NEUROSCIENCE of Consciousness

Neuroscience of Consciousness, 2024, **10(1)**, niae036

DOI: https://doi.org/10.1093/nc/niae036

Research Article

Phenomenology of auto-induced cognitive trance using text mining: a prospective and exploratory group study

Audrey Vanhaudenhuyse[1,2,‡,*], Marie-Carmen Castillo[3,‡], Charlotte Martial[4,5], Jitka Annen[4,5], Aminata Bicego[1], Floriane Rousseaux[1], Leandro R.D. Sanz[4,5], Corine Sombrun[6], Antoine Bioy[3], Olivia Gosseries[1,4,5,*]

[1]Conscious Care Lab, GIGA Consciousness, University of Liège, Domaine Universitaire du Sart-Tilman, B34, Liège 4000, Belgium
[2]Algology Interdisciplinary Center, University Hospital of Liège, Domaine universitaire du Sart-Tilman B35, Liège 4000, Belgium
[3]Laboratory of Psychopathology and Processes of Change, University of Paris 8, 85 boulevard Saint-Germain, Paris 75006, France
[4]Coma Science Group, GIGA Consciousness, University of Liège, Domaine universitaire du Sart-Tilman B34, Liège 4000, Belgium
[5]Centre du Cerveau[2], University Hospital of Liège, Domaine universitaire du Sart-Tilman B35, Liège 4000, Belgium
[6]Trance Science Research Institute, 34 Bd des Italiens, Paris 75009, France

[‡]The first two authors contributed equally to this article.
The last two authors contributed equally to this article.
*Corresponding authors. Audrey Vanhaudenhuyse, Conscious Care Lab, GIGA Consciousness and Algology Interdisciplinary Center, University and University Hospital of Liège, Domaine universitaire du Sart-Tilman B35, Liège 4000, Belgium. E-mail: avanhaudenhuyse@chuliege.be; Olivia Gosseries, Coma Science Group, GIGA Consciousness and Centre du Cerveau[2], University and University Hospital of Liège, Domaine Universitaire du Sart Tilman, Liège 4000, Belgium. E-mail: ogosseries@uliege.be

Abstract

Auto-induced cognitive trance (AICT) is a modified state of consciousness derived from shamanic tradition that can be practised by individuals after specific training. The aim of this work was to characterize the phenomenological experiences of AICT, using text mining analysis. Free recalls of subjective experiences were audio-recorded in 27 participants after five pseudo-randomized experimental sessions: ordinary conscious resting state, with auditory stimulation and with an imaginary mental task, as well as during AICT with and without auditory stimulation. Recordings were transcribed, normalized total word counts were calculated for each condition, and analyses of content were performed using IRaMuTeQ software. Results showed that the length of the participants' reports was higher for AICT compared to the other conditions, and that the content could be categorized into four classes of discourse: AICT memory, AICT, ordinary conscious states, and AICT with and without stimulation. AICT was also characterized by specific content compared to rest, auditory stimulation, and imagination conditions. Content analysis of the narrative revealed nine categories encompassing the presence of nature, people, animals, positive and negative features, sensory perceptions, body modifications, metacognition, and difficulty of describing thoughts. Among these categories, AICT is specifically characterized by reports related to the presence of nature, animals, body modifications, as well as the difficulty of describing thoughts. These results suggest that a richer phenomenology was reported during AICT, compared to the other conditions, and that AICT constitutes a class of discourse on its own, with a clear dissociation from the other conditions.

Keywords: auto-induced cognitive trance; text mining; subjective experience; phenomenology; narrative content; modified state of consciousness

Introduction

Trance has been used for millennia in different cultures, during various shamanic rituals and for many purposes (Harner 1990, Sombrun 2012, Flor-Henry et al. 2017). The modified state of consciousness (MSC) experienced during these rituals can be described as a lucid but narrowed awareness of external surroundings with a hyper-focused immersive experience of flow, expanded inner imagery, modified somatosensory processing, and an altered sense of self (Csikszentmihalyi 1990, Flor-Henry et al. 2017). In contemporary Western culture, we have witnessed the development of trance practices that are unrelated to traditional rituals (Gosseries et al. 2024). These practices of trance are usually used to serve personal growth and therapeutic purposes (Wallis 2000).

