Natural language processing for subjectivity analysis in personal narratives

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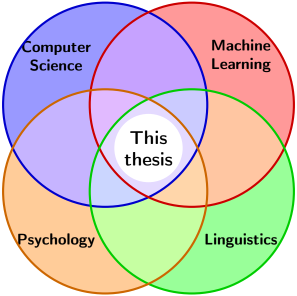
Introduction

Context



- Natural language processing for psychology is underexplored
- We build on an existing subfield: sentiment and emotion analysis
- We study subjectivity (first-person perspective, meaning-making processes, and experiential content)
- We focus on personal narratives (emotional narratives, dream reports)

Introduction

How to model subjective experience in personal narratives?

We first address the *content* by classifying elements of personal narratives, then the *form* through the concept of style

- 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

Papers

International conferences (2):

- Language models for character and emotion detection in dream narratives (first author, oral, LREC-COLING)
- Formal definition of style in personal narratives (first author, oral, EMNLP)

International workshops (3):

- Data paper on emotional narratives (first author, SIGHUM @ EACL)
- Position paper on emotion analysis (equal contribution, CMCL @ ACL)
- Multimodal emotion analysis competition paper (3rd place, intern supervision, ABAW @ ECCV)

National venues (2, French translations):

- Position paper on emotion analysis (TALN conference)
- Language models for dream analysis (TAL journal)

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

My research models are publicly hosted on Hugging Face and were trained using the Jean Zay supercomputer

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." → `joy`
Darwin (1872), Tomkins (1962), Ekman (1999), and Plutchik (2001) Demszky et al. (2020) and Greschner et al. (2025)		
Constructivist theories	a continuous value with an *affective* meaning	"His voice soothes me." → `valence` (4/5), `arousal` (1/5)
Schachter and Singer (1962) and Russell and Barrett (1999) Buechel and Hahn (2017)		
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)		

Psychology and emotion annotation

Psychological theories	**In text, emotion is...**	**Example**
	composed of *semantic roles*	"Louise (`experiencer`) was angry (`cue`) towards Paul (`target`), because he didn't inform her (`cause`)."

Campagnano, Conia, and Navigli (2022) and Klinger (2023)

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

Limitations in emotion analysis

- Though the theories reviewed are usually considered rivals, their integration is possible and desirable (Scherer, 2022a)
- Emotion verbalization is underexplored
  (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

Which verbal signs are used to infer expressed emotions?

Raphaël Micheli categorizes a range of linguistic markers into three *emotion expression modes* (Micheli, 2013a). The emotion can be:

- *labeled* explicitly with an emotional term ("I am sad")
- *shown* with utterance features such as interjections and punctuations ("Ah! That's great!")
- *suggested* with the description of a situation which generally, in a given sociocultural context, leads to an emotion ("She gave me a gift")

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

→ [add refs] (Etienne, Battistelli, and Lecorvé, 2022; Dragos et al., 2022)

How to integrate psychological theories of emotion?

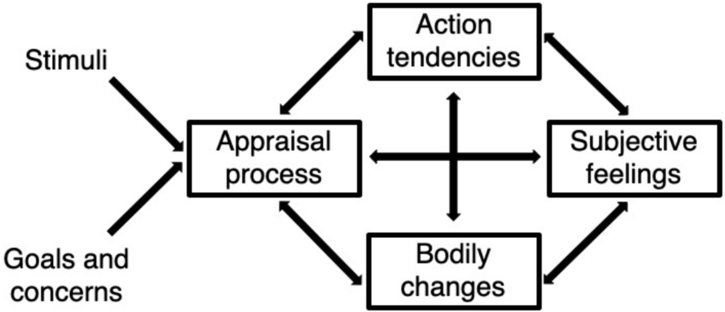


Figure: **The integrated framework for emotion theories** (Scherer, 2022b). Rectangles represents the components constituting an emotional episode, and arrows represent causation.

