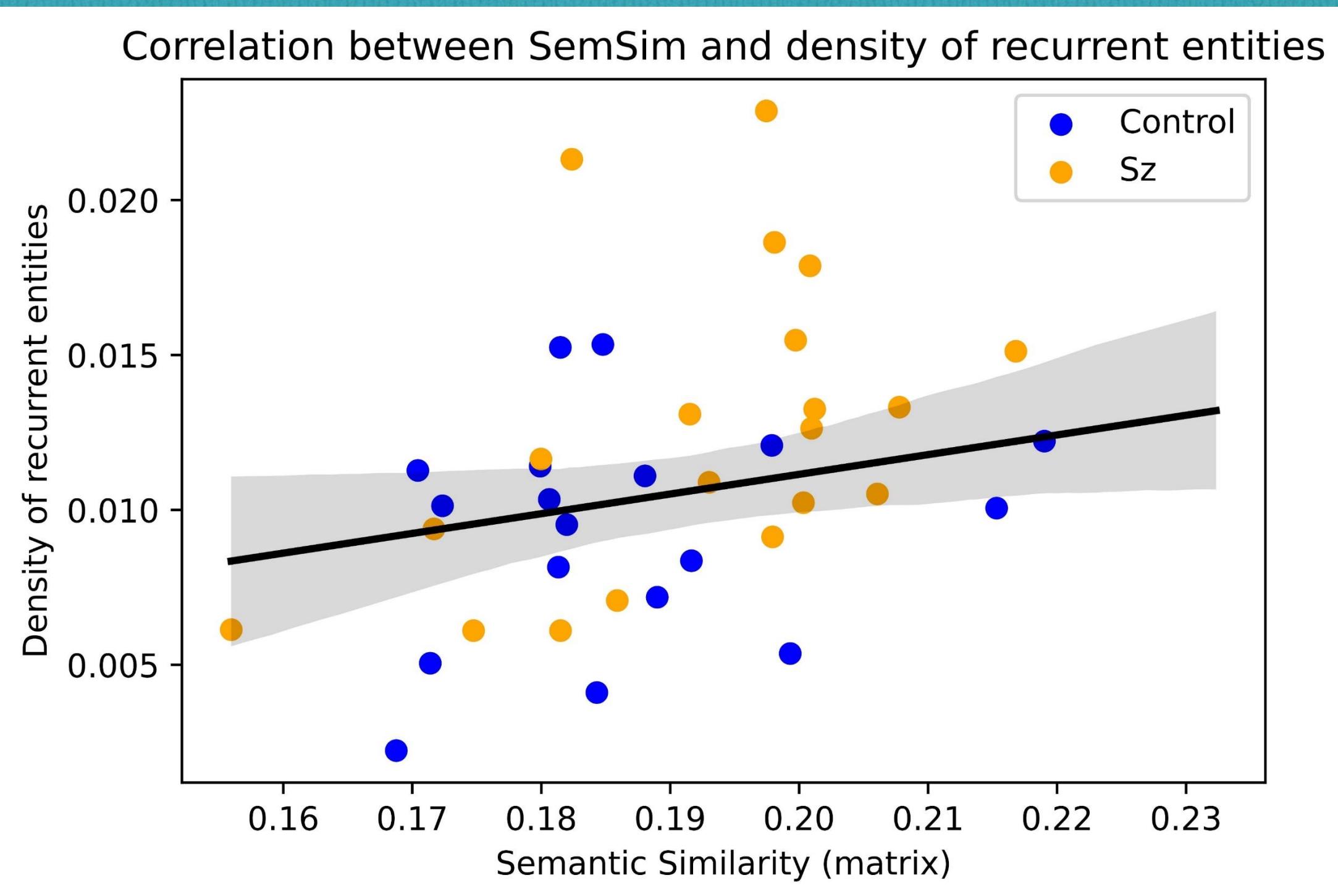


As the word windows become larger, the average semantic similarity approaches the average semantic similarity in the affinity matrix.

