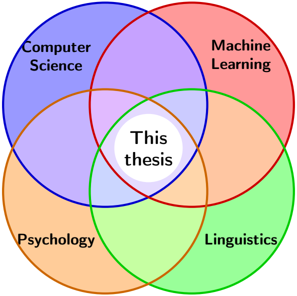
Natural language processing for subjectivity analysis in personal narratives

Gustave Cortal

Thesis director: Alain Finkel
Co-advisors: Patrick Paroubek and Lina Ye

Introduction

Context



- Natural language processing for psychology is underexplored

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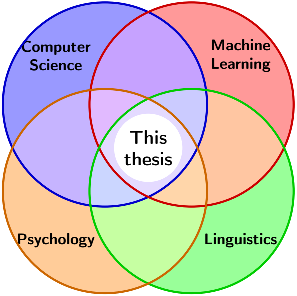

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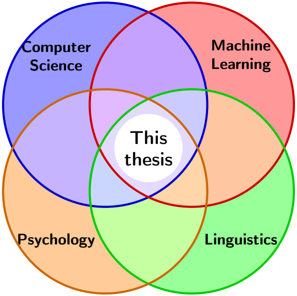

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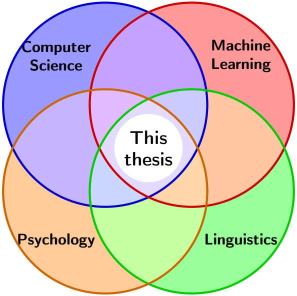

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- We study subjectivity (first-person perspective, meaning-making processes, and experiential content)
- We focus on personal narratives (emotional narratives, dream reports)

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- Cognitive science perspective on emotion analysis
- French corpus based on emotion components
- Emotion analysis in emotional and dream narratives
- Formalization of style in personal narratives

Contributions

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Open corpus and tools

Corpus:

French narratives based on emotion components

hf.co/gustavecortal

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Open corpus and tools

Corpus:

French narratives based on emotion components

Tools:

Language model for emotion and character prediction in dream narratives +400 downloads

hf.co/gustavecortal

French language models for emotion component prediction and discrete emotion prediction +1200 downloads

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Cognitive science perspective on emotion analysis

G. Cortal and C. Bonard. Improving Language Models for Emotion Analysis: Insights from Cognitive Science. *CMCL @ ACL 2024*.

Psychology and emotion annotation

Psychological theories	In text, emotion is...	Example
Basic emotions theory	a *category*	"I love philosophy." $\rightarrow$ `joy`
Darwin (1872), Tomkins (1962), Ekman (1999), and Plutchik (2001)		
Demszky et al. (2020) and Greschner et al. (2025)		

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Constructivist theories	a continuous value with an *affective* meaning	"His voice soothes me." → `valence` (4/5), `arousal` (1/5)
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Appraisal theory	a continuous value with a *cognitive* meaning	"I received a surprise gift." → `sudden` (4/5), `control` (0/5)
Arnold (1960) and Lazarus (1991) Troiano, Oberländer, and Klinger (2023)		

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	composed of *semantic roles*	"Louise (`experiencer`) was angry (`cue`) towards Paul (`target`), because he didn't inform her (`cause`)."

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Similar to aspect-based sentiment analysis (W. Zhang, Li, et al., 2022): "The battery life is *amazing* (+), but its camera quality is *disappointing* (−)."

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  (Micheli, 2013b; Etienne, Battistelli, and Lecorvé, 2022)
- Benchmarks evaluate certain aspects of emotional understanding but do not consider its full complexity
  (Campagnano, Conia, and Navigli, 2022; W. Zhang, Deng, et al., 2023; Paech, 2024)

Linguistic and cognitive science theories

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→ Emotion expression modes vary in interpretive difficulty
(Nathalie Blanc, 2010; Creissen and N. Blanc, 2017; Foppolo and Mazzaggio, 2024)

→ There exist an annotation scheme for emotion expression modes
(Etienne, Battistelli, and Lecorvé, 2022; Dragos et al., 2022)

How to integrate psychological theories of emotion?

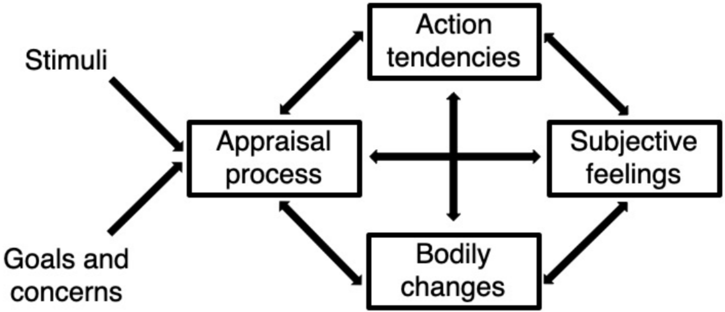

Figure: **The integrated framework for emotion theories** (Scherer, 2022b). Rectangles represents the components constituting an emotional episode, and arrows represent causation.