As clinicians, we are meeting more and more patients who are turning to non-pharmacological complementary approaches to deal with their health problems. Among these patients, an increasing number had consultations with 'shamans', neo-shamans, or have practised rituals with the goal to improve their health conditions. However, we currently have very little reliable evidence of their effectiveness. As scientists and clinicians, it is therefore our duty to first better characterize these processes of MSC and later to assess their clinical effectiveness. A relevant

Received 27 July 2023; revised 2 October 2024

method to understand these experiences of MSC is to focus on the experience reported by the participant immediately after the trance state (i.e. first-person experience) (Rock 2006, Peres et al. 2012). At present, little is known about the phenomenology of trance experienced during shamanic rituals.

While the variety of trances (possession, channeling, shamanic rituals, etc.) makes it challenging to find a unique signature of this MSC, there is a growing interest in the scientific community. Some studies report that these types of trance are associated with subjective changes in body perception, self-awareness, thinking and emotional state, and with a disengagement from the sensory environment (Wallis 2000, Flor-Henry et al. 2017, Gosseries et al. 2020, 2024). Modification of sensori-motor perceptions (e.g. decreased pain perception), increased sense of happiness and visual imagery, production of unknown sounds, languages and songs, increases in arousal as well as clairvoyance, spiritual hearing, and out-of-body experiences are among the features most frequently reported during trance states related to shamanic practice (Oohashi et al. 2002, Sombrun 2012, Kawai et al. 2017, Mainieri et al. 2017, Anastasia et al. 2020, Wahbeh and Butzer 2020). These preliminary results, mostly coming from small sample studies or case reports, suggest that these trance states involve a change in the subjective experience. Recently, the term 'auto-induced cognitive trance' (AICT) has been proposed for situations where trance is abstracted from any ritual or cultural expression (and thus not practised in the shamanic culture and tradition) (Flor-Henry et al. 2017, Gosseries et al. 2024). AICT is a method developed by C.S., one of co-authors, that allows people to acquire the ability to self-induce a trance based on a sound loop training programme (see 'Methods' section). To date, there is no assessment of the phenomenology of AICT at the group level.

The descriptive phenomenological approach, as used in this study, analyses the narrative or verbatim account of individuals who achieve such MSC experiences, complementary to what an external observer (third-person) might report (Sims 1995). Studies based on verbatims accounts permit the definition of different MSCs, and thus differentiate them based on their respective phenomenology (Cardeña 2011) (e.g. hypnotic state vs. meditative state). One technique employed to understand the subjective perspective of individuals is to count the number of words used in their narratives (Laing 1967). 'Word counts analysis' reflects the length of the report and can also reflect the richness and vividness of the reports (Cardeña et al. 2022). In addition, text mining allows the exploration of thoughts and accesses subjective experiences through narratives, regardless of the structure of the narrative and the diversity of words used (Leech and Onwuegbuzie 2007). This approach values the analysis of natural speech as a condition to access psychological states and provides objective descriptions of verbal behaviours (Waterman et al. 1993). The systematized description of language corpus can be analysed with textual and statistical software (Charjan and Pund, 2013), which can reduce the 'thematic or interpretative arbitrariness' (Castillo 2021). It allows scientific exchange around 'results that can be communicated, verified and challenged by other researchers' (Santarpia 2021). This type of verbal data processing leads to understanding of the phenomenology of experiences and their interpretations. This automated analysis method reveals universes of discourse or 'lexical worlds' by identifying words within narratives. Lexical worlds (i.e. occurrence, proximity in a sentence or paragraph of words to each other) define a 'cloud of words' (also named the 'universes of discourse') that are linked to each other. Finally, content analysis is also a usual method of systematized description and analysis of verbal data, the objective of which is to give an account of the subject's internal experience (i.e. free description of the lived experience and internal content: images, feelings, etc.) (Ghiglione and Blanchet 1991, Scelles 1997). This kind of analysis, considered to be 'interpretive descriptive', serves to 'depict a phenomenon (context, properties, variations, etc.) to explain it and to account for its meaning. It is an inductive approach to research that is attentive to the complexity of human phenomena. The interpretative nature of the description refers to the search for meaning, relationships between components and arrangements or configurations (patterns)' (Santiago-delefosse et al. 2015).