# Relationship between NPs, entities and semantic similarity



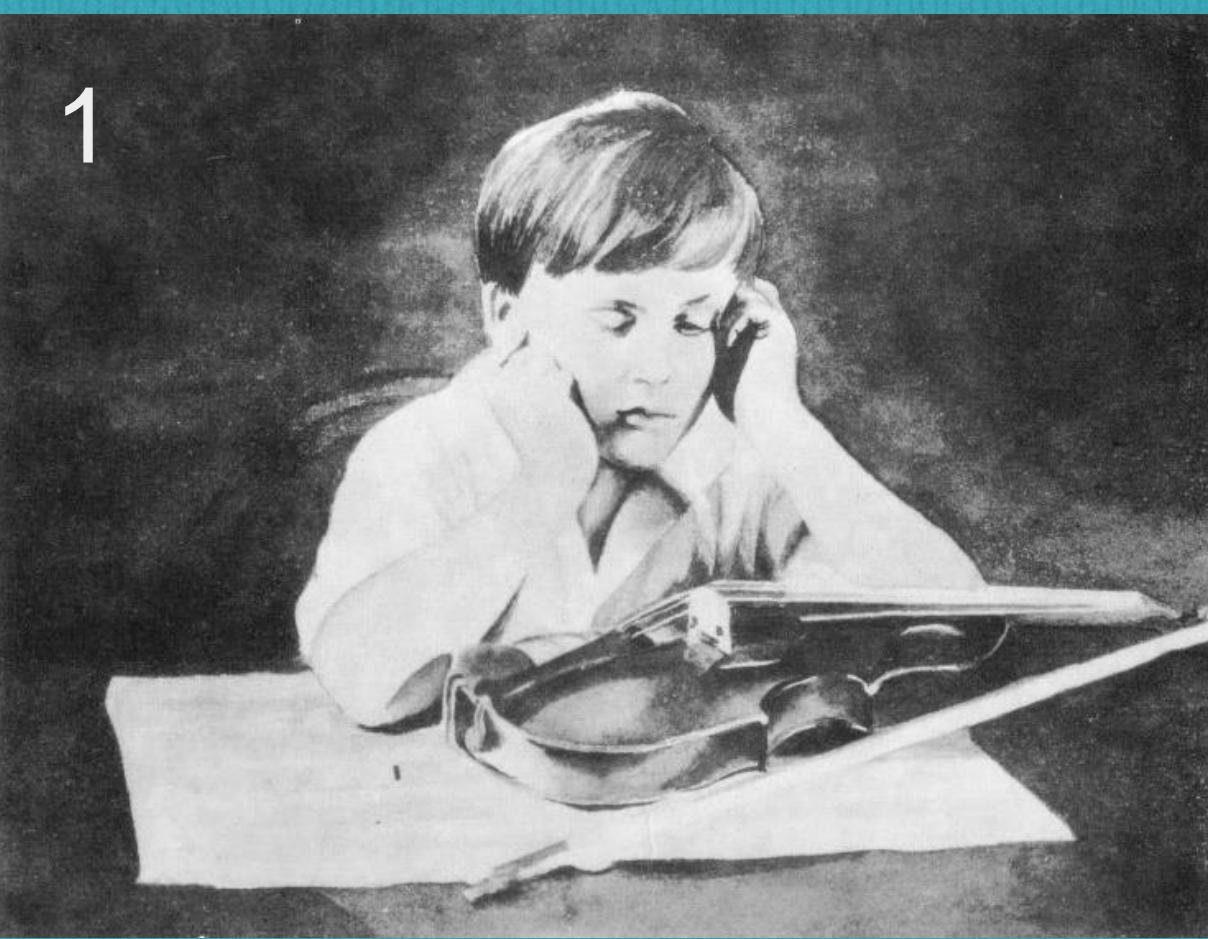
# Relationship entities and semantic similarity