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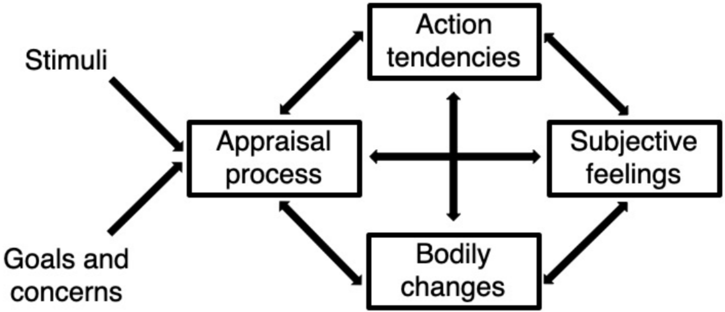

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→ We use this framework to construct a corpus based on components

French narratives based on emotion components

The corpus is available at hf.co/datasets/gustavecortal/FrenchEmotionalNarratives

G. Cortal, A. Finkel, P. Paroubek, L. Ye. Emotion Recognition based on Psychological Components in Guided Narratives for Emotion Regulation. *SIGHUM @ EACL 2023*.

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→ A new French corpus of emotional narratives structured by the authors according to their behaviors, thoughts, physical feelings, and reasons

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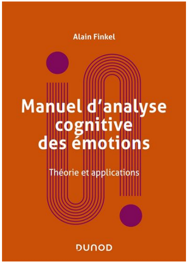

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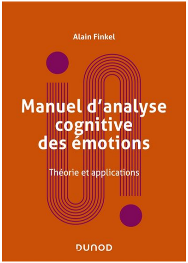

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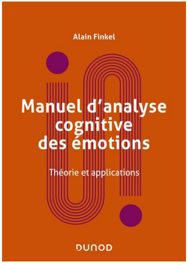
- uses emotion components to reorganize the narrative of experienced events
- helps individuals better regulate their emotions



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French narratives based on emotion components

Contribution: +1,000 narratives structured with emotion components by the writers themselves plus discrete emotion labels

Component	**Answer**
`Behavior`	I'm giving a lecture on a Friday morning at 8:30. A student goes out and comes back a few moments later with a coffee in his hand.
`Feeling`	My heart is beating fast, and I freeze, waiting to know how to act.
`Thinking`	I think this student is disrupting my class.
`Reason`	The student attacks my ability to be respected in class.

Chosen emotion: `anger` (possible choices: `anger`, `fear`, `joy`, `sadness`)

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→ A. Finkel has been collecting narratives since 2005 during emotion regulation sessions; I structured them to build a corpus for emotion classification

Language models for emotion analysis in emotional and dream narratives

Language models are available on hf.co/gustavecortal

G. Cortal, A. Finkel, P. Paroubek, L. Ye. Emotion Recognition based on Psychological Components in Guided Narratives for Emotion Regulation. *SIGHUM @ EACL 2023*

G. Cortal. Sequence-to-Sequence Language Models for Character and Emotion Detection in Dream Narratives. *LREC-COLING 2024*

Discrete emotion detection based on components

Component	Logistic Regression (tf-idf)			CamemBERT		
	Precision	Recall	F_1	Precision	Recall	F_1
All	71.2 (2.6)	69.1 (2.2)	67.8 (2.3)	**85.1**	**84.8**	**84.7**

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Without `feeling`	64.3 (1.9)	61.5 (1.2)	61.3 (2.2)	81.6	79.8	79.9
Without `thinking`	70.9 (1.8)	69.1 (2.0)	68.3 (2.2)	79.6	78.5	78.7
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→ Some components benefit from contextual understanding and world knowledge; need to study static *vs.* contextual semantics

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→ Dream narratives possess a narrative structure and represent attempts to communicate subjective experience

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(Flanagan, 1966; Domhoff and Schneider, 2008)

The annotation process is complex and costly

→ How to automate the annotation process using language models?

Example of an annotated dream with HVdC

Series: **Girls (tutorial)** Number: **0039**

<table>
<tr><th>CHAR.</th><th colspan="2">AGGRESSION</th><th colspan="2">FRIENDLINESS</th><th>SEXUALITY</th><th>SET.</th><th>OBJ.</th></tr>
<tr><td rowspan="5">2MUT
1MUT
1FKT</td><td colspan="2">1MUT 3> 1FKT
D 2= 1MUT</td><td colspan="2">D 5= 1MUT</td><td></td><td>OU</td><td rowspan="5">[not coded]</td></tr>
<tr><th colspan="5">ACTIVITIES</th><th>MOD.</th></tr>
<tr><td colspan="5">[not coded]</td><td rowspan="3">[not coded]</td></tr>
<tr><th>FAILURE</th><th>SUCCESS</th><th>MISFORTUNE</th><th>GOOD FORT.</th><th>EMOTIONS</th></tr>
<tr><td></td><td></td><td></td><td></td><td>AP, D</td></tr>
</table>

Character:

- **Status**: individual alive (**1**), group alive (**2**), dead individual (**3**), dead group (**4**), imaginary individual (**5**), imaginary group (**6**), original form (**7**), changed form (**8**)
- **Gender**: male (**M**), female (**F**), joint (**J**), indefinite (**I**)
- **Identity**: known (**K**), prominent (**P**), occupational (**O**), ethnic (**E**), unknown (**U**)
- **Age**: adult (**A**), teen (**T**), child (**C**)

Emotion: anger (**AN**), apprehension (**AP**), sadness (**SD**), confusion (**CO**), and happiness (**HA**)

Existing research on computational dream analysis

Lexical-based approaches associate text spans with specific categories (*e.g.*, type of interactions) (Miller, 1994; Fogli, Aiello, and Quercia, 2020)

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McNamara et al. (2019) and Yu (2022) combine the lexical-based and distributional semantic-based approaches with machine learning

Existing research on computational dream analysis

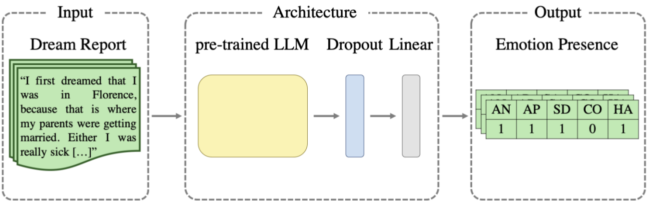
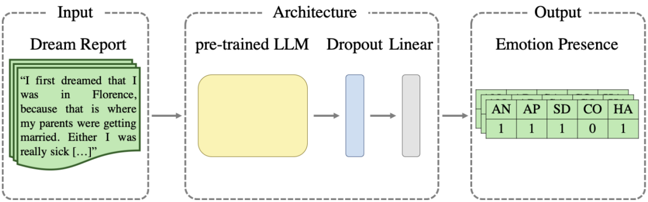


Figure: **Architecture for multi-label emotion detection** (Bertolini et al., 2023).

