

Space of Dream Data through the Lens of Multilevel Graph



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September 9th 2024

EXISTING LITERATURE

Speech Graphs Provide a Quantitative Measure of Thought Disorder in Psychosis

Natalia R. Mota^{1,*}, Alessio A. P. Vassarotti^{2,3,4}, Nathalia Lewan¹, Anna C. Feretti⁵, Osiane Koenig⁶, Guilherme A. Coelho⁷, Mauro Capelli⁸, Silvano Ribeiro¹

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OPEN Schizophrenia

Thought disorder measured as random speech structure classifies negative symptoms and schizophrenia diagnosis 6 months in advance

Natalia R. Mota¹, Alessio A. P. Vassarotti^{2,3,4}, Mauro Capelli⁸, Silvano Ribeiro^{1*}

In chronic psychotics, negative symptoms are considered to be related to whether speech disordered or not. In this study, we analyzed the memory reports made by patients with schizophrenia and controls. Concreteness was measured as the number of words that were contracted into a single word. The results showed that patients had more words contracted than controls. Control group, $p < 0.05$; patients, $p < 0.001$. Mean accuracy time is shorter in patients than in controls. Words with greater semantic density are used more frequently by patients and controls. Semantic density was negatively correlated with negative symptoms, negative symptoms were negatively correlated with speech disorder, and speech disordered patients had more negative symptoms. [View Article Online](#)

SCIENTIFIC REPORTS

OPEN Graph analysis of dream reports is especially informative about psychosis

SUBJECT AREAS: APPLIED PSYCHOLOGY | DIALOGUE AND LANGUAGE | DYSFUNCTIONAL MENTALITY

Received: 23 October 2013 Accepted: 25 November 2014 Published: 15 January 2015

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Early psychiatric institutionalization is understood as pathophysiology, which subjects patients to the loss of identity. To search a quantitative insight into the structure of dream reports, we analyzed the speech graphs of patients with schizophrenia and controls. The results showed that patients with schizophrenia had more speech graph anomalies than controls, such as more speech graph nodes and edges, and more speech graph cycles. Patients also had more speech graph nodes with higher degree, and more speech graph edges with higher weight. The speech graph analysis revealed that patients with schizophrenia had more speech graph cycles than controls. The results indicate that the speech graph analysis is a promising technique to identify the speech graph anomalies in patients with schizophrenia. This study demonstrates that the speech graph analysis can be a useful technique to identify speech graph anomalies in patients with schizophrenia. The speech graph analysis can also be used to identify speech graph anomalies in other mental disorders, such as depression, anxiety, and autism spectrum disorder.

Different groups in psychiatry are more often than not a difficult task, accompanied by subjective tests and necessarily performed by experts. Standard psychiatric diagnosis has been heavily criticized, despite its importance in clinical practice. In this study, we analyzed the speech graphs of patients with schizophrenia and controls. The results showed that patients with schizophrenia had more speech graph anomalies, and clear-cut distinction between patients and controls. The speech graph analysis can be used to identify speech graph anomalies in patients with schizophrenia. The speech graph analysis can also be used to identify speech graph anomalies in other mental disorders, such as depression, anxiety, and autism spectrum disorder.

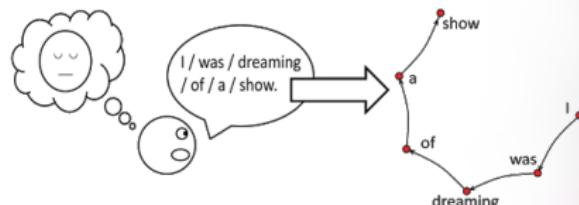
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To elucidate these issues, we quantified the speech graph attributes (SGA) (Figure 1). In Figure 2 of dream and waking reports, we show the distribution of SGA for the two groups of subjects. The distribution of SGA for the two groups of subjects is shown in Figure 3. Using a Bayesian classifier, we compared the differential diagnostic of speech graph analysis for the two groups of subjects. The results showed that the classification of the reports into the major Western languages was performed to assess language-related variations.

Results

Speech samples were collected from the long-term inpatients as inpatients before they became healthy. Each report is a mean of 100 words. “Waking” reports were obtained from healthy volunteers who did not have any dreams. Each report was transcribed and expressed as a speech graph, in which every word represented a node, and every temporal connection between words represented an edge. The speech graph analysis was performed on the 100 words of each report. Dream reports (Figure 1b) may more active groups than waking reports from the same subjects (Figure 1c).

SOURCE: REPORTS | 4: 3491 | DOI:10.1186/s40608-014-0491-1



EXISTING LITERATURE

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Speech Graphs Provide a Quantitative Measure of Thought Disorder in Psychosis

Natalia R. Mota^{a,*}, Michael A. P. Vasquez^{a,b,c,d*}, Nathalia Lewin^a, Anna C. Ferretti^a, Osiane Gauvin^a, Guillermo A. Cucchi^a, Mauro Caputi^a, Silvano Ribeiro^a

^a Santa Fé Institute of Technology, São Paulo State, Brazil; ^b Santa Fé Institute, Brazil; ^c Federal University of São Paulo, São Paulo, Brazil; ^d Universidade Mackenzie, São Paulo, Brazil; ^e Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil; ^f Center for Brain Health, Department of Psychology, University at Albany, State University of New York, Albany, NY, United States; ^g Department of Psychology, University at Albany, State University of New York, Albany, NY, United States

ARTICLE [OPEN](#)

Thought disorder measured as random speech structure classifies negative symptoms and schizophrenia diagnosis 6 months in advance

Natalia R. Mota^a, Mauro Caputi^a and Silvano Ribeiro^a

SCIENTIFIC REPORTS

OPEN Graph analysis of dream reports is especially informative about psychosis

SUBJECT AREA: APPLIED PSYCHOLOGY | DIALECTIC MEDICINE

Received: 20 October 2013 **Accepted:** 22 November 2014 **Published:** 15 January 2015

Citation: Mota, N.R., Vasquez, M.A.P., Lewin, N., Ferretti, A.C., Gauvin, O., Cucchi, G.A., Caputi, M. & Ribeiro, S. Graph analysis of dream reports is especially informative about psychosis. *Sci Rep* 5, 9516; doi: 10.1038/srep09516 (2015).