The aim of the study this to characterize AICT phenomenology by comparing freely expressed verbal reports of AICT and other conditions (i.e. resting state, auditory stimulation and imagination of a previous intense AICT) experienced by individuals trained in AICT practice. The imagination condition was introduced to evaluate whether the AICT reflects a specific state or can be considered as a mental imagery task. Word count, textual and content analysis will enable us to characterize the narrative of individuals in the different pre-cited conditions. We hypothesize that AICT will be characterized by a specific narrative, compared to ordinary consciousness conditions.

Methods

Participants

Twenty-seven participants were included in this study. The inclusion criteria were the following: over 18 years old, fluent French speakers, highly proficient at entering an AICT state, and practicing AICT regularly. Participants previously received training in AICT and were recruited via the leader of the AICT workshops (C.S.) who provided a list of 'AICT experts' (according to her). We then contacted them and asked if they were interested in participating in our study. If they were interested, we asked them if they were able to keep still and silent during the AICT state since this protocol is part of a larger EEG study. We then invited them to participate in the study.

The 4-day AICT training programme was undertaken out by the participants according to their own interest months or years before the study. Participants have also read about AICT through C.S.'s books and testimonies relating her training in traditional shamanic Mongolian communities. The training consists of a sound-loop-based programme allowing people to enter AICT, with the goal of voluntarily inducing AICT at will without the need for a sound or movement cue (Oswald et al. 2023, Gosseries et al. 2024, Kumar et al. 2024). Participants lay on the floor with their eyes closed while listening to these sound loops (i.e. designed electronic binaural sounds with pure tones between 100 Hz and 200 Hz and beat rates lower than 10 Hz, combined with voices and noises inspired by those produced during traditional Mongolian shamanic rituals). AICT can be induced in various ways, for example by making sounds (e.g. singing, protolanguage) or specific movements (e.g. stereotyped gestures, rapid eye movements). Gradually, participants find their personal inducer (e.g. movement of the hand, vocalization). Participants were then given the opportunity to continue practicing autonomously at home. All subjects provided signed informed consent for participation in the study and no incentive was offered. The study was approved by the Ethics Committee of the Faculty of Medicine of the University of Liège.

Procedure

Prior to the experiment, we collected socio-demographic data (i.e. age, sex, education, nationality, culture of origin). Each participant