Existing research on computational dream analysis



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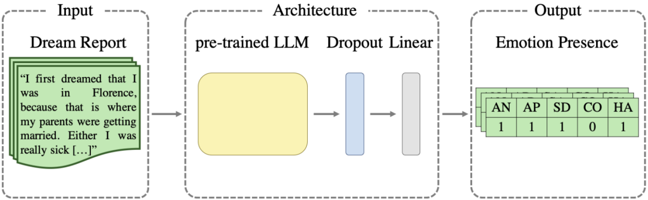

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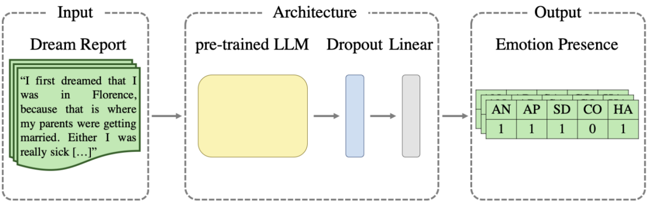

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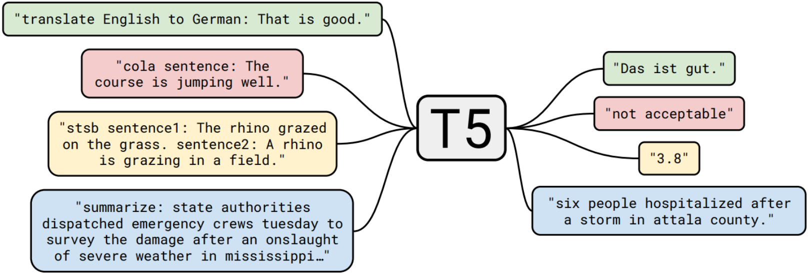
→ We address this by identifying characters and their emotions with transformer-based sequence-to-sequence models

T5 language models



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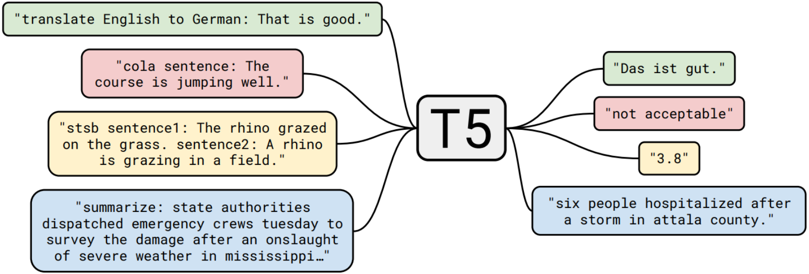

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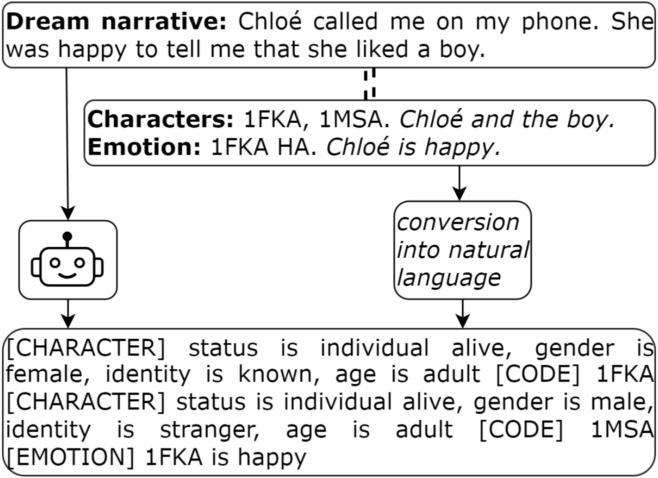
→ 248M-parameter LaMini-Flan-T5 encoder-decoder transformer, pre-trained on 2.58M instructions across 15 tasks (Wu et al., 2023)

Character and emotion detection in dream narratives



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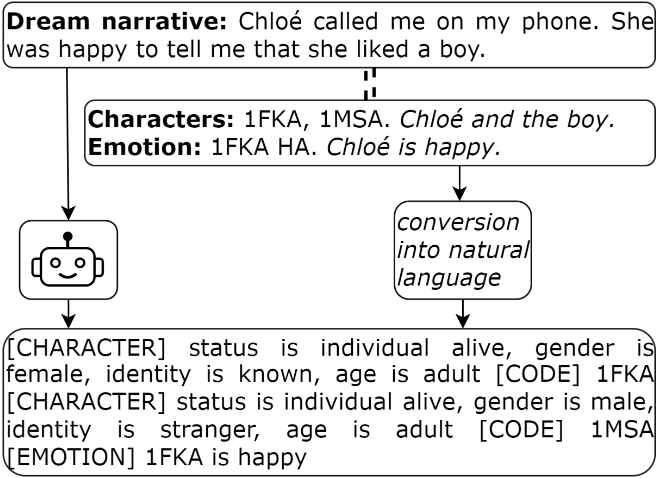

→ Our framework can be extended to include other HVdC categories

Results

`Baseline` is LaMini-Flan-T5 finetuned on 1823 dream narratives

Table: **Character and emotion detection**. $p < 0.05$.