Significant Pearson correlation coefficient: 0.402

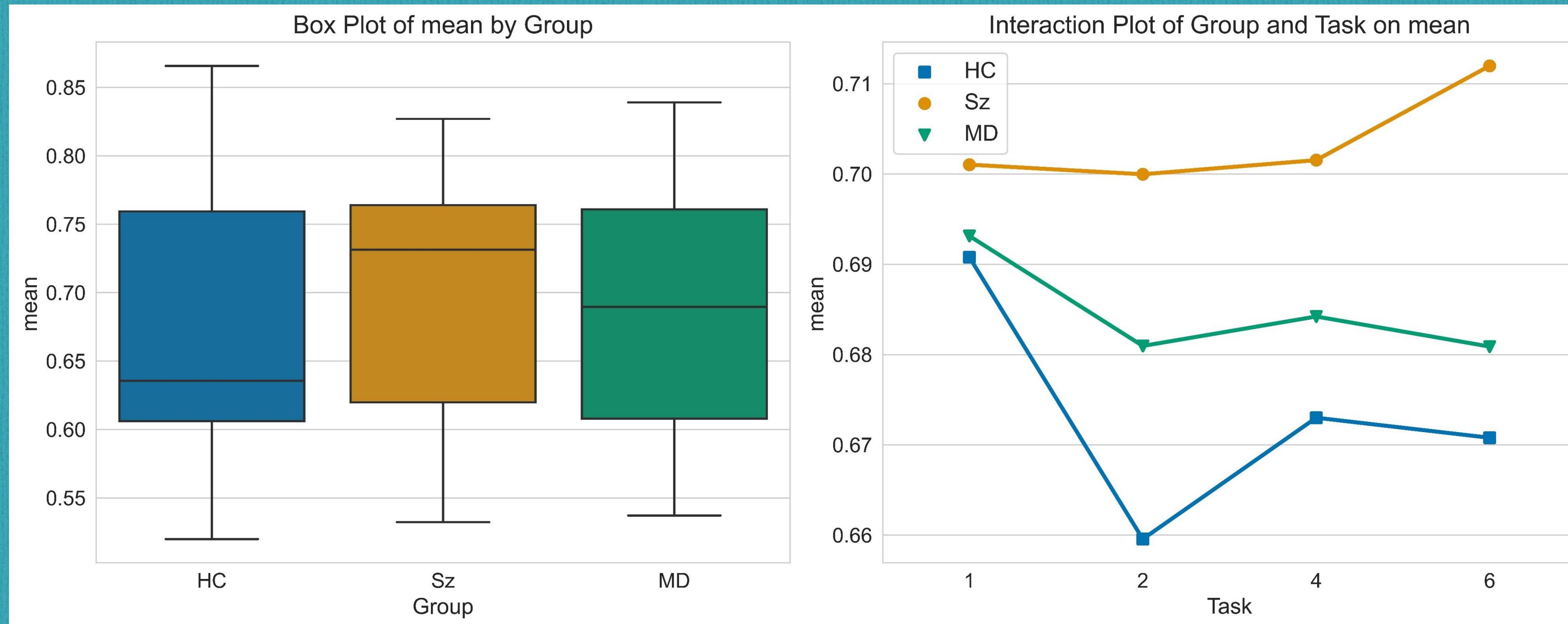
# Semantic similarity measures in German: different task and language

- Data compiled and provided by the research team of the Department of Psychiatry of the Phillips University of Marburg (PI: Prof. Tilo Kircher; lead investigator: Dr. Friederike Stein).
- Spontaneous speech dataset using Thematic Apperception Test (TAT) from 43 clinically stable in-patients with schizophrenia spectrum disorders (SZ), 39 patients with major depression (MD), and 43 healthy controls (HC). 4 pictures and 3 minutes speech.