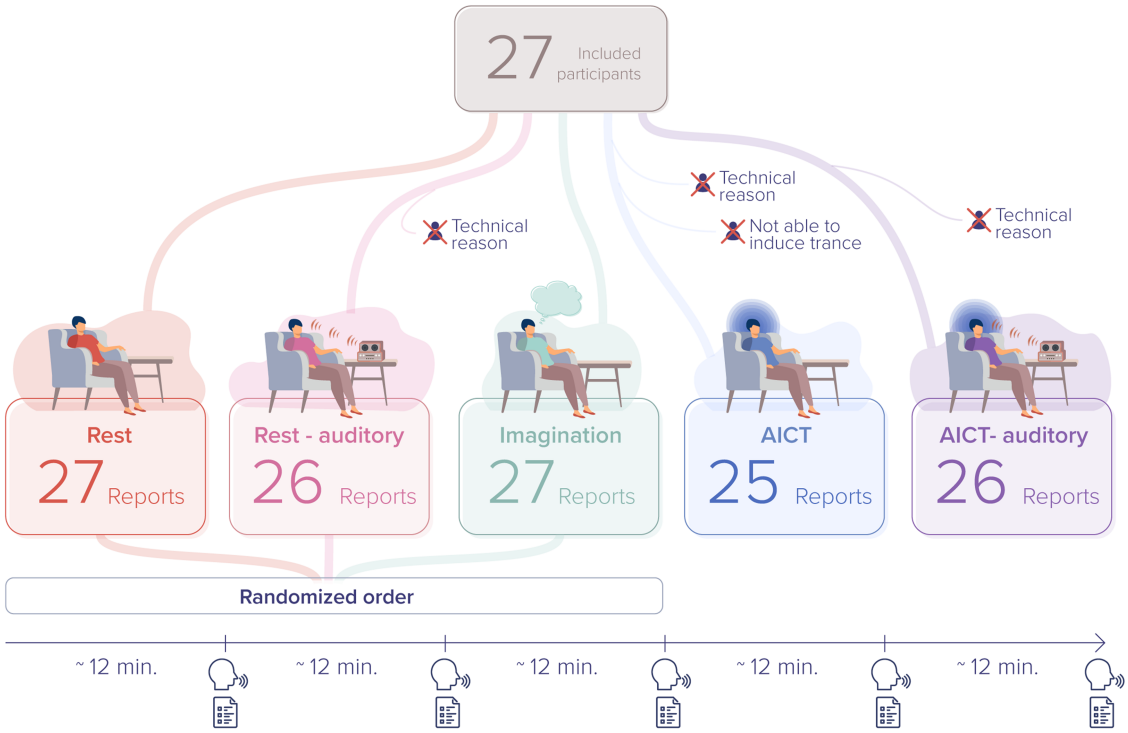

Figure 1 Study protocol. Each participant took part in one session with five conditions: ordinary conscious resting state (rest), ordinary conscious state with auditory stimulations (rest-auditory), imagination of a previous intense trance (without entering an AICT state) (imagination), AICT, and AICT with auditory stimulations (AICT-auditory). The order of the first three conditions was randomized between participants. Each session lasted approximately 12 min, after which a free recall was audio-taped and later transcribed.

underwent one experimental session that consisted of five conditions: ordinary conscious resting state (rest), ordinary conscious state with auditory stimulation (rest-auditory) (Bekinschtein et al. 2009), imagining a previous intense AICT without entering an AICT state (imagination), AICT, and AICT with auditory stimulation (AICT-auditory) (Fig. 1). The order of the first three conditions was randomized between subjects while the last two conditions were always done after the first three conditions (to avoid potential after-effects of AICT), and in the same order (starting with the AICT without external stimulation as done in their daily life). Participants were instructed to keep their eyes closed for each condition, and to think of nothing in particular (rest and rest-auditory conditions) or to imagine a previous intense AICT (imagination) on the non-AICT runs, and to induce and stay in AICT on both AICT runs (AICT and AICT-auditory conditions). The auditory conditions were added since the data reported here are part of a larger project in which neurophysiology data and additional questionnaires were collected, which will be reported elsewhere. The auditory stimulation used in the second and fifth condition was taken from the local-global paradigm (Bekinschtein et al. 2009, King et al. 2013, El Karoui et al. 2015) and consisted of a series of four sounds that were identical (either low- or high-pitched tones) and the fifth sound was either identical or different. This auditory paradigm allows researchers to assess EEG responses to violations of temporal regularities that are either local in time or global across several seconds. The imagination condition was added to determine whether the AICT is a specific state or could be assimilated to a mental imagery task. AICT was induced according to the participants' preference and habits, using body movements and/or vocalizations for the time they needed to reach the AICT state, after which they remained immobile and in AICT. Each session lasted around 12 min. The experimenters knew when participants achieved the AICT since they had asked the participants to remain still once they reach the trance state. After each session, participants completed a self-report to assess whether they achieved a trance state and rate the intensity of their experience on a Likert scale ranging from 0 (no trance) to 10 (most intense trance ever experienced). Participants then provided free recall of their subjective experience (the instruction was 'Please describe in detail your experience. Describe the sequence of events, as well as the thoughts, feelings, or sensations you experienced', and 'any additional comment'). These detailed narrative reports were audio-recorded and later transcribed. The recordings were made by the experimenters as soon as each session (rest, AICT, etc.) ended, typically after 12 min. The free recall was recorded with a smartphone. The participants were alone in the room with the experimenters. Because some participants were assessed on the same day and some participants knew each other, we specifically requested that they did not share their experience until all the participants had been seen.

Data analysis

First, we compared the length of the subjects' reports in the five conditions (i.e. rest, rest-auditory, imagination, AICT, and AICT-auditory). This was calculated using the total word count (i.e. count of all words the subject produced to report their experience). Because the number of words used to report the same experience is likely to vary according to the verbal tendencies of the participants, we normalized the total word count of each subject to their longest report. Normality of the distribution, central tendencies (mean and median), and dispersion (standard deviations) of these variables were examined with the Shapiro–Wilk statistical test.

We then performed an analysis of variance (ANOVA) to compare the length of the reports between each condition. The significance level after Bonferroni correction was considered at 0.005.