Model	Status	Gender	Identity	Age	Character	Emotion
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→ Our models can address this task; there is room for improvement

58 F_1-score for gender prediction using lexical approaches (Fogli, Aiello, and Quercia, 2020)

86 F_1-score for emotion presence detection using transformers (Bertolini et al., 2023)

Case study on the war veteran

Group	Category	% Vet	% Total	Δ
Identity	known	24.9	51.6	-26.7
	prominent	1.9	2.5	-0.6
	occupational	22.4	8.0	14.4
	ethnic	4.1	0.9	3.1
	unknown	46.8	37.0	9.8
Gender	male	56.2	43.0	13.1
	female	24.1	33.1	-9.0
	joint	10.9	12.2	-1.3
	undefined	7.9	8.7	-0.9

Table: **Identity and gender proportions for the veteran** (n=566 narratives) versus other dreamers. Δ shows the difference in percentage points; $p < 0.05$.

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→ The veteran dreams more about *occupational*, *ethnic*, and *unknown* identities compared to other dreamers

Generated annotations for DreamBank are available on hf.co/gustavecortal

Formalization of style in personal narratives

G. Cortal and A. Finkel. Formalizing Style in Personal Narratives. *EMNLP 2025*.

Motivation

Limitation: A formalization of style that captures how subjective experience is linguistically communicated is lacking

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Formalization could enable more precise identification of linguistic patterns associated with psychological states and may support interventions (White and Epston, 1990)

→ We aim to create a accessible framework that researchers can build upon in future studies

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Scholarly work has examined personal modes of reasoning and expression (Hadamard, 1945; Granger, 1968; Husserl, 1982; Dilts, 1994)

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In NLP, style transfer aims to control linguistic attributes while preserving semantic content (Jin et al., 2022; Troiano, Velutharambath, and Klinger, 2023)

→ They provide operational tools to capture or control linguistic form, but do not focus on how such forms encode subjective experience

How to give an operational definition of style?

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Goal: Map narratives to sequences based on extracted linguistic features:

"I wake in a dark room. I feel a cold wind. I tell myself to move." $\rightarrow$ *amv*

Contributions

- A sequence-based framework defining style as *patterns in sequences of linguistic choices that encode subjective experience*

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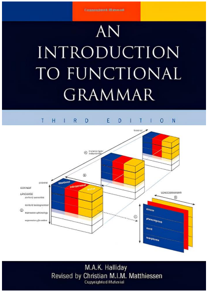
- A methodology for identifying patterns using sequence analysis
- A case study on dream narratives

What linguistic features encode subjective experience?

We ground our framework in *systemic functional linguistics* (Halliday et al., 2014)



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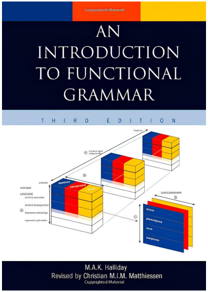
Meaning emerges through choices in systems of linguistic features to achieve communicative goals



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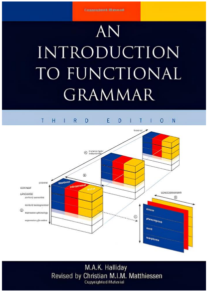
Language achieves three functions:

- Interpersonal: language builds social relationships
- Textual: information is organized to create coherent messages
- *Ideational*: language represents experience through processes and participants



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According to the *ideational function*, language represents experience through **processes** and participants

Processes	**Examples**
`Action`: actions and events in the physical world.	He$_{\texttt{Actor}}$ **takes**$_{\texttt{Action}}$ the valuable$_{\texttt{Affected}}$ I$_{\texttt{Actor}}$ **give**$_{\texttt{Action}}$ her$_{\texttt{Recipient}}$ a chance$_{\texttt{Range}}$
`Mental`: internal experiences such as thoughts, perceptions, and feelings.	The moon$_{\texttt{Senser}}$ **sees**$_{\texttt{Mental}}$ the earth$_{\texttt{Phenomenon}}$ He$_{\texttt{Senser}}$ **disliked**$_{\texttt{Mental}}$ Gilbert's writing$_{\texttt{Phenomenon}}$
`Verbal`: acts of communication.	David$_{\texttt{Sayer}}$ **said**$_{\texttt{Verbal}}$ "the corrupt, [...]"$_{\texttt{Verbiage}}$
`State`: states of being, having, or existence.	Clément$_{\texttt{Carrier}}$ **is**$_{\texttt{State}}$ a teacher$_{\texttt{Attribute}}$ Arthur$_{\texttt{Possessor}}$ **has**$_{\texttt{State}}$ a cat$_{\texttt{Possessed}}$

Formal definition of style

Alphabet: Let Σ be the set of process types

$$\Sigma = \{\texttt{Action}, \texttt{Mental}, \texttt{Verbal}, \texttt{State}\}$$

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$$T = (c_1, c_2, \ldots, c_n) \in \mathcal{C}^n$$

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$\to$ We implement ϕ using a language model with in-context learning

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Style of text: We define the style of text T as the set of patterns contained in its sequence $\phi(T)$

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where $w \subseteq \phi(T)$ denotes a substring (contiguous symbols)

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Style of author: The style of author A, denoted $\mathcal{S}(A)$, is the union of patterns contained in each text $T \in \mathcal{C}_A$

$$\mathcal{S}(A) = \bigcup_{T \in \mathcal{C}_A} \mathcal{S}(T)$$

Methodology for our sequence-based framework

Narrative: "I wake in a dark room. I feel a cold wind. I tell myself to move."