→ We use this framework to construct an emotion corpus

French narratives based on emotion components

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

Motivation

Limitation: No annotation schemes consider all emotion components

Kim and Klinger (2019) study emotion communication in fiction via subjective sensations, postures, and facial expressions

Casel, Heindl, and Klinger (2021) associate text spans with Scherer's emotion components

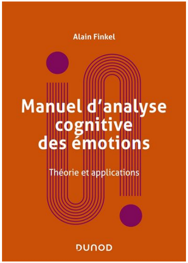
$\rightarrow$ We structure emotional narratives according to behaviors, thoughts, physical feelings, and reasons

Cognitive Analysis of Emotions

Goal: Create a corpus of narratives structured according to emotion components, following a questionnaire from *Cognitive Analysis of Emotions* (Finkel, 2022)

The questionnaire:

- explores emotions with behavioral (*behavior*), physiological (*feeling*), and cognitive (*thinking* and *reason)* components
- uses emotion components to reorganize the narrative of experienced events
- helps individuals better regulate their emotions



Finkel (2022)

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`)

→ 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

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 Precision	Logistic Regression Recall	Logistic Regression F_1	CamemBERT Precision	CamemBERT Recall	CamemBERT F_1
All	71.2 (2.6)	69.1 (2.2)	67.8 (2.3)	**85.1**	**84.8**	**84.7**
Without `behavior`	77.4 (2.3)	75.8 (2.4)	74.5 (2.6)	80.3	79.8	79.7
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
Without `reason`	64.3 (4.1)	64.5 (2.4)	62.3 (2.8)	78.7	78.5	78.6
Only `behavior`	52.1 (3.5)	54.6 (2.9)	51.7 (2.9)	68.4	67.1	66.6
Only `feeling`	69.6 (1.5)	68.9 (2.1)	68.4 (2.0)	67.8	68.4	67.7
Only `thinking`	50.1 (3.4)	53.8 (2.3)	50.6 (2.7)	70.5	70.1	70.1
Only `reason`	68.2 (1.8)	66.8 (2.2)	66.6 (2.3)	71.4	68.4	68.9

→ All components help; best results come from using all, *supporting Scherer's hypothesis*

→ Some components benefit from contextual understanding and world knowledge (`behavior` and `thinking`)

Motivation for dream analysis

We performed emotional analysis on concrete, real life situations

We now turn to oniric, fictional situations: dream narratives

According to the *continuity hypothesis*, dreams reflect waking-life concerns, emotions, and social contexts (Schredl and Hofmann, 2003)

$\rightarrow$ Dream narratives possess a narrative structure and represent attempts to communicate subjective experience

Quantitative analysis of dream narratives

Quantitative dream analysis studies the continuity hypothesis, and relies on dream databases and annotation schemes
(Winget and Kramer, 1979; Domhoff and Schneider, 2008)

DreamBank contains 27,000 narratives, only 1823 annotated with the Hall and Van de Castle (HVdC) scheme
(Flanagan, 1966; Domhoff and Schneider, 2008)

The annotation process is complex and costly

→ How to automate the annotation process using language models?

Hall and Van de Castle annotation scheme

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="7">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="7">[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>

#0039
It was my birthday and I was having a party but in a place I've never been before. It was in a forest type area. All I remember is that at the same time I had two boyfriends. Only one was at my party, though he had just broken up with my best friend so I kinda felt uncomfortable being with him. We had got in an argument so he left. I don't quite remember how but we did make up but I don't remember when or why even got in the argument. I woke up when I heard the telephone ringing. (103 words)

Figure: **Example of an annotated dream narrative with HVdC.**

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)

Distributional semantic-based approaches represent text spans in a vector space to identify prototypical situations
(Gutman Music, Holur, and Bulkeley, 2022)

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

Bertolini et al. (2023) are the first to fine-tune a pre-trained language model for detecting the presence of emotions

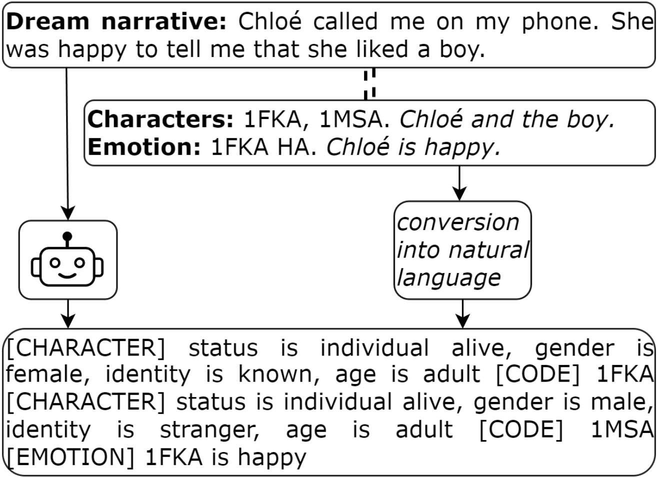
This approach uses full narrative context and compares predictions with HVdC gold annotations