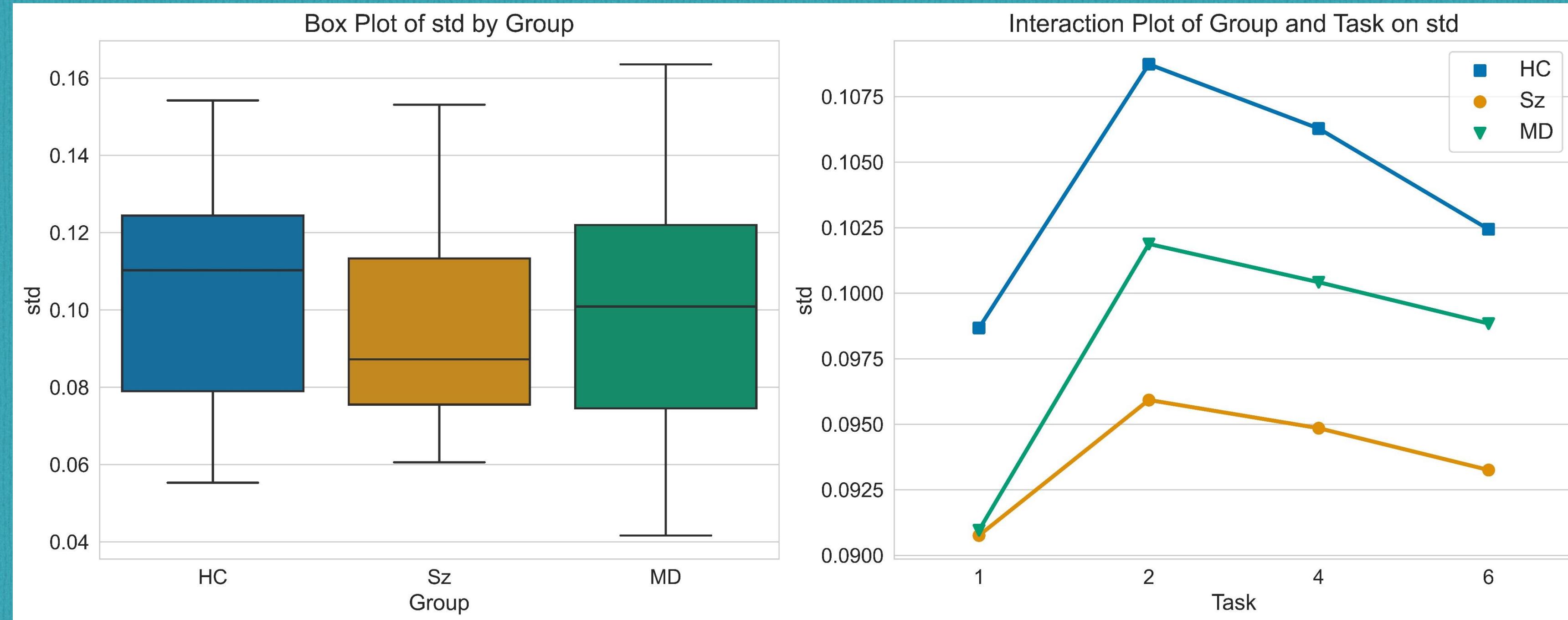
Thematic Apperception Test (TAT)  
(Murray, 1943)