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ABSTRACT Schizophrenia is a severe psychiatric disorder characterized by positive (delusions, hallucinations) and negative (anhedonia, emotional flattening) symptoms. Dreaming is associated with the onset of positive symptoms, and it has been used as a complementary tool to explore the cognitive and emotional features that are related to the disease. In this work, we analyzed dream reports from patients diagnosed with schizophrenia, comparing each word's connection with other words that characterize their disease with words dispensed with others from healthy individuals. We found that dreams are the verbal route to the unconscious, as clinically tested, after the treatment. We conclude that “dreams are the verbal route to the unconscious” is clinically useful, after all.

Methodology In this work, we analyzed dream reports from patients diagnosed with schizophrenia, comparing each word's connection with other words that characterize their disease with words dispensed with others from healthy individuals. We found that dreams are the verbal route to the unconscious, as clinically tested, after the treatment. We conclude that “dreams are the verbal route to the unconscious” is clinically useful, after all.

Results Dream reports were generated by 12 healthy subjects, 12 schizophrenia patients, and 12 healthy controls. Each report was transcribed and represented as a speech graph, in which every word represented a node, and every temporal connection between two consecutive words represented an edge. In total, 30 graphs were generated for both groups of reports. Figure 1b shows more active groups than waking reports from the same subjects (Figure 1c).

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Published online: 17 April 2015

Khalid Al-Obaidi is partially funded by

Mohamed El-Shehry is partially funded by

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“In chronic psychotic patients, word graph analysis shows potential as complementary psychiatric assessment.”

“The results demonstrate the feasibility of the differential diagnosis of psychosis based on the analysis of dream graphs, pointing to a fast, low-cost and language-invariant tool for psychiatric diagnosis and the objective search for biomarkers.”

“The results also show that dream reports are substantially more informative about the mental state of psychotic subjects than waking reports.”

SOURCES OF DREAMS



Sogniario

Sogniario è una applicazione mobile sviluppata dall'Università di Camerino per registrare e catalogare i sogni.

Username —

Password — 

 Entra come utente  Entra come ricercatore

 Scarica l'app (Android)

SOURCES OF DREAMS

DreamBank

www.dreambank.net

Dream series:

Filters: Full dreams Abbreviated dreams Headline dreams Case-sensitive? More info Results display: List Table Contingency Consistency chart: 100 Numbers Graphs

Search: [HELP]

Dream series: Dream: leaving dream [n=144] Father's voice [date] and [deceased] [n=1112] ...
 Full dreams Abbreviated dreams Headline dreams Case-sensitive? More info Results display: List Table Contingency Consistency chart: 100 Numbers Graphs

Number of dreams searched: 1221 Search term: [dreams]

Case-sensitive: no

Number of dreams searched: 1221 Search term: [dreams]

Case-sensitive: no

Dream series: Dreams: 48 years of dreams

Search: [HELP]

Number of dreams searched: 1221 Search term: [dreams]

Case-sensitive: no

Redisplay: Full dreams Abbreviated dreams Highlight matches Count words

(Click here to jump to the bottom of the list)

#1940-001 We are standing in front of a hotel at a resort and we have to take a boat to another beach where it is "calm," but there is a big storm with breakers out at sea and there are French doors closing off the exit from the boat house to the sea. I remember holding the doors closed against the onslaught of the breakers. Later everyone has to leave the boat house and then, in a few minutes, a huge wave tears the boat house away and whips it out to sea. Only the boatman and a few stragglers remain and they are eventually saved. We must stay at a hotel. (111 words) [\[DODINGS\]](#)

#1940-002 Dr. Brooke (thesis advisor) asks me to go to a night club called "Iowa Park" where they usually drink till 4 AM. I don't want to go but he said that he would not look at my paper otherwise. He even buys me a literal Shift. Mother is still alive (she died 4/13/47). She prevents me from going. She is jealous and she wants me to help her clean the house. (77 words) [\[DODINGS\]](#)

#1948-003 I am a queen, much admired. M. (lover) is at my side and service. Feeling of ultimate achievement. Shift. Mrs. Jones (professor and supervisor) has died. Mr. Jones is very bereft. I offer him help and services. Much ado about it. The newspapers carry headlines and are tacked up all along the corridor of the psychology department. Bouquets of flowers sent. General feeling of sorrow. I am consulted by Mr. Jones about the funeral arrangements and then offer to go to live with him in his house as I am divorcing Edward (first husband). (36 words) [\[DODINGS\]](#)

#1959-001 Driving to mountains with Edward, we go ahead while mother-in-law and my father follow. Father is in a hearse, dragged along the ground by a truck. He said he liked it that way. W. and I have a regular meal but W. forgets to give some to father. I realize that he needs to be dead already (he had died 1948). Shift. K. (companion), we drive together through them and down the mountain. We stop at a lake. I am swimming in the water standing on a sand bar and gradually pushes us back against the house, also see my brother somewhere in the background of the house. Shift. I invite K. to stay at our place in L. City telling him that no one will be there, but when we arrive Mrs. L. (our renter) is asleep and father is in my brother's bedroom. Therefore K. is forced to stay with me in my bed. Remember only a few kisses. In the morning father worrying about Mrs. L.'s political views. (207 words) [\[DODINGS\]](#)

#1950-002 Parents come to life! out of the grave, despite having been cremated. Father looks like a same and mother tries to run my life again. They don't seem astonished. I understand that Forest Lawn is being sued for burying them alive! Shift. I walk along a ramp with A.S. (University instructor) and think of him as my therapist. He says, "In two years mother's cancer could have been cured," but he can't explain it. He is very understanding. At home mother sees a daughter born after mother's death and she says, "So that is what you have been up to." Much commotion and people. Feeling of inexplicable, how could it have happened? But no one seems to care. (100 words) [\[DODINGS\]](#)

AN ARLIE'S DREAM

"I am at a lake in my hometown. Something is going on there and we are in a hurry to get away. We get in a station wagon and have a hard time getting two pet deer, with the same names as my son and daughter, corralled. Finally we get them into the vehicle and we are almost all the way out when the wheel goes off one side of the road and the vehicle is stuck and the deer is about halfway out. At this point I notice my mother-in-law is cutting off a Christmas tree which is growing in the water at the end of the dock."