Second, for the textual analysis, the text corpora was pre-processed in two steps. The first step was manual division of the narrative into textual segments, i.e. blocks of text that form a consistent semantic unit or a distinct idea. This may be a sentence, a paragraph or a set of paragraphs that are linked by a common theme or idea. The second step consisted in removing any discourse that was not relevant to the subject (e.g. questions or comments from the experimenters). The semantic repetitions were preserved because they may highlight the specific weight of a word for the subject (e.g. 'I saw skeletons. And these skeletons were numerous. The skeletons were approaching me'). Natural language processing was applied to investigate the semantic evidence in all the transcribed reports using the IRaMuTeQ software ('R interface for Multidimensional Analyses of Texts and Questionnaires'), which is based on the classification method (descending hierarchical classification) of Reinert (Reinert 1986). This automated method of discourse analysis assumes that the semantic structures of a discourse are related to the distribution of the words in the text. The software analyses the distribution of the vocabulary in the classes, and connections are made between contexts that have common words. The software identifies the most frequently used and most frequently associated words in a text which then constitute speech classes, by syntactic categorization and calculation of the word occurrence frequency. The speech classes are in the form of a list of words with *P* values derived from χ^2 tests. The *P* values indicate the frequency with which words occurred in a speech class.

Finally, content analysis was carried out based on the participants' verbatim reports, using IRaMuTeQ software. The content analysis method employed here is based on the description of the content of the narratives. This description consists of listing and ordering the facts or words and sentences of the text corpus to observe what is being said (i.e. thematic description; e.g. words/sentences related to body perception). It is structured by the categorization, i.e. the identification of themes characterizing the narrative. This content analysis was performed by two experimenters (A.B., M-C.C.) independently, any points of disagreement were resolved through discussion. A Cochran's test was applied to examine the presence of significant differences in the number of participants reporting features in different conditions for each category extracted with the content analysis. We then applied the McNemar test to examine in detail the significant differences in categories. Significance level was considered at 0.05.

All analyses were performed on text in the original language (French) and results were translated to English when required for this publication.

Results

Participants

Twenty-seven participants trained in AICT were enrolled in the study. Demographic data are detailed in Table 1. All but one participant reported achieving AICT in the AICT condition [intensity of trance during AICT condition (mean ± standard deviation) 8 ± 1.4, during AICT-auditory condition 6.7 ± 2.5] and none reported AICT in any other condition. Out of 135 reports, 4 were excluded from the analysis (because of missing audio recordings: 1 rest, 1 AICT, 1 AICT-auditory; because trance state was not achieved: 1 AICT; see Fig. 1).

Table 1. Demographic data of the 27 participants practising AICT

Age (years)	
Mean ± SD	45 ± 13
Sex, *n* (%)	
Female	23 (85)
Male	4 (15)
Education, *n* (%)	
PhD	5 (19)
Master's degree	15 (56)
Bachelor's degree	6 (22)
High school	1 (3)
Nationality, *n* (%)	
French	15 (56)
Belgian	12 (44)
Western European culture, *n* (%)	27 (100)
AICT practice before the experiment (months)	
Mean ± SD	28 ± 39

Word count

The mean normalized total word count was 0.27 ± 0.19 (median 0.25) for the rest, 0.34 ± 0.25 (median 0.26) for the rest-auditory, 0.55 ± 0.34 (median 0.53) for the imagination, 0.79 ± 0.29 (median 0.93) for the AICT, and 0.67 ± 0.29 (median 0.68) for the AICT-auditory conditions. The ANOVA revealed significant differences between conditions ($P < .001$, $F = 15.22$). Post hoc multiple comparisons showed higher word counts for AICT compared to rest, rest-auditory, and imagination (but not AICT-auditory). AICT-auditory also had higher words count compared to rest and rest-auditory (but not imagination). Finally, the word count for imagination was higher compared to the rest condition (see Fig. 2 and Table 2).

Textual analysis

For the textual analysis, there were a total of 1031 textual segments (all conditions mixed), with an average of 36.77 words per segment. We extracted 898 segments out of 1031 (87.1%). The 133 segments removed included non-relevant textual segments such as question rephrasing. The natural language processing program (i.e. the global analysis on the 898 segments) identified four distinctive classes of discourse. We chose the following labels to name these classes of discourse: AICT memory (Class 1), AICT (Class 2), ordinary conscious states (Class 3), and AICT with and without stimulation (Class 4) (Fig. 3). AICT memory (Class 1) accounted for 31.51% (283/898 text segments), AICT (Class 2) accounted for 37.86% (340/898), ordinary conscious states (Class 3) accounted for 15.81% (142/898) and AICT with and without stimulation (Class 4) accounted for 14.81% (133/898) of the analysed text segments. Words extracted for each class are illustrated in Fig. 3. See Supplementary Table S1 in Supplementary files for words extracted in French and their English translation.