# Semantic similarity (consecutive words)



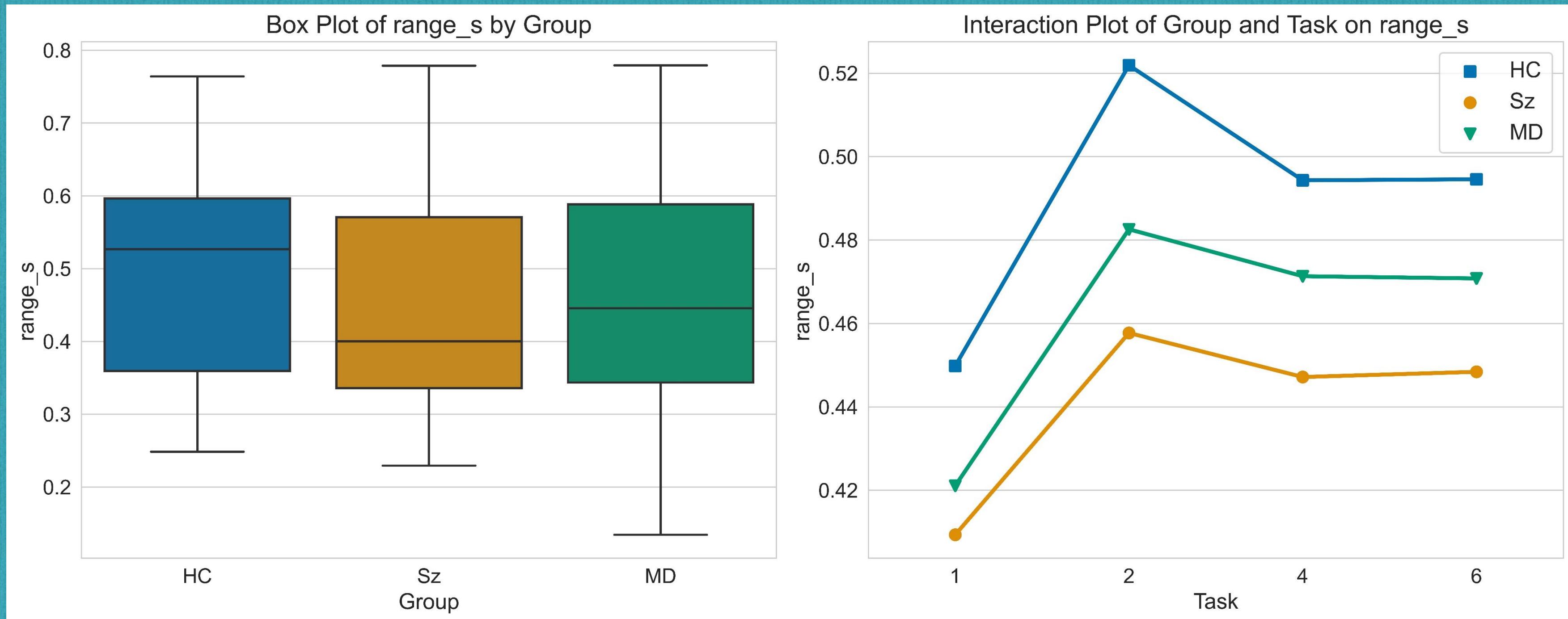
Significant differences between SZ and HC in **mean of semantic similarity** (consecutive words), but also picture effect.

# Standard deviation of semantic similarity



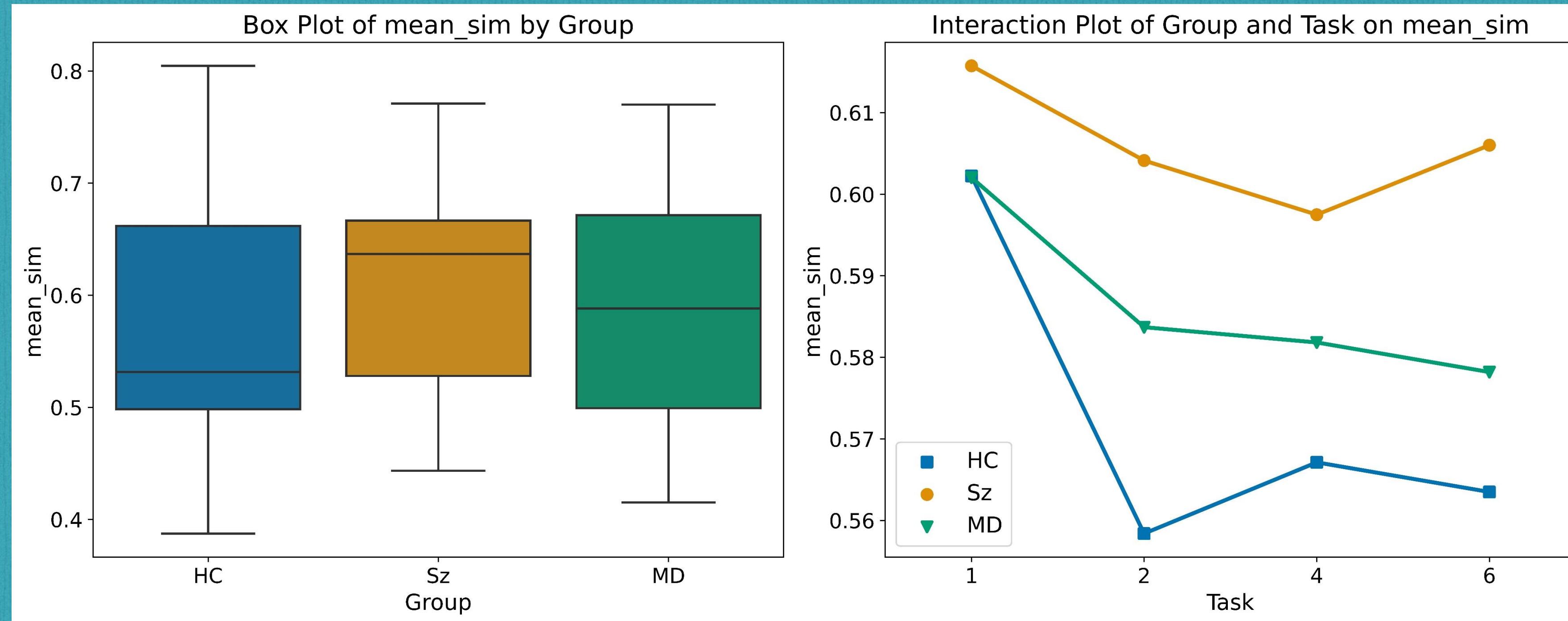
Significant differences between SZ and HC in **standard deviation of semantic similarity** (consecutive words), but also picture effect.