Limitations: emotions are not linked to characters; emotion frequency is not modeled

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

Character and emotion detection in dream narratives

[add seq2seq architecture illustration, add list of characters and emotions]



Results

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

Model	Status	Gender	Identity	Age	Character	Emotion
`Baseline`	82.9	78.0	76.2	86.2	64.7	75.1
$\texttt{No}_{\texttt{semantics}}$	71.4	56.5	61.0	90.5	41.8	75.8
$\texttt{No}_{\texttt{names}}$	80.7	74.3	74.2	84.0	60.9	73.0
$\texttt{Size}_{\texttt{small}}$	78.4	72.1	70.3	81.7	56.8	70.2
$\texttt{Size}_{\texttt{large}}$	84.5	80.3	78.6	87.3	67.6	74.7
$\texttt{First}_{\texttt{group}}$	82.3	77.7	74.9	85.6	63.7	71.9
$\texttt{First}_{\texttt{individual}}$	80.6	76.1	74.2	83.9	62.7	67.3
$\texttt{First}_{\texttt{emotion}}$	83.9	78.7	77.1	87.6	65.0	72.0
$\texttt{Conversion}_{\texttt{comma}}$	84.0	79.8	77.7	87.1	66.7	73.7
$\texttt{Conversion}_{\texttt{marker}}$	82.4	78.5	76.5	86.1	65.4	74.4

Table: **Character and emotion detection**. $p < 0.05$, $p < 0.01$.

→ Our models can address this task; there is room for improvement

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; $p < 0.05$.

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

Formalization of style in personal narratives

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

Motivation

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

→ They describe "styles of thought" but lack operational tools

Style is central to how authors express themselves: stylistics (Wales, 2014), stylometry (Neal et al., 2017)

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

Motivation

Tellier and Finkel (1995) define linguistic style as lexical and syntactical patterns using formal language theory [be more precise]

Barbieri et al. (2012) proposes constrained Markov processes to generate song lyrics that match an author's style while satisfying rhyme and meter constraints

$\rightarrow$ Drawing on these ideas, we provide a sequence-based framework to analyze how personal narratives convey subjective experience

Motivation

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

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

How to give an operational definition of style?

Intuitive definition: a distinctive manner of communicating subjective experience in personal narratives

Hypothesis: An individual uses some redundant choices of features that characterize its style

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:

1. A sequence-based framework defining style as *patterns in sequences of linguistic choices that encode subjective experience*
2. A methodology for identifying patterns using sequence analysis
3. A case study on dream narratives

What linguistic features encode subjective experience?

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

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

Language achieves three functions: interpersonal (language builds social relationships), textual (information is organized to create coherent messages), and *ideational* (language represents experience)

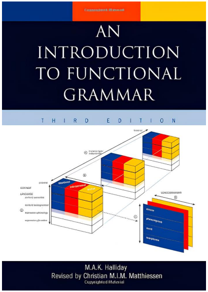


Figure: Halliday et al. (2014). $+57,000$ citations.

What linguistic features encode subjective experience?

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 a finite alphabet grounded in *Systemic Functional Linguistics* to capture meaningful distinctions in experience

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

Mapping: Let ϕ be a function that maps a narrative text T to a sequence of symbols in Σ^*

$$\phi(T) = u = (u_1, u_2, \dots, u_n)$$

$\rightarrow$ We implement ϕ using language models with in-context learning to extract features at the clause level

Formal definition of style

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

$$\mathcal{S}(T) = \{w \in \Sigma^* \mid w \subseteq \phi(T)\}$$

(where $w \subseteq u$ denotes that w is a substring of u)

$\rightarrow$ Style is formally captured as the set of sequential patterns chosen by the author to encode experience