Content analysis

Because of missing data previously reported (Fig. 1), content analysis was conducted on 27 reports for the rest condition, 26 for rest-auditory, 27 for imagination, 25 for AICT, and 26 for the AICT-auditory condition.

Content analysis revealed the following nine most frequently reported categories (Supplementary Table S2 in Supplementary file): 1-Nature: presence of features relating to nature; 2-People: presence of one or several individuals (known or unknown by the participants); 3-Animal: presence of one or several animals; 4-Positive experience: experience perceived as positive, with positive feelings and sensations; 5-Negative experience: experience

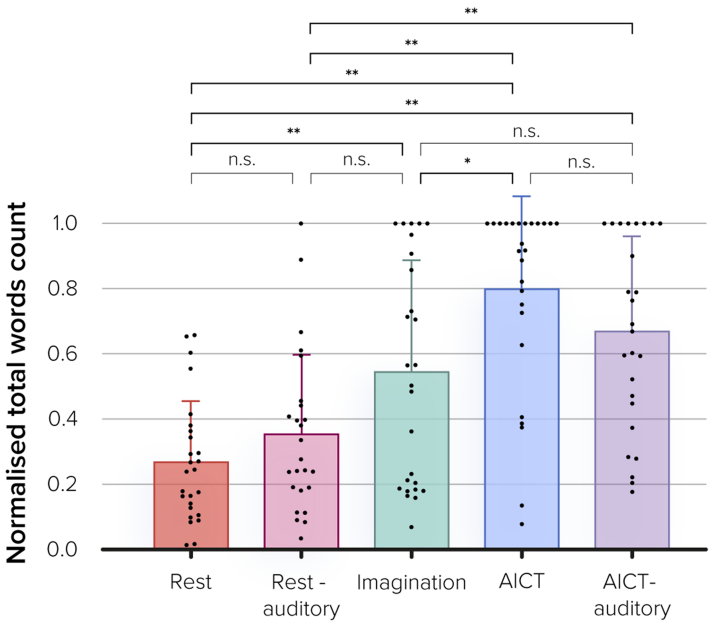

Figure 2 Normalized total word count for each condition (rest, rest-auditory, imagination, AICT, and AICT-auditory). The mean average length of the subjects' reports in the five conditions was computed using the count of all the words the subjects produced to report their experiences (i.e. total word count), normalized to the subjects' longest reports. Modified significance level after Bonferroni correction at 0.005. n.s.: no significant. *$P < .005$, **$P < .0001$

perceived as negative, with negative feelings and sensations; 6-Perceptions: sensory perceptions coming from the external real or imagined environment (e.g. colours, airstream, movements of the surrounding); 7-Body: perceptions directly related to modifications in the body or to movements executed or imagined; 8-Metacognition: the narrative content was characterized by description of thoughts and the content of thoughts; 9-Ineffability: difficulty in describing thoughts.

During the rest condition, only one participant reported the presence of nature-related features, two reported the presence of people, and none the presence of an animal. Thirteen participants reported a positive experience during the rest condition, and five participants reported a negative experience (other participants did not mention any valence). Nine reported perception, and seven reported body perception. Twenty participants reported metacognitive features while none reported ineffable feelings. More precisely, the description of the flow of thoughts (i.e. metacognition category) was not associated with a particular feeling, but remained around an imprecise theme (e.g. 'I thought about everything and nothing', 'without any thread', 'it went in all directions'). Moreover, this content was mainly centred on daily life (e.g. 'I thought about what I was going to eat in the evening', 'I thought about what had happened the days before, my vacations, what is going to happen tomorrow').

During the rest-auditory condition, four participants reported the presence of nature-related features, nine reported the presence of people, and four the presence of an animal. Six participants reported a positive experience and 13 participants reported a negative experience (experience mostly linked to the auditory stimulation—e.g. stimulations were perceived as 'unpleasant', 'boring', 'disturbing', 'annoying'). The 'perception' category was found in 21 participants with the report of auditory perception like hammering and 'body perceptions' related to the sound (e.g. 'I was in the centre of my head', 'intense heart beating', 'fractured brain', 'echoes in my brain'). Sixteen participants also reported body perception. Description of thoughts about imprecise themes (i.e. metacognition) was observed in 15 participants (e.g. 'things that come up', 'memories of my evening last night', 'ideas about work', 'I don't really know what to do, what to think about', 'I was thinking about thinking', 'I wondered if this would last long'). None reported ineffable feelings.