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STOPWORDS
REMOVAL

AN ARLIE'S DREAM

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STOPWORDS

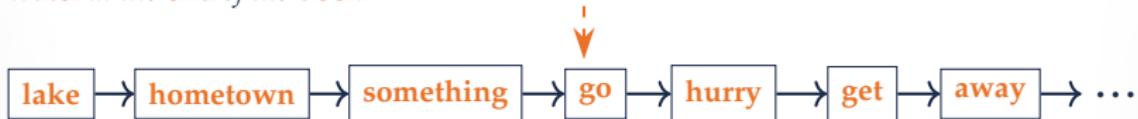
REMOVAL

LEMMATIZATION

AN ARLIE'S DREAM

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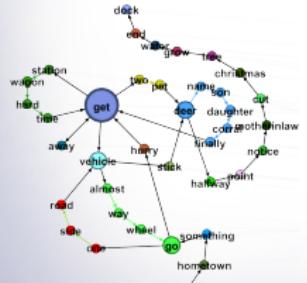
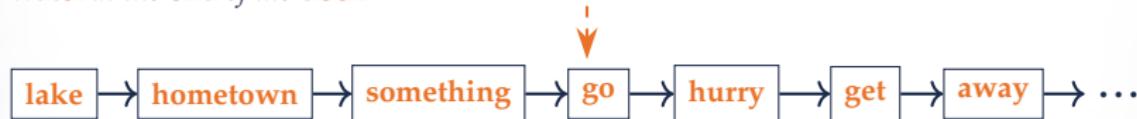
STOPWORDS
REMOVAL
LEMMATI-
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AN ARLIE'S DREAM

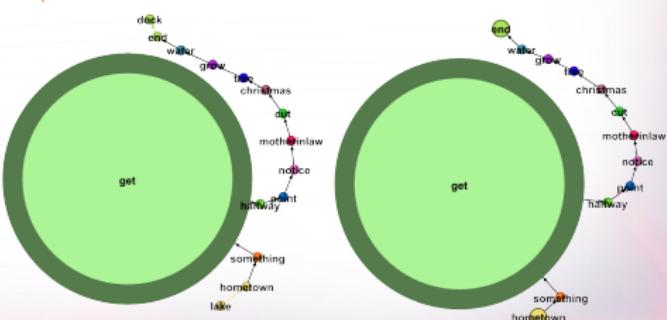
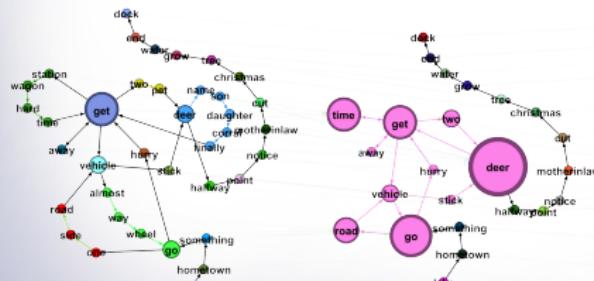
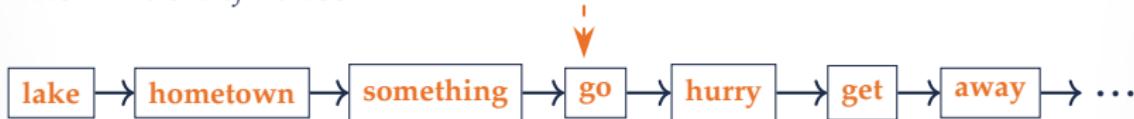
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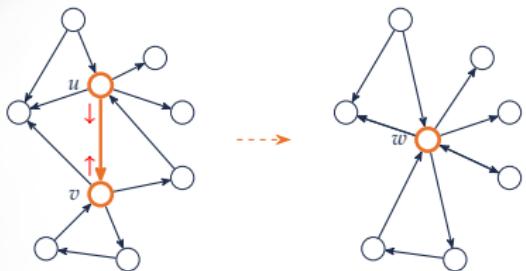
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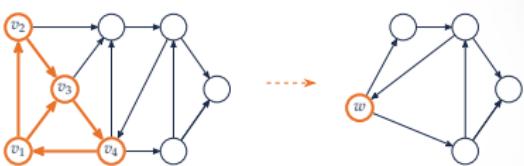
STOPWORDS
REMOVAL
LEMMAТИ-
ZATION

GRAPH CONTRACTION

Edge contraction

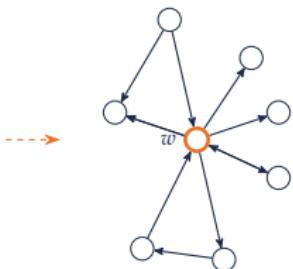
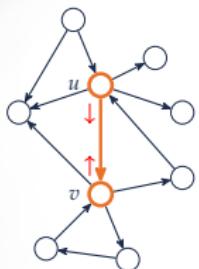


Subgraph contraction



GRAPH CONTRACTION

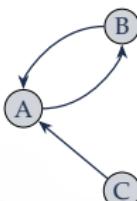
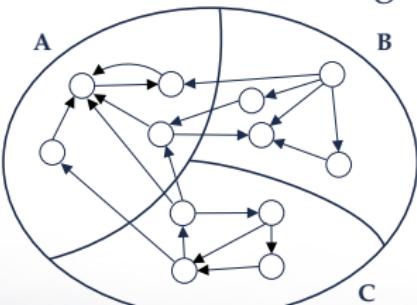
Edge contraction



Subgraph contraction



Quotient graph



MULTILEVEL GRAPH

Definition (Multilevel graph)

A **multilevel graph** M is a couple (G, Γ) where:

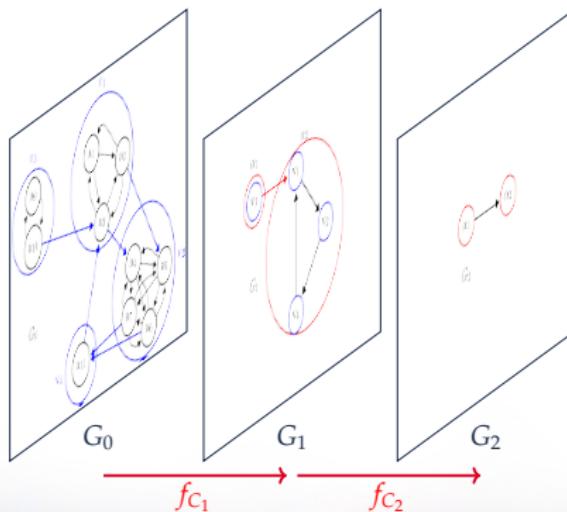
- ▶ $G = (V, E)$ is a graph;
- ▶ $\Gamma = \langle f_{C_1}, f_{C_2}, \dots, f_{C_k} \rangle$ is a sequence of contraction functions.

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INTRODUCTION
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DEFINITIONS
oooo

CONTRACTION
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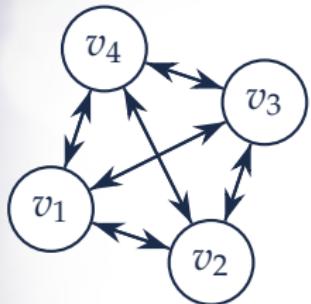
SYNTACTIC DREAM ANALYSIS
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SEMANTIC DREAM ANALYSIS
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CONCLUSION
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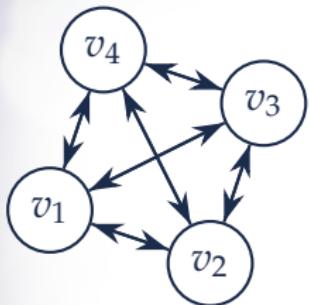
CONTRACTION SCHEMES

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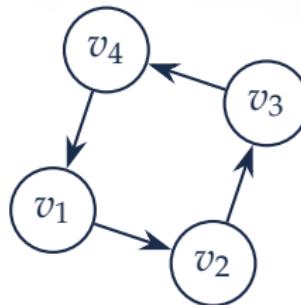


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CONTRACTION SCHEMES

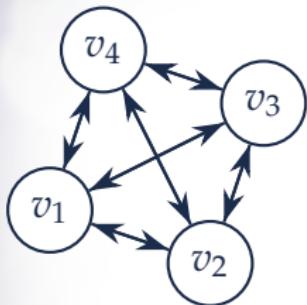


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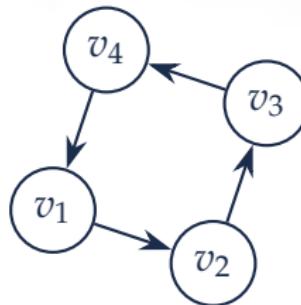


Simple cycles

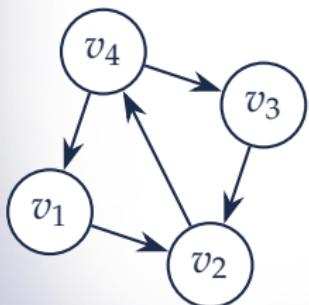
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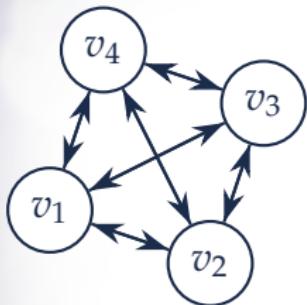


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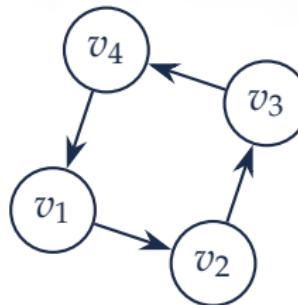


Strongly
connected
components

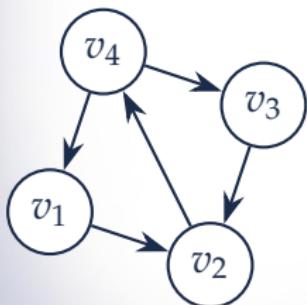
CONTRACTION SCHEMES



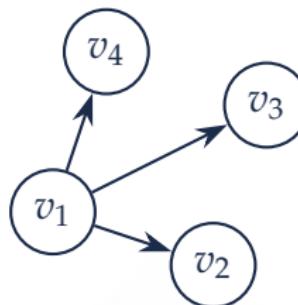
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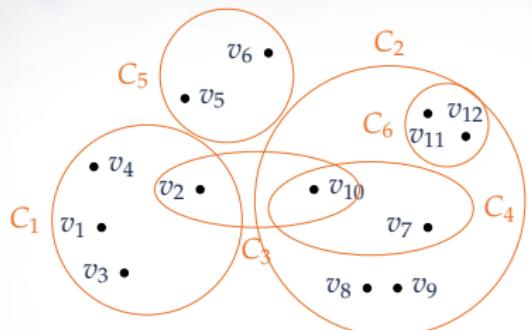


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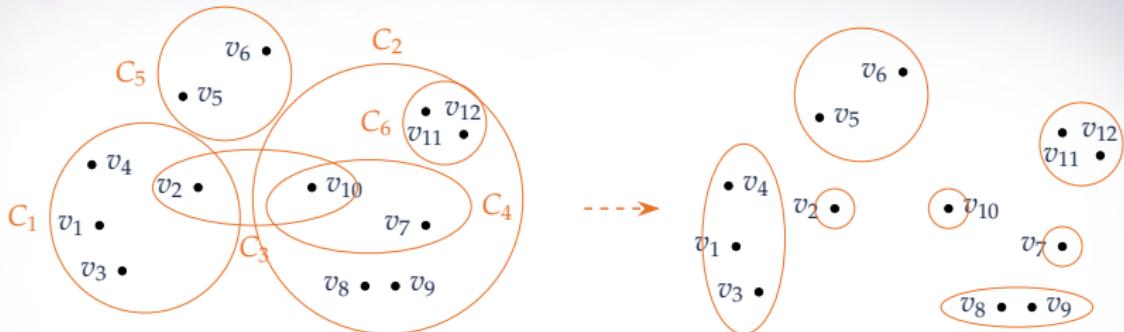