# Range of semantic similarity



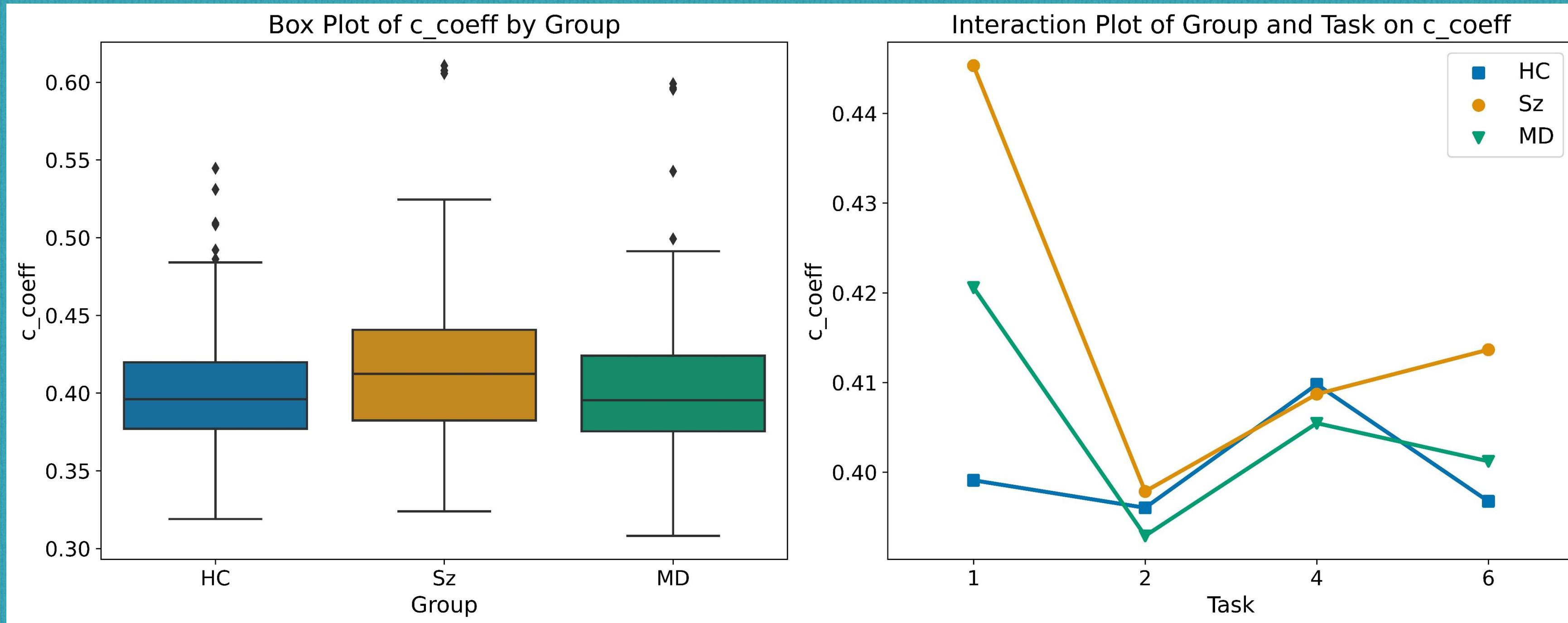
Significant differences between SZ and HC in *range of semantic similarity* (consecutive words), but also picture effect.