During the imagination condition, nature category was present in one participant's report, while seven reported the presence of an animal (e.g. frog, monkey, wolf, dog) and nine reported the presence of a person (e.g. known people that were not in the experimental room). In this condition, the experience was fairly characterized as neutral by the participants (positive experience $n = 9$, negative experience $n = 7$). Nine participants reported perceptions while 10 reported body perceptions. The most observed theme in their narratives was related to the description of thoughts (i.e. metacognition, $n = 18$). Participants reported that they were in control of their thought content (e.g. 'I said to myself: I must try to remember', 'I was trying go into a trance too much'), focused on

Table 2. Post hoc multiple comparisons of the word count differences between conditions

Contrast	Difference between means	*P* value
AICT vs. Rest	0.53	<.0001*
AICT vs. Rest-auditory	0.45	<.0001*
AICT vs. Imagination	0.25	.004*
AICT vs. AICT-auditory	0.13	.107
AICT-auditory vs. Rest	0.40	<.0001*
AICT-auditory vs. Rest-auditory	0.33	<.0001*
AICT-auditory vs. Imagination	0.12	.161
Imagination vs. Rest	0.28	<.0001*
Imagination vs. Rest-auditory	0.20	.015*
Rest-auditory vs. Rest	0.07	.244

Bonferroni corrected alpha at 0.005.
*Denotes significant *P* values.