Stars

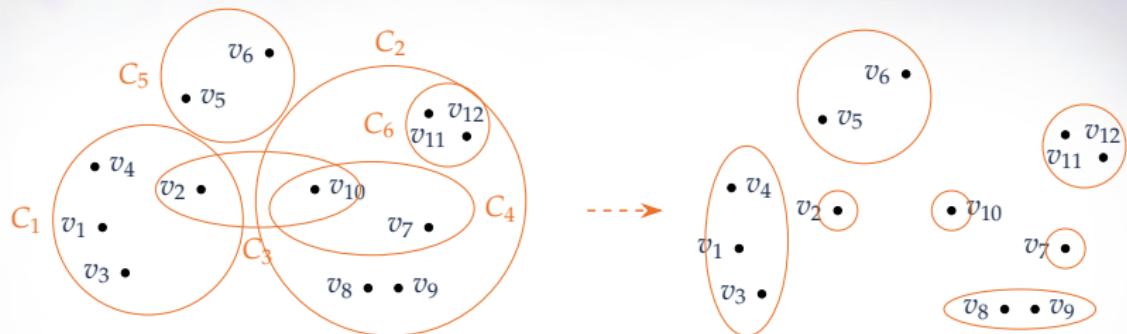
SUBSETS CONTRACTION



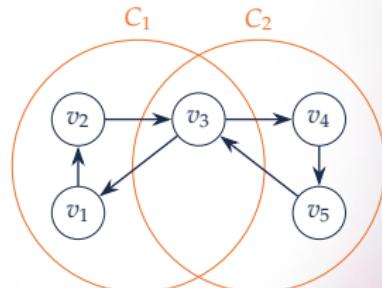
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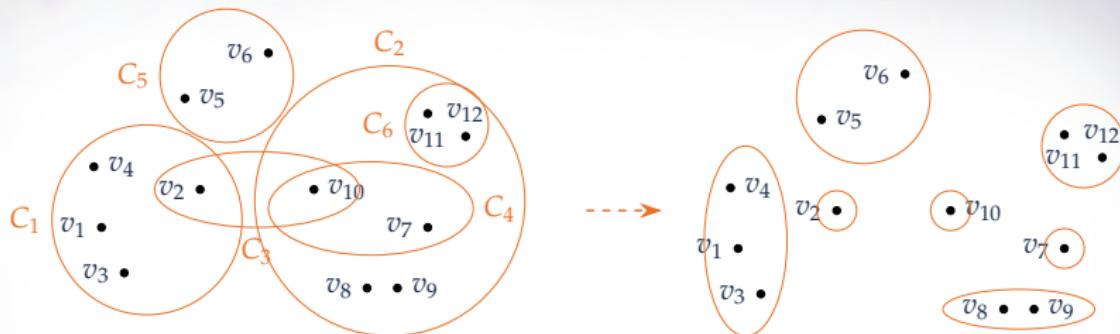
SUBSETS CONTRACTION

 T

v_1	$\{C_1\}$
v_2	$\{C_1\}$
v_3	$\{C_1, C_2\}$
v_4	$\{C_2\}$
v_5	$\{C_2\}$



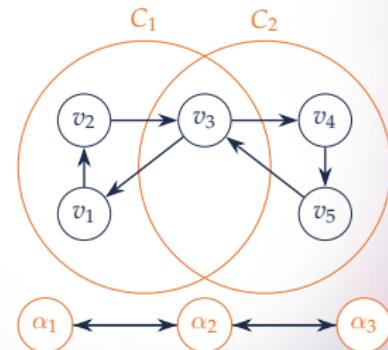
SUBSETS CONTRACTION

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v_1	$\{C_1\}$
v_2	$\{C_1\}$
v_3	$\{C_1, C_2\}$
v_4	$\{C_2\}$
v_5	$\{C_2\}$

 T'

$\{C_1\}$	α_1
$\{C_1, C_2\}$	α_2
$\{C_2\}$	α_3

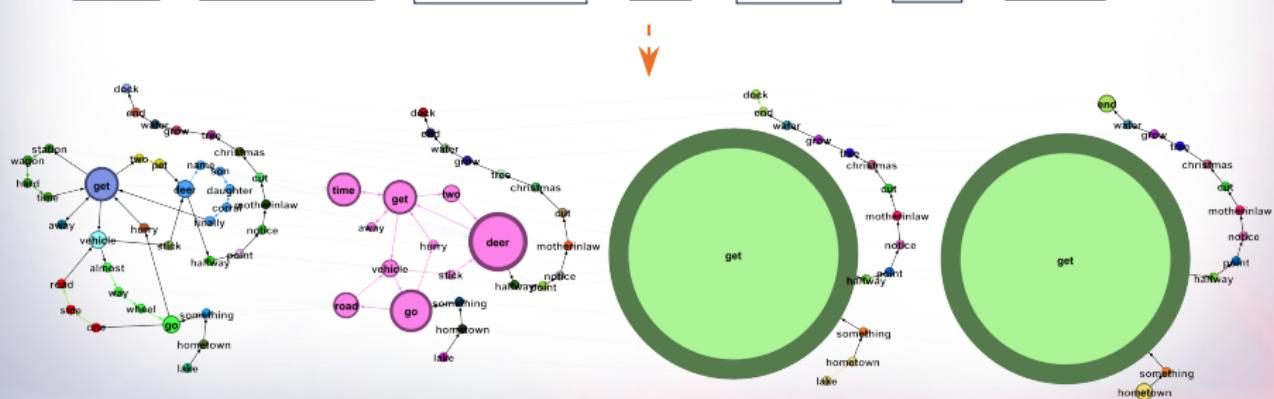
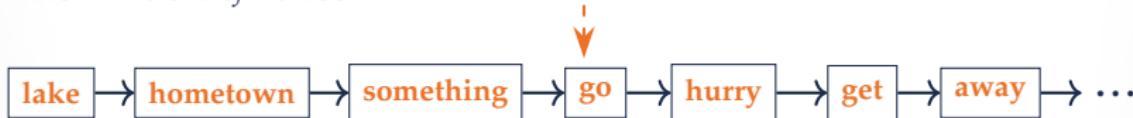


SYNTACTIC ANALYSIS OF DREAMS

The aim is to examine the typical syntactic structure of individual dreams of a particular dreamer, with possible implications related to mental health.