Methodology for our sequence-based framework

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}

Substrings are contiguous sequences of symbols within a sequence

Results on the war veteran

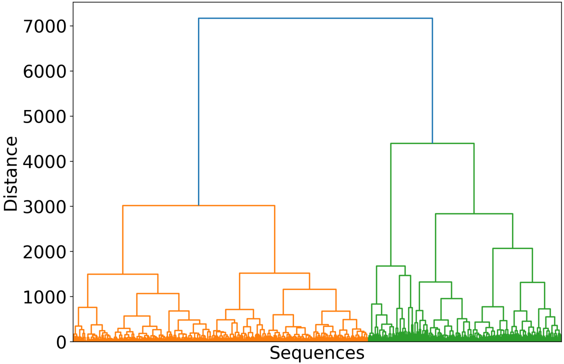
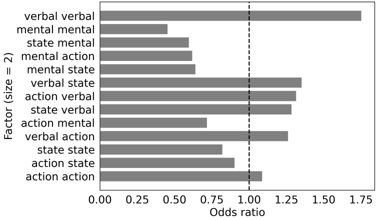


Figure: Dendrogram with Ward linkage and cosine similarity

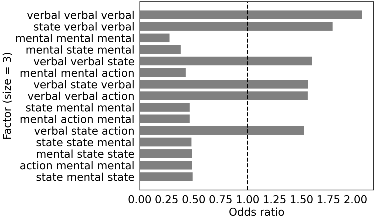
Representative sequences: *savamasasaaamaaasavvvaaaaaaavssaaaaa* and *sssssavaavssvsavvvvsmasasaasasaamaamvmsss* with
a = action, m = mental, s = state, v = verbal

Results on the war veteran

We compare the proportion of sequences containing a given substring



(a) Size 2.



(b) Size 3.

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

→ The veteran favors verbal processes over mental ones

→ Our results can inform psychological interpretations; need more individuals to generalize findings

How can this framework be extended?

- **Incorporating additional linguistic features** with a functional role (duration of processes, concreteness of participants)
- **Authorship profiling**: predicting 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

Conclusion

How to model subjective experience in personal narratives?

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

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)

I wanted to apply my NLP skills to industry work with social impact

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

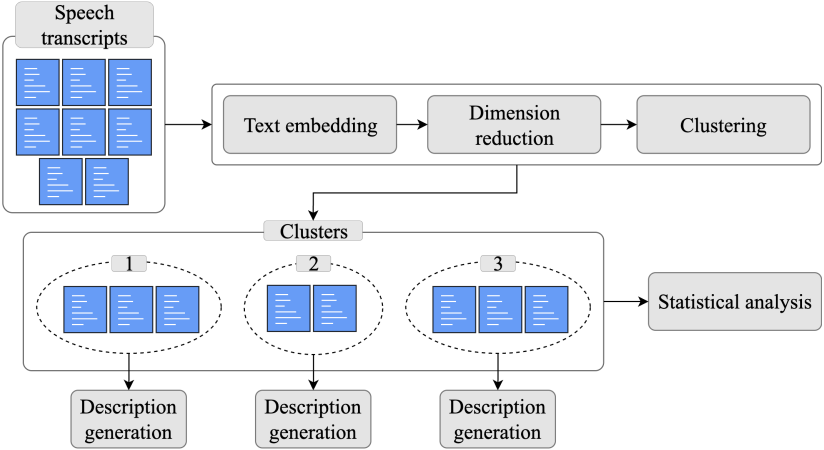
Automatic thematic analysis in mental health narratives using language models

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

Motivation

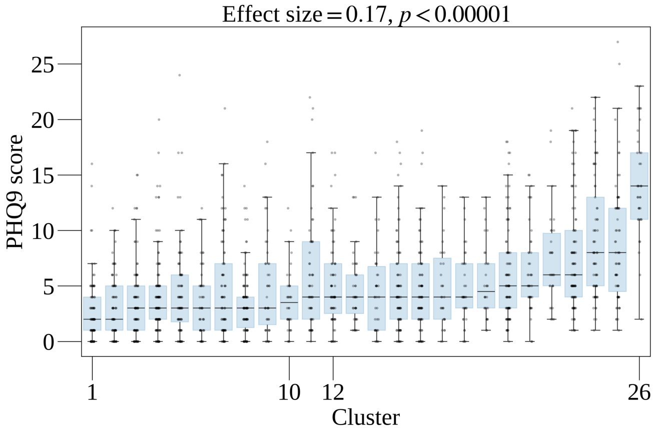
- Qualitative analysis of speech content is central to clinical practice
- Thematic analysis studies how people construct meaning
- Thematic analysis is time-consuming, often constrained to small, monolingual corpora
- Computational approaches offers time savings, can analyze a larger amount of data