Clause	Process (symbol)	Participants
I wake in a dark room	`Action` (**a**)	`Actor`
I feel a cold wind	`Mental` (**m**)	`Senser`, `Phenomenon`
I tell myself to move	`Verbal` (**v**)	`Sayer`, `Recipient`

Sequence: *amv* | **Substrings:** {am, mv}

Results on the war veteran

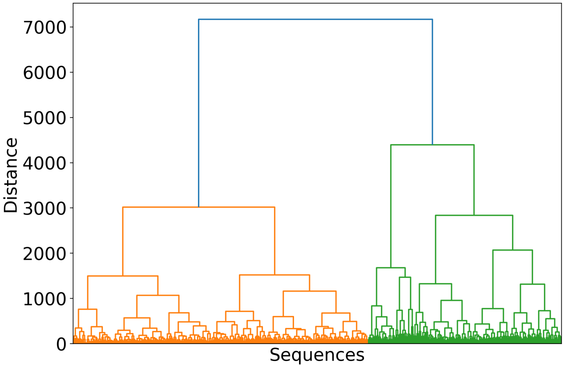

Figure: Dendrogram with Ward linkage and cosine similarity

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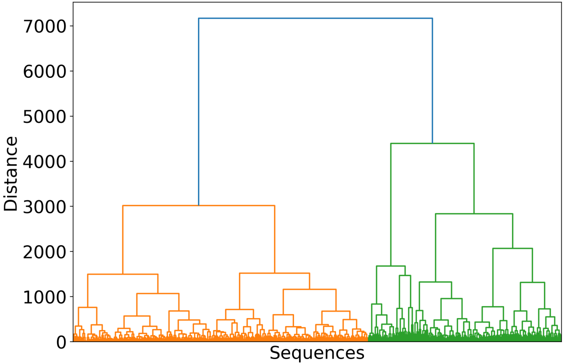

Figure: Dendrogram with Ward linkage and cosine similarity

Representative sequences: *savamasasaaamaaasavvvaaaaaaavssaaaaa* and *sssssavaavssvsavvvvsmasasaasasaamaamvmsss*

with a = action, m = mental, s = state, v = verbal

Results on the war veteran

We compare the proportion of sequences containing a given substring

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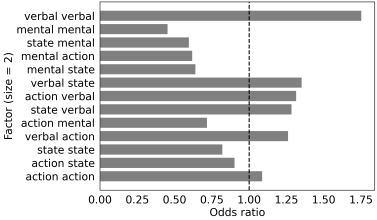

(a) Size 2.

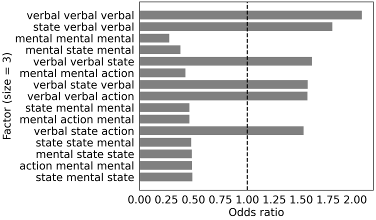

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Figure: Top substring odds ratio between the veteran and the norm

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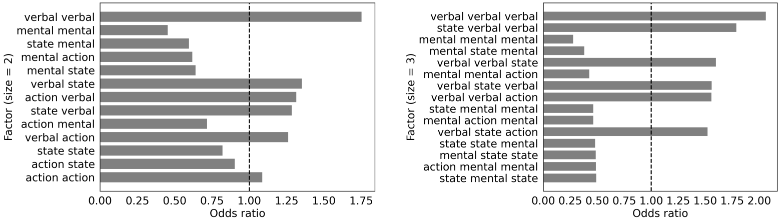

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→ The veteran favors verbal processes over mental ones

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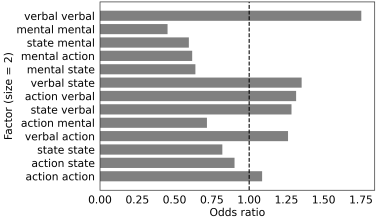

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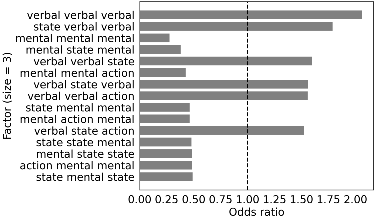

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Figure: Top substring odds ratio between the veteran and the norm

$\rightarrow$ The veteran favors verbal processes over mental ones

$\rightarrow$ Our results can inform psychological interpretations; need more individuals to generalize findings

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- **Style-conditioned narrative generation** (Barbieri et al., 2012; Alhafni et al., 2024)

How can this framework be extended?

- **Incorporating additional linguistic features**: duration of processes, concreteness of participants
- **Authorship profiling**: classifying authors based on their sequences (Ferrara et al., 2016)
- **Style-conditioned narrative generation** (Barbieri et al., 2012; Alhafni et al., 2024)
- **Applying methods from complexity science** (Lempel and Ziv, 1976; Hipólito et al., 2023)

Conclusion and perspectives

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- **Psychology of language models**: sycophancy, thought operations
  (Didolkar et al., 2025; M. Sharma et al., 2025)

Impact

Ongoing PhD thesis related to my works

(a) A. Haddou on cognitive distortions (2025, ENS Paris-Saclay).

(b) R. Faure on style analysis (2025, ENS Paris-Saclay).