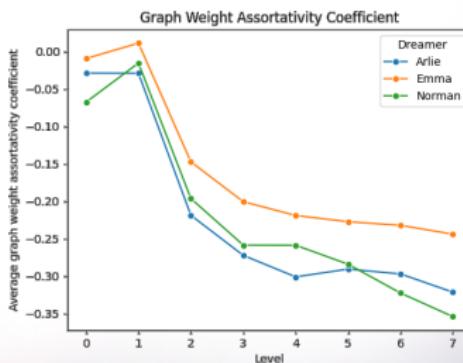
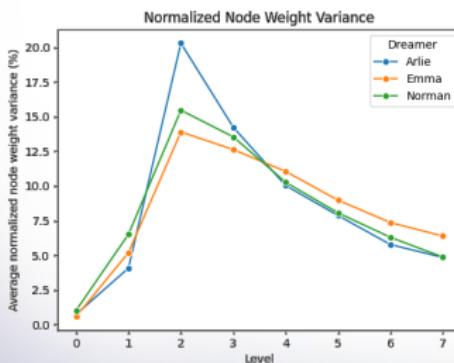
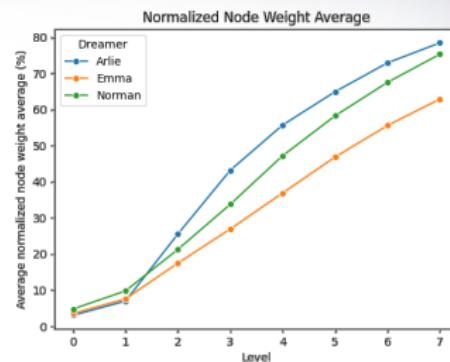
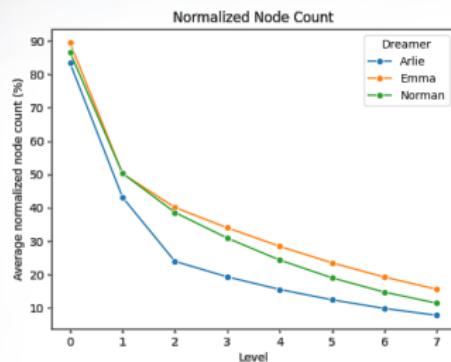
AN ARLIE'S DREAM

"I am at a lake in my hometown. something is go on there and we are in a hurry to get away. We get in a station wagon and have a hard time get two pet deer, with the same name as my son and daughter, corral. finally we get them into the vehicle and we are almost all the way out when the wheel go off one side of the road and the vehicle is stick and the deer is about halfway out. At this point I notice my mother-in-law is cut off a christmas tree which is grow in the water at the end of the dock."

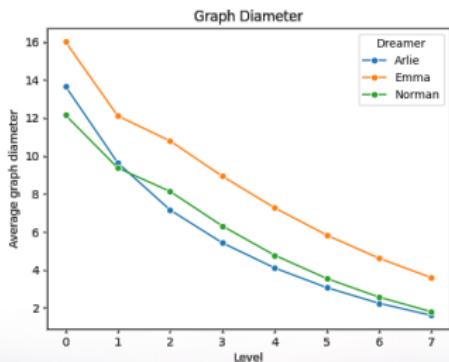
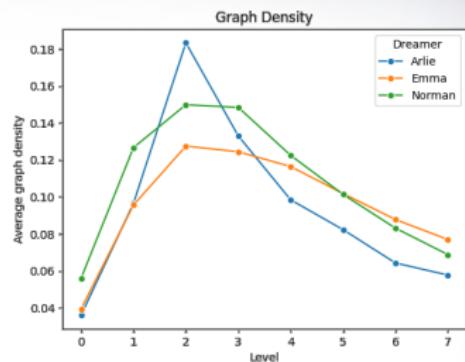
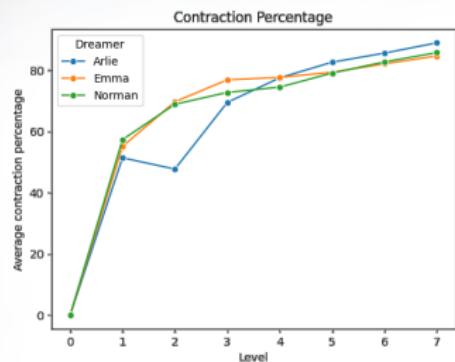


