Structural differences between non-lucid, lucid dreams and out-of-body experience reports assessed by graph analysis

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ABSTRACT

It has been recently found using graph theory that measures of network structure can predict ratings of dream complexity, where increases in connectedness and decreases in randomness are observed in relation to increasing dream report complexity. This approach proved to be useful to differentiate dream reports in the pathological population as well as NREM and REM dream reports, but it has not yet been used to study the differences between different oneiric experiences.

In this work we analyze dream reports that include non-lucid, lucid dreams and out-ofbody experiences initiated from sleep paralysis. The reports are presented as directed graphs, where each different word plays the role of a node, and consecutive words are connected by a directed, unweighted edge. We analyze different network measures to compare the graphs.

What is a speech graph?

plural, feminine, conjugated, etc.). The lemma is the form that by convention is accepted as representing all the

inflected forms of the same word.

Preliminary results presented here suggest that both local measures, such as the degree of nodes, and global measures, such as clustering and the number of strongly connected components, allow for a categorization of different dream experiences.

Noun graph

Speech graph examples



METHODS

Data collection

Gender		Age	Dreams		12:59 🖬	84528 D A D	show	Att.	m I m		
Female	97	34,81±10, 6	Normal	824	- 1 8 5	4 4 0	a / 🧹	KANAP	$(\) $		
Male	76	33,13±11,5	Lucid	122	Dream report	р.		The state		States:	
Other	1	31	OBE	68	I was dreaming of a show	sming of a show	and and the I	I TANG AND			
			Sleep Paralysis	15				IXA	+ +	· ANTRAN	
Total	174		False Awakening	9			of 🔍 🦯	· VV	+ <i>†</i>		
			Total	1034			was	1	the second secon	¥.	
							dreaming	Malua	e vez ve le		
63 of 174 completed a Dream Journal for 2 month.					Speech Graphs are directed multigraphs that represent Naiv sequential word relationships in a speech.				grapn	~	
The collected dream narratives were converted into a graph using SpeechGraph java software developed by <i>Mota NB et.al.</i> 2012,2013					Only the structure is kept, semantics is disregarded.						
					<i>Lemmatization</i> is a linguistic process that consists of finding the corresponding <i>lemma</i> , given an inflected form (i.e.,				+noun selection	-1-1-	
(nup://net	uro.uti	TLUI/SOTTV	vares/speecngra	apris)				N			

RESULTS

Speech Graph Attributes



 Mota, N.B., Furtado, R., Maia, P.P.C., Copelli, M. & Ribeiro, S. Graph analysis of dream reports is especially informative about psychosis. Sci. Rep. 4, 3691; DOI:10.1038/srep03691 (2014)
Mota NB, et al. (2012) Speech Graphs Provide a Quantitative Measure of Thought Disorder in

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Psychosis. PLoS ONE 7(4): e34928. doi: 10.1371/journal.pone.0034928



We analyze different graph measure

We analyze different graph measurements and find non-trivial correlations.

We believe this is the first step in finding quantitative differences in graph structure for the characterization of dream experiences.