# Semantic similarity (from affinity matrix)



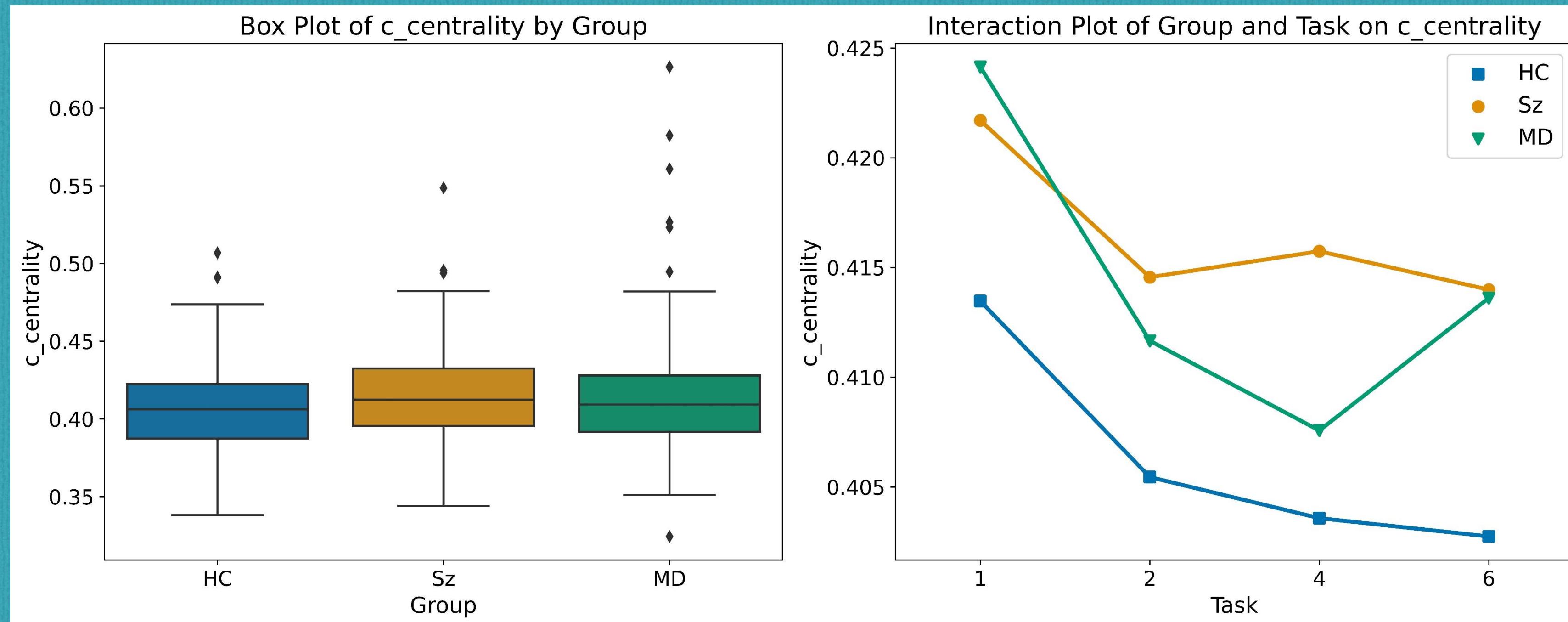
Significant differences between SZ and HC in ***mean of semantic similarity*** (matrix of all content words), but also picture effect.