(c) N. Richet on multimodal emotion (2024, ETS Montréal).

NLP for psychiatry (industry)

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6-month PhD internship at Callyope on *NLP for quantifying memory, future thinking, and the self in mental health narratives*

Automatic thematic analysis in mental health narratives using language models

G. Cortal, S. Guessoum, X. Cao, R. Riad. *Fine-grained mental health topic modeling in different cohorts using large language models* (preprint). 2025.

Motivation

- Qualitative analysis of speech content is central to clinical practice

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- Computational approaches offers time savings, can analyze a larger amount of data

Data collection

Narratives and clinical scores from *four cohorts*: French general population (n=1809) and three clinical cohorts (Italian n=116, Chinese n=52, Spanish n=90)

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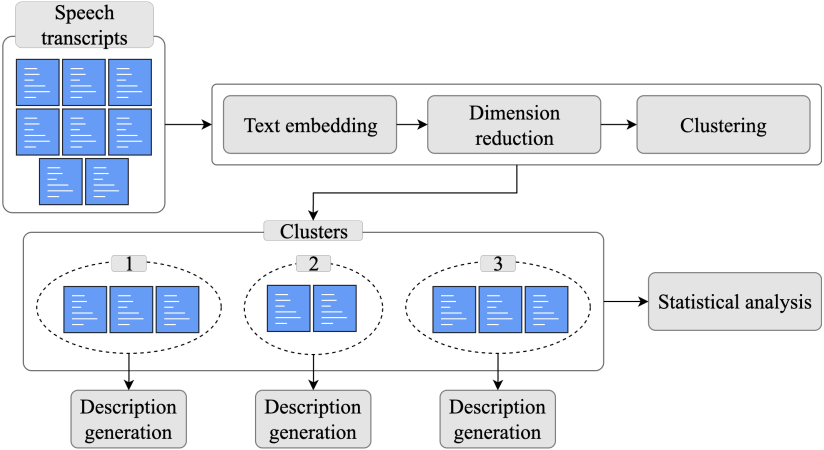
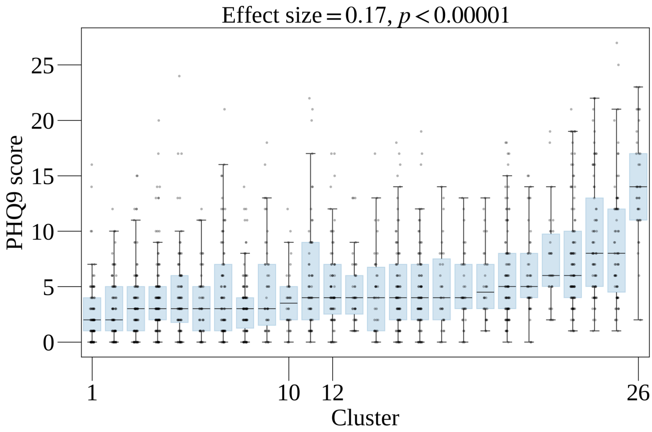
Open-ended questions involving last 24h, positive future event, current feelings and sleep, etc.

Semantic clustering and description generation



Distribution of depression scores across clusters

Current feelings and sleep (n=1,786)



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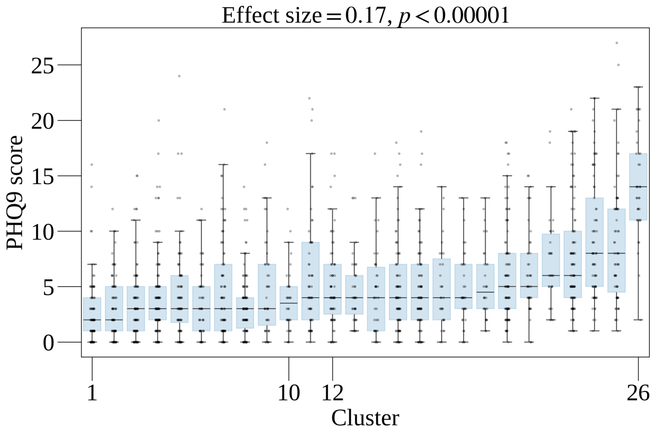

→ Depression scores vary significantly: cluster 26 highest (13.4±5.4), cluster 1 lowest (2.6±2.2)

Generated cluster descriptions

Cluster 1 description: The individuals express consistent satisfaction with their current well-being, emphasizing good sleep quality, restful or pleasant nights, and a general sense of relaxation, even when noting variations in sleep duration or occasional fatigue. (age=39±19, n=92)

Cluster 10 description: The individuals express frequent nighttime urinary interruptions disrupting sleep, often attributed to age-related conditions like prostate issues or overactive bladder, alongside mixed reports of physical well-being, mental resilience, and lifestyle factors such as retirement or exercise influencing their overall health and sleep patterns. (age=69±15, n=34)

Cluster 12 description: The individuals express stress related to academic exams, significant life decisions, and workloads, alongside sleep disturbances caused by lifestyle changes, increased responsibilities, or environmental adjustments, while some also highlight temporary relief from pressures through personal achievements or upcoming positive events. (age=24±9, n=67)

Cluster 26 description: The individuals express sleep disturbances characterized by insomnia, frequent awakenings, and restless sleep, alongside pervasive anxiety, emotional instability, and self-esteem issues, which collectively contribute to persistent fatigue, impaired daily functioning, and a diminished sense of well-being. (age=25±9, n=37)

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→ Clustering captures symptom severity and age-related circumstances

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Selected research papers

Constant Bonard and Gustave Cortal (2024). "Improving Language Models for Emotion Analysis: Insights from Cognitive Science". In: *Proceedings of the Workshop on Cognitive Modeling and Computational Linguistics*. Ed. by Tatsuki Kuribayashi et al. Bangkok, Thailand: Association for Computational Linguistics, pp. 264–277. DOI: 10.18653/v1/2024.cmcl-1.23

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Gustave Cortal and Alain Finkel (2025). "Formalizing Style in Personal Narratives". In: *Proceedings of the 2025 Conference on Empirical Methods in Natural Language Processing*. Ed. by Christos Christodoulopoulos et al. Suzhou, China: Association for Computational Linguistics, pp. 7322–7337. ISBN: 979-8-89176-332-6

Appendix

What are the psychological mechanisms used to infer what is communicated?