STOPWORDS
REMOVAL
LEMMAТИ-
ZATION

ARLIE, EMMA AND NORMAN RESULTS



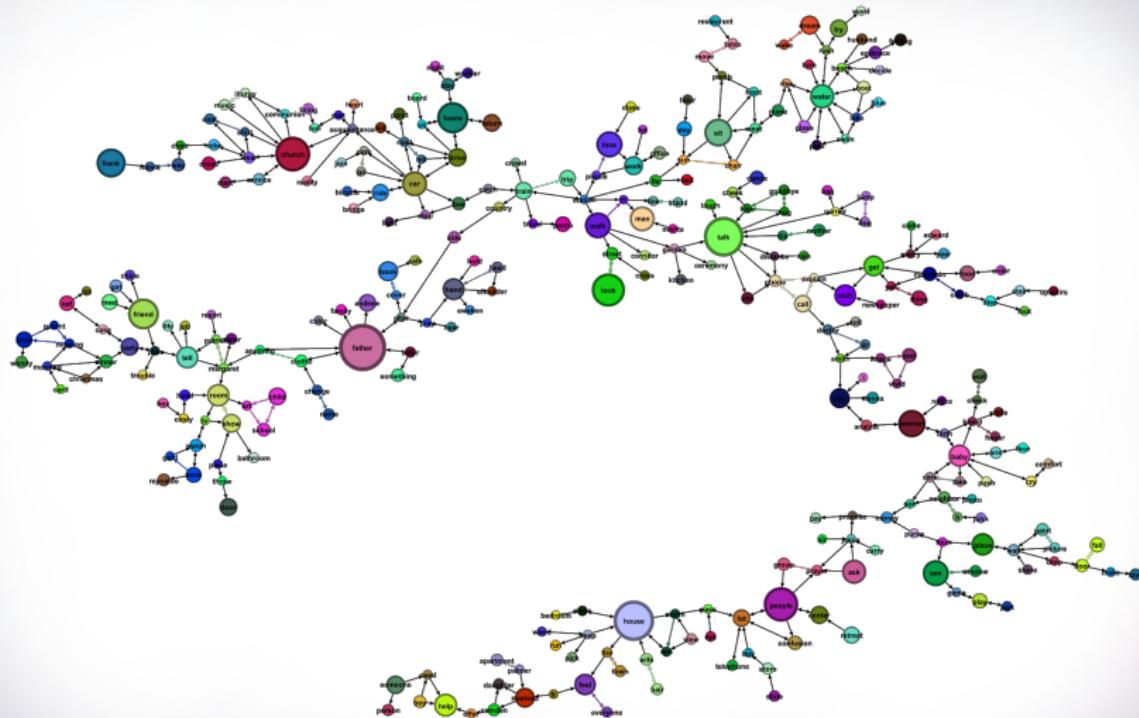
ARLIE, EMMA AND NORMAN RESULTS



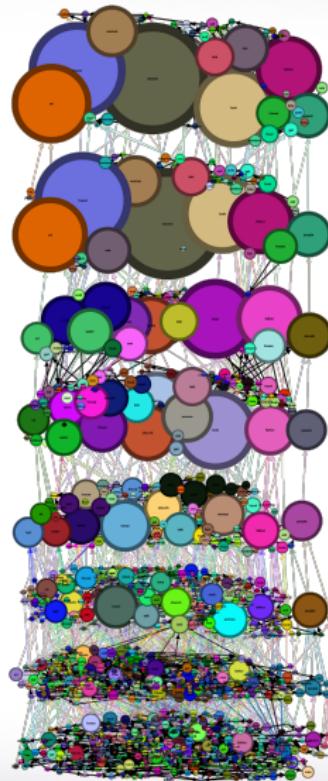
SEMANTIC ANALYSIS OF DREAMS

The aim is to build a multilevel semantic space of words that depicts the content themes in a collection of dreams of a particular dreamer.

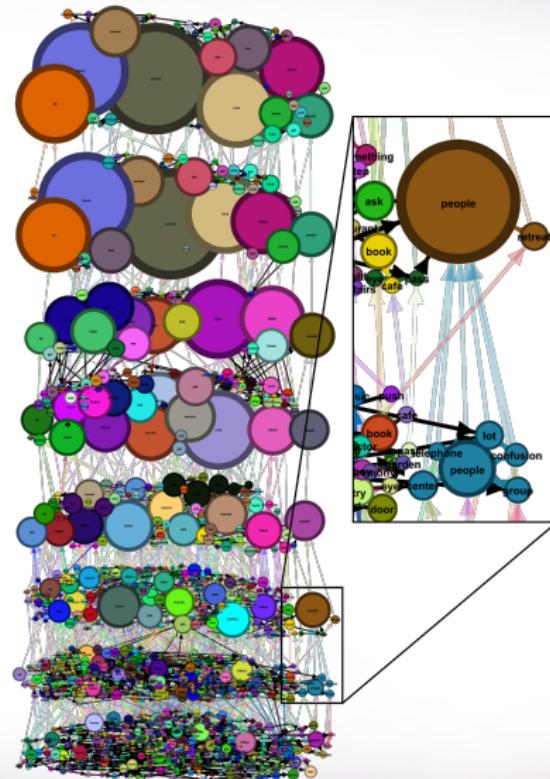
EMMA'S GRAPH



EMMA'S MULTILEVEL GRAPH



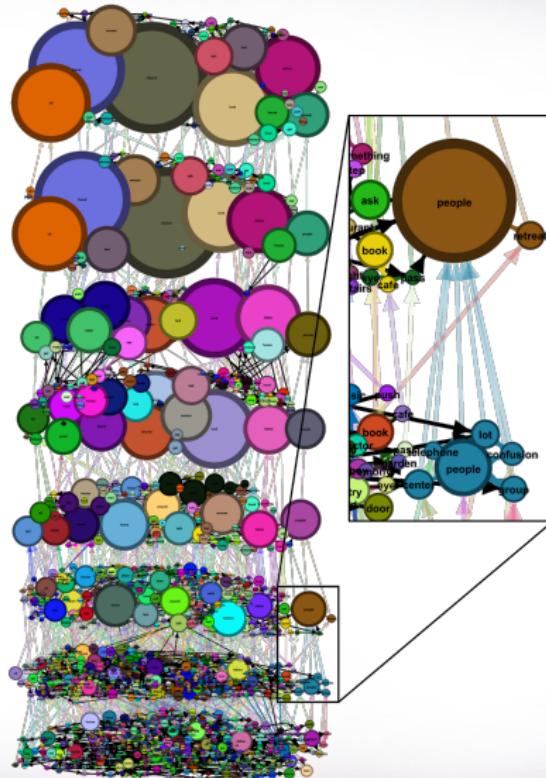
EMMA'S MULTILEVEL GRAPH



EMMA'S MULTILEVEL GRAPH

EXAMPLES OF CYCLES

- ▶ “cake”-“party”
- ▶ “boat”-“lake”-“water”
- ▶ “trip”-“train”-“station”
- ▶ “road”-“car”-“drive”-“hill”
- ▶ “liturgy”-“church”-“music”