Semantic clustering and description generation



Distribution of depression scores across clusters

How you are feeling and how your sleep has been lately



→ 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)

→ Clustering captures symptom severity and age-related circumstances

Perspectives

Perspectives

- **Emotion analysis for mental health**: empathic support, cognitive distortions, theory of mind
  (Gandhi et al., 2023; Ma et al., 2023; A. Sharma et al., 2023)
- **Post-training for psychology**: preferences and reasoning data
  (M. Zhang, Eack, and Chen, 2025)
- **Psychology of language models**: sycophancy, thought operations
  (Didolkar et al., 2025; M. Sharma et al., 2025)

Conclusion

How to model subjective experience in personal narratives?

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

Papers: 2 int. conferences, 3 int. workshops, 2 national venues

Open corpus and tools: French corpus based on emotion components; language models for emotion analysis in emotional and dream narratives

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

Gustave Cortal, Alain Finkel, et al. (2023). "Emotion Recognition Based on Psychological Components in Guided Narratives for Emotion Regulation". In: *Proceedings of the 7th Joint SIGHUM Workshop on Computational Linguistics for Cultural Heritage, Social Sciences, Humanities and Literature*. Ed. by Stefania Degaetano-Ortlieb et al. Dubrovnik, Croatia: Association for Computational Linguistics, pp. 72–81. DOI: 10.18653/v1/2023.latechclfl-1.8

Gustave Cortal (2024). "Sequence-to-Sequence Language Models for Character and Emotion Detection in Dream Narratives". In: *Proceedings of the 2024 Joint International Conference on Computational Linguistics, Language Resources and Evaluation (LREC-COLING 2024)*. Ed. by Nicoletta Calzolari et al. Torino, Italia: ELRA and ICCL, pp. 14717–14728

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

The Morse code is a pairing between <combination of short and long signals> and [letters]

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

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

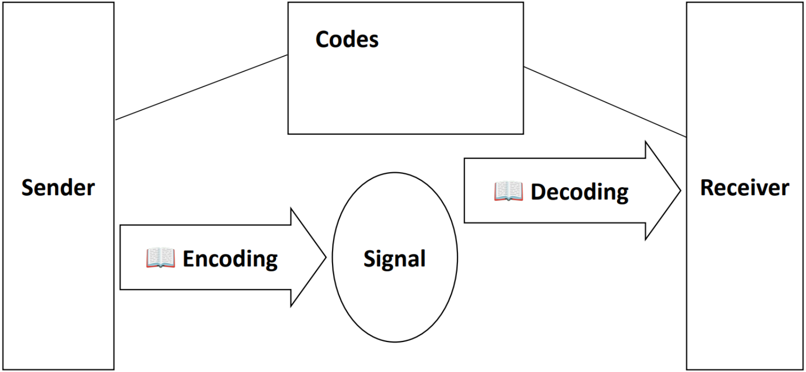


Figure: Dictionary analysis in cognitive pragmatics.

Codes underdetermine emotion meaning

Let's take emotion expression modes as an example:

- *Labeled*: "I am happy now" is explicit about the feeling but does not encode what the emotion is about
- *Displayed*: interjections ("Wow!", "Ah!", "Damn!") show affect yet leave valence and focus unclear
- *Suggested*: "The ship has black sails." can communicate any kind of emotion

→ We rely on other sources of evidence to infer what is communicated

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

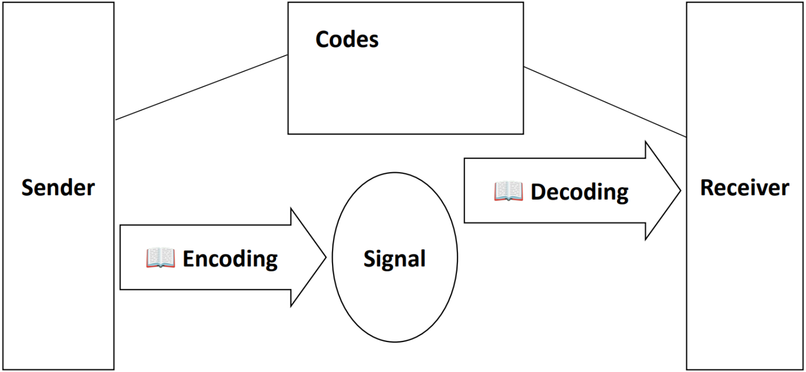


Figure: Dictionary analysis in cognitive pragmatics.