A *code* is a pre-established pairing between stimuli and sets of information

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The formal semantics of a language is made of syntactical and lexical rules that pairs <strings of words> with [sentential meanings]

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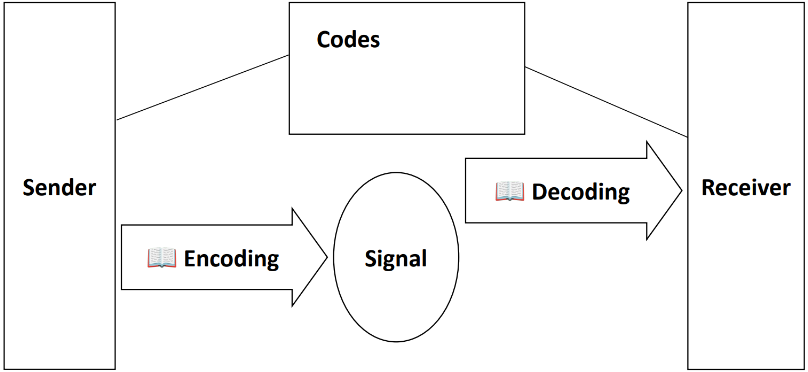

Figure: Dictionary analysis in cognitive pragmatics.

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$\rightarrow$ We rely on other sources of evidence to infer what is communicated

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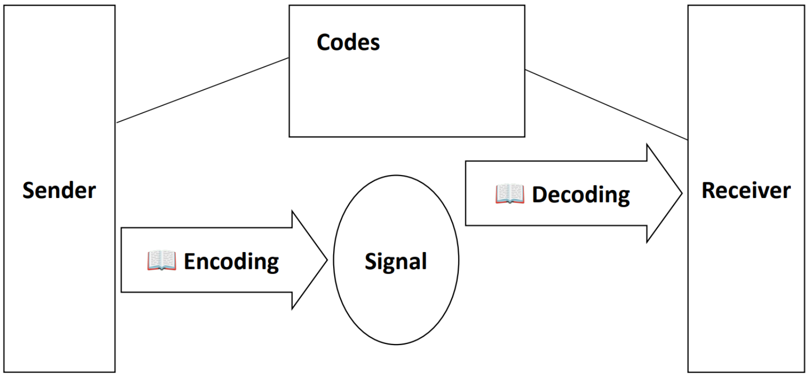

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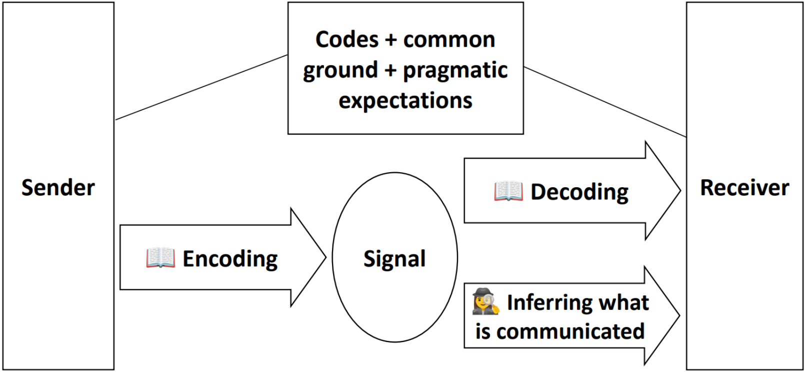

Figure: Detective analysis in cognitive pragmatics.

Component classification in emotional narratives

Model	**Precision**	**Recall**	$\boldsymbol{F_1}$
Logistic Regression	84.9 (0.3)	84.3 (0.3)	84.4 (0.3)
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$\rightarrow$ Models can be used to automatically classify unstructured narratives

Results

StableBeluga$_{i}$ is a 7B model with in-context learning using *i* examples

Model	Status	Gender	Identity	Age	Character	Emotion
Baseline	82.87	78.02	76.17	86.21	64.74	75.13
StableBeluga$_1$	43.95**	39.76**	31.25**	56.16**	15.65**	-
StableBeluga$_3$	52.44**	46.49**	38.46**	63.88**	21.06**	-
StableBeluga$_5$	55.89**	46.29**	42.61**	63.73**	24.86**	-

Table: F_1-scores for character and emotion detection. Significant differences from baseline: ** ($p < 0.01$), * ($p < 0.05$).