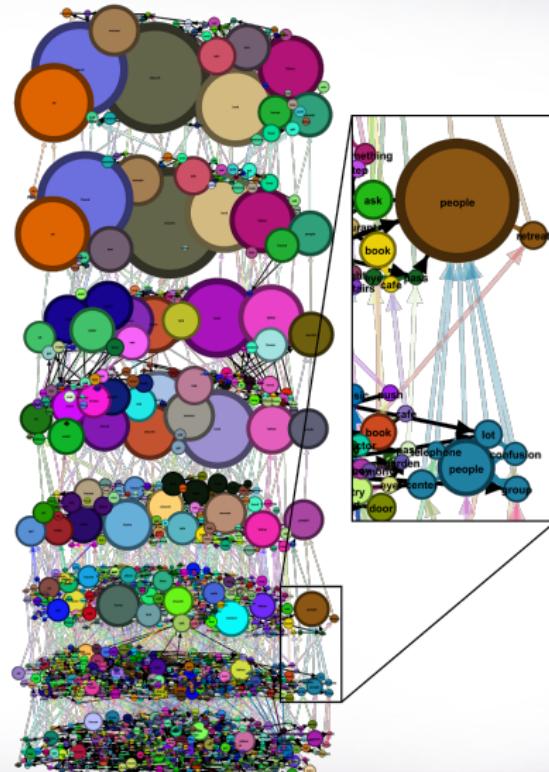
EMMA'S MULTILEVEL GRAPH

EXAMPLES OF CYCLES

- ▶ "cake"-“party”
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- ▶ “liturgy”-“church”-“music”

EXAMPLES OF SCCs

- ▶ “sit”-“chair”-“front”-
“porch”-“seat”-“plane”
- ▶ “lake”-“boat”-“water”-“rise”-
“pool”-“swim”-“rush”



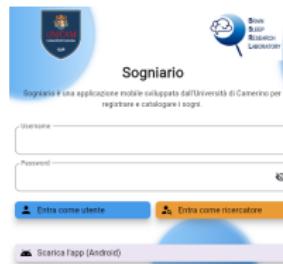
CONCLUSIONS AND FUTURE WORK

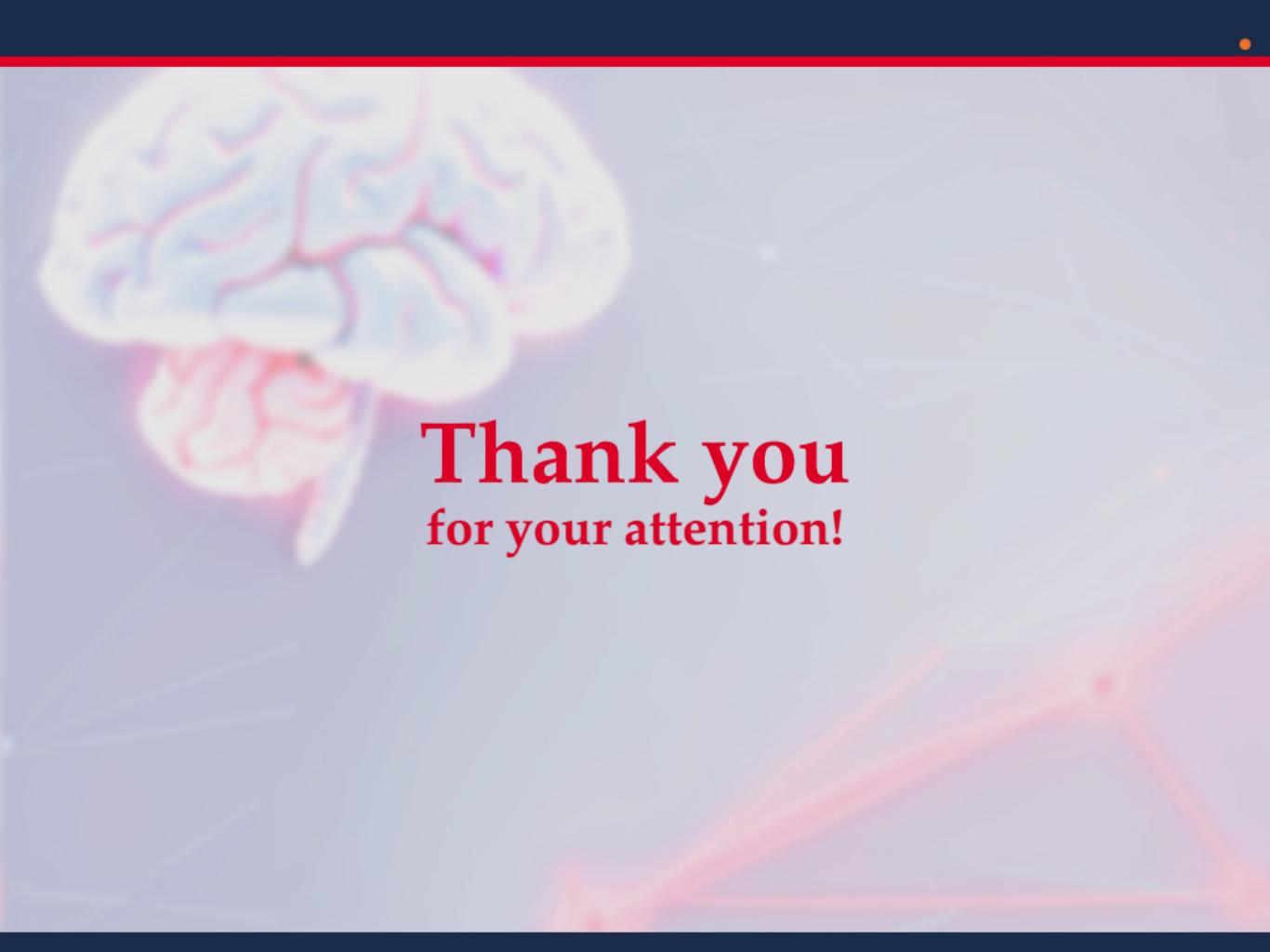
- ▶ Global and dynamic perspective, beyond single-level analysis



CONCLUSIONS AND FUTURE WORK

- ▶ Global and dynamic perspective, beyond single-level analysis
- ▶ Application of multi-level analysis techniques to categorized data





Thank you
for your attention!