# Semantics graphs: Clustering coefficient



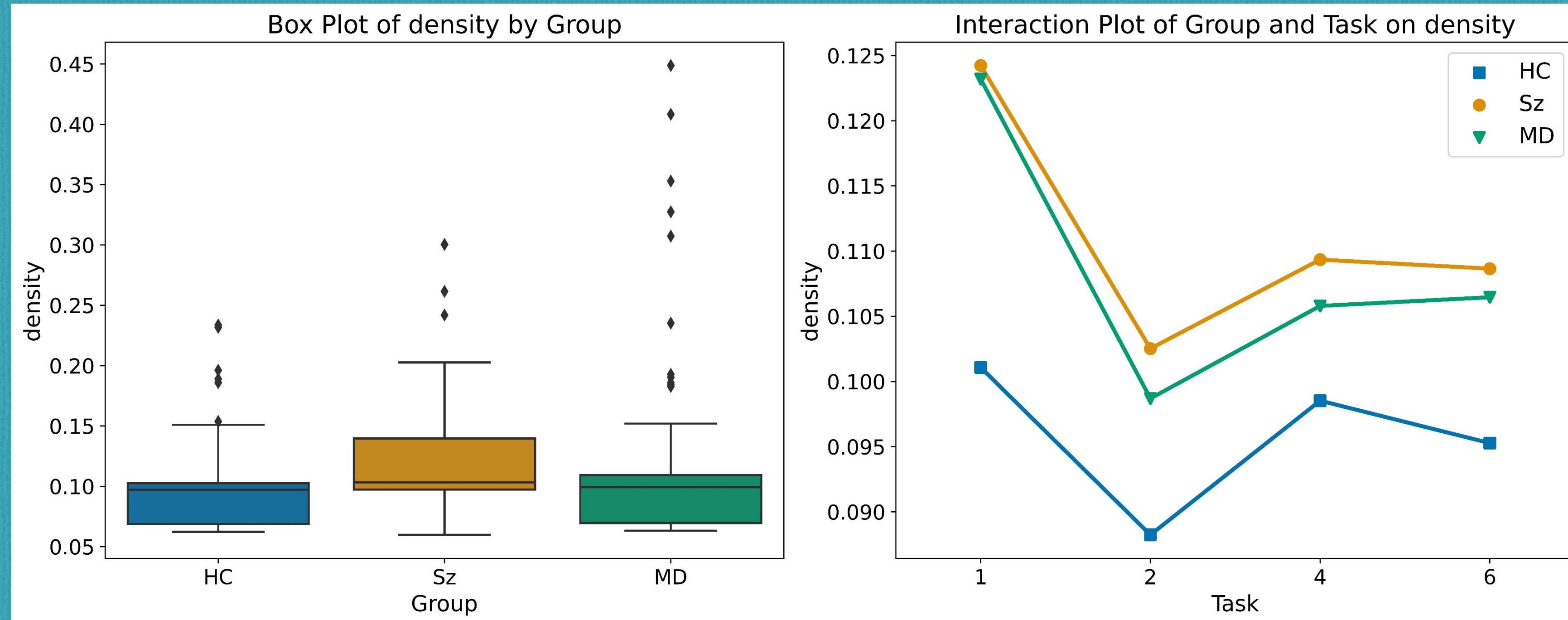
Significant differences between Sz and HC ( $p$ -value: 0.015) in **average clustering coefficient**. Also picture effect.

# Semantics graphs: Closeness centrality



Differences between Sz and HC (p-value: 0.073) in **average closeness centrality**. Also picture effect.

# Semantic graphs: Density of the graph



Differences between Sz and HC ( $p$ -value: 0.079) in **density of the graph**. Also picture effect.

# Summary

- There is a connection between referential structure and lexical-conceptual structure.
- Recurrence, and NP production could be viewed as causing increase in semantic similarity and larger topological distance (Chilean data).
- Loosening of associations may relate to increase in semantic similarity.
- The use of semantic graphs to calculate semantic similarity leads to similar results.
- There is need to control for picture effects.