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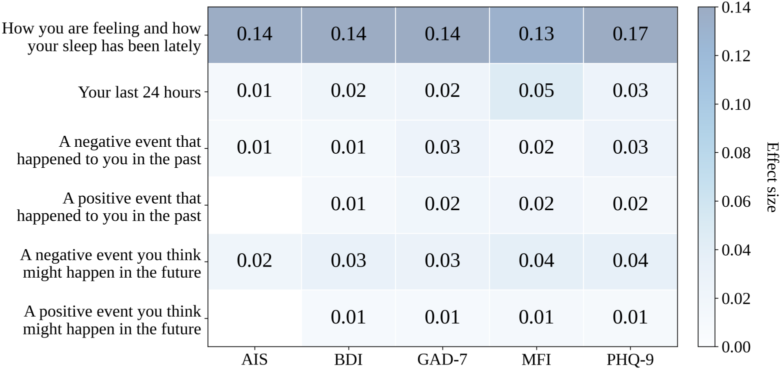
→ Compared to `StableBeluga`, our supervised models perform better while having 28 times fewer parameters (248M *vs.* 7B)

Effect size across questions and clinical scores



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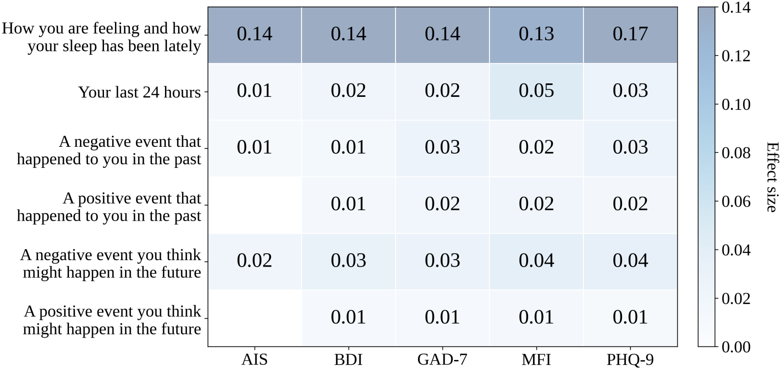
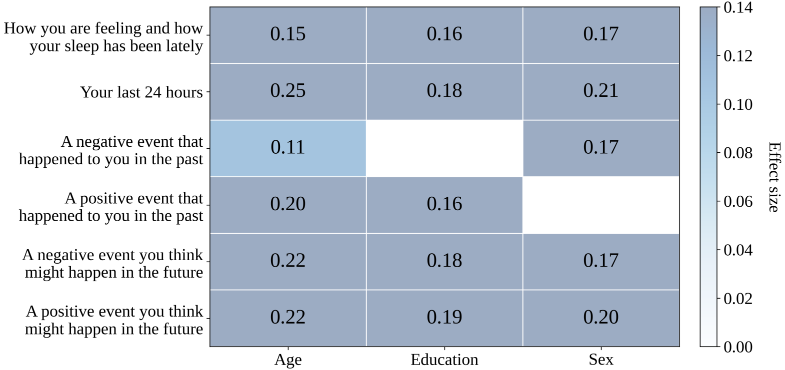


→ Certain questions better discriminate clinical scores

Effect size across questions and sociodemographics



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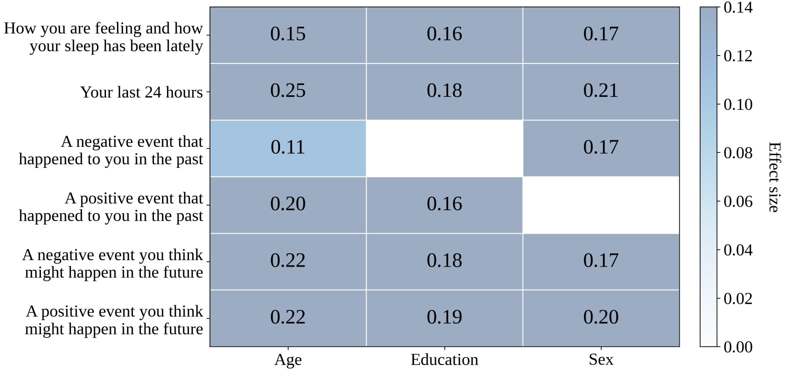

→ Nearly all questions discriminate sociodemographics

Demographics

	General Population n=1809	Androids n=116	MODMA n=52	VOCES n=90
Demographics				
Language	French	Italian	Chinese	Spanish
Age	***	*n.s.*	*n.s.*	***
Mean (SD)	37.8 (18.2)	37.4 (12.0)	31.3 (9.2)	38.6 (14.9)
Range	18–91	19–71	18–52	21–76
Sex, n (%)	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Female	1187 (66.2)	84 (72.4)	16 (30.8)	39 (43.3)
Male	595 (33.2)	32 (27.6)	36 (69.2)	48 (53.3)
Other	11 (0.6)	0 (0.0)	0 (0.0)	3 (3.3)
Education, n (%)	*n.s.*	*n.s.*	*n.s.*	*n.s.*
No diploma	52 (2.9)	11 (9.5)	7 (13.5)	-
Secondary	291 (16.2)	37 (31.9)	8 (15.4)	-
Higher short	213 (11.9)	52 (44.8)	0 (0.0)	-
Higher long	1236 (69.0)	16 (13.8)	37 (71.2)	-

Clinical evaluation

	General Population n=1809	Androids n=116	MODMA n=52	VOCES n=90
C-SSRS	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Suicidal risk, n (%)	-	-	-	60 (66.7)
No suicidal risk, n (%)	-	-	-	30 (33.3)
MADRS / MDD	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Depression, n (%)	-	64 (55.2)	23 (44.2)	-
No depression, n (%)	-	52 (44.8)	29 (55.8)	-
PHQ-9	*n.s.*	*n.s.*	***	***
Mean (SD)	5.2 (4.6)	-	9.4 (8.5)	10.5 (6.8)
Range	0–27	-	0–25	0.0–26.0

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