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

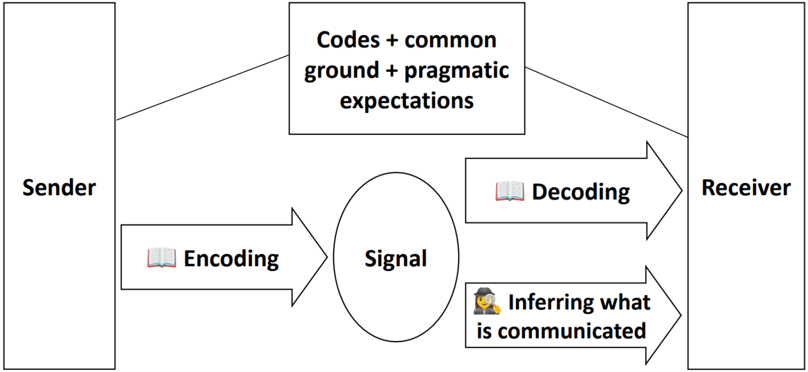


Figure: Detective analysis in cognitive pragmatics.

Component classification in emotional narratives

Model	Precision	Recall	F_1
Logistic Regression	84.9 (0.3)	84.3 (0.3)	84.4 (0.3)
CamemBERT	**93.2**	**93.0**	**93.1**

Table: Scores (± std) for emotion component classification.

→ Models can be used to automatically classify unstructured narratives

Results

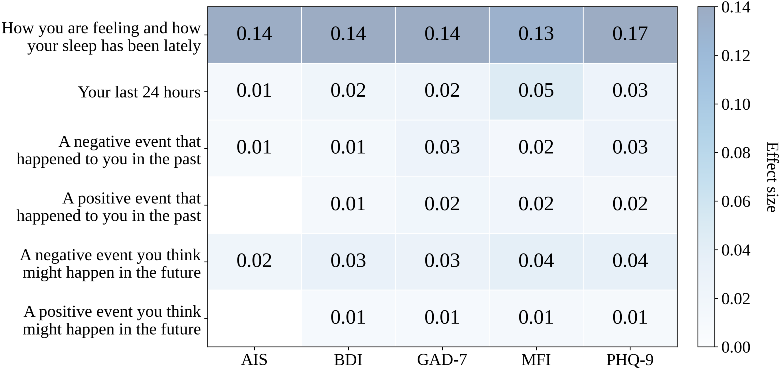
StableBeluga$_i$ is a 7B model with in-context learning using *i* examples

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: ** ($p < 0.01$), * ($p < 0.05$).

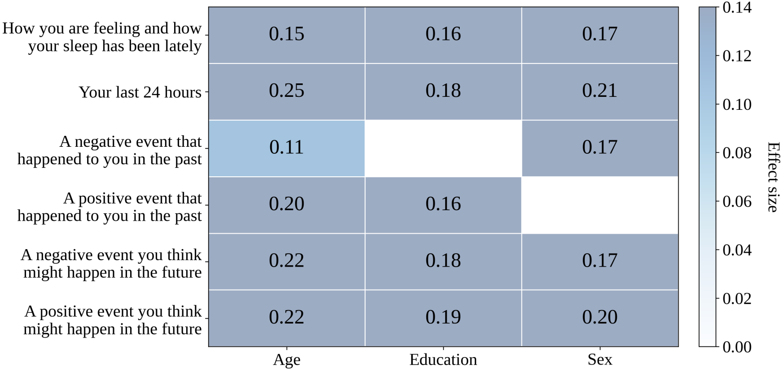
→ Compared to StableBeluga, our supervised models perform better while having 28 times fewer parameters (248M *vs.* 7B)

Effect size across questions and clinical scores



→ Certain questions better discriminate clinical scores

Effect size across questions and sociodemographics



→ 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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