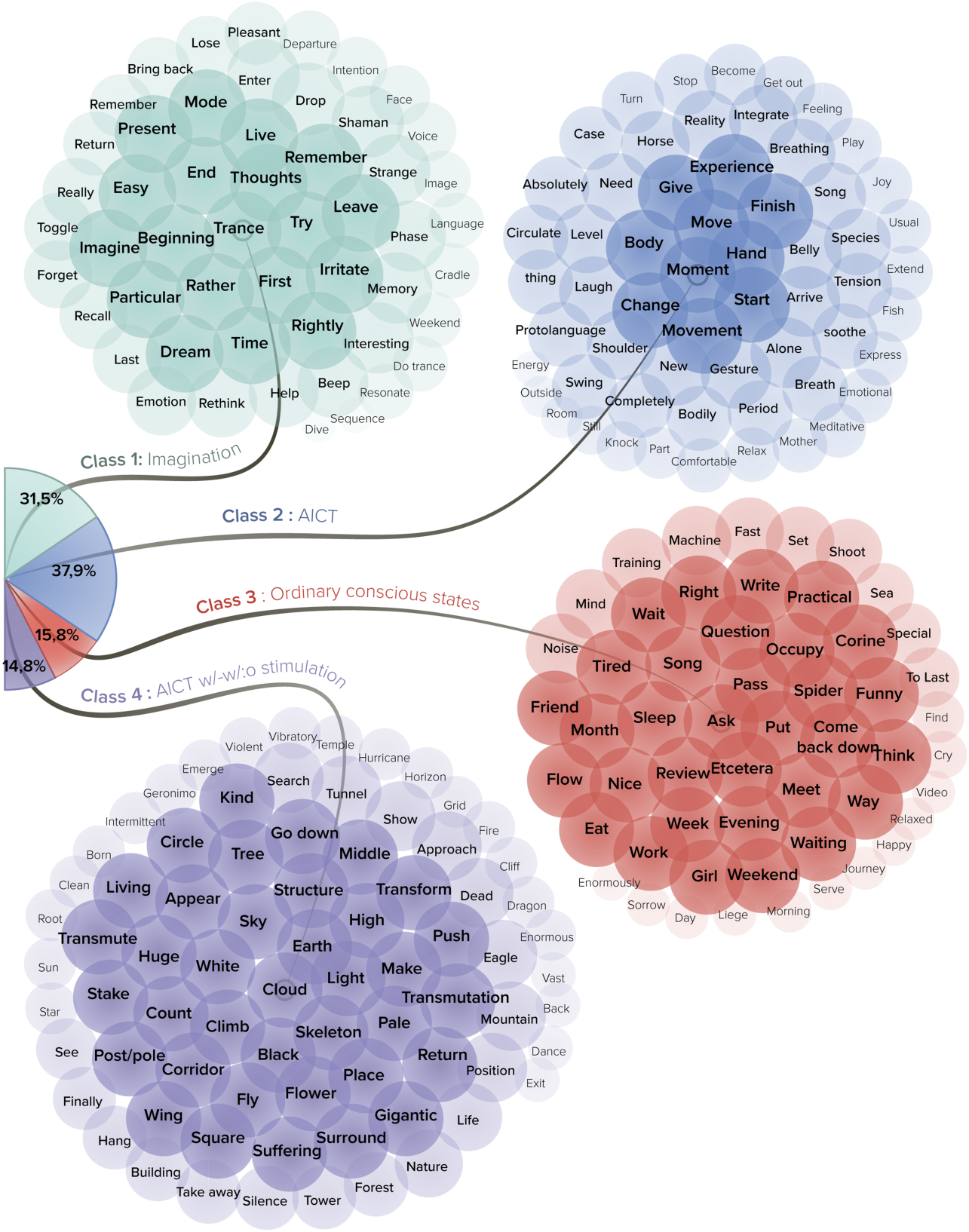

Figure 3 Classes of discourse and word cloud representation. The semantic evidence of all the transcribed reports was categorized into four classes of speech. The circle size, shape, and colour were weighted by *P* value associated with the χ^2 tests from <0.0001 for innermost darker circles to 0.04 for outermost lighter circles. *P* value details can be read in the supplementary file.W/: with, W/o: without

the recollection of previous trances (e.g. 'At the beginning I was quite concentrated on the memories', 'to recall trances that I had done'), and to inhibit AICT state (e.g. 'I was holding myself back'; 'I really had to make an effort because I thought I understood that I

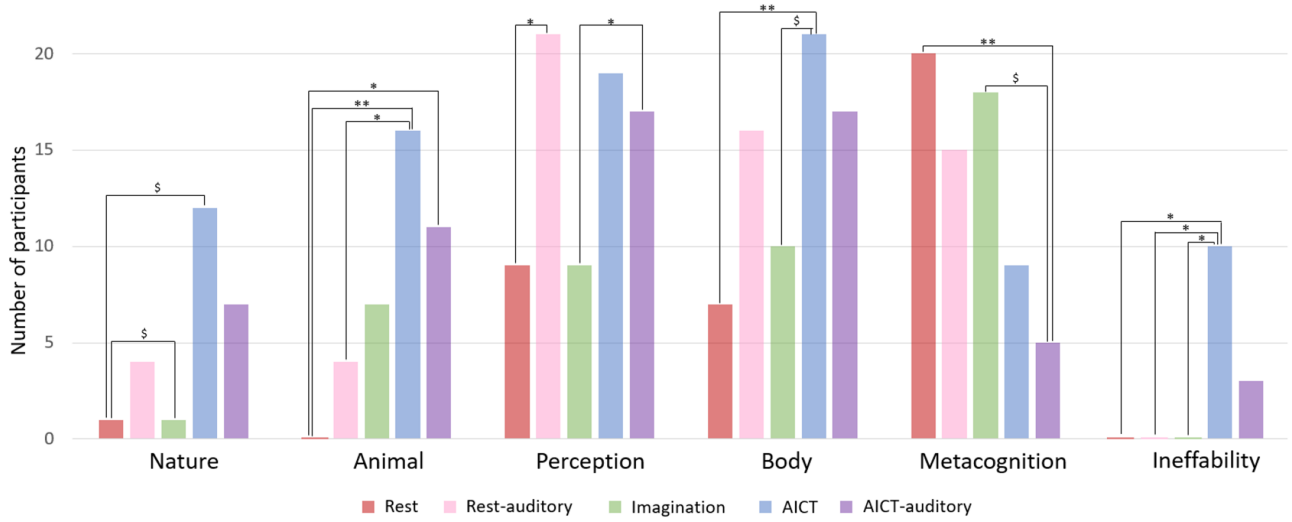

Figure 4 Post-hoc analysis of the content analysis revealed significant differences between conditions in six categories. **P < .01, *P < .05, $P = .05

should not go into a trance', 'Thinking about trances while telling myself: I should not go into a trance'). No difficulty in describing thoughts (i.e. ineffability) was reported.

During the AICT condition, 12 participants reported the presence of features from nature (e.g. 'a block of crystal', 'the amazon rainforest I think'), 13 of one or several people (e.g. 'circle of Native American men', 'both my parents'), and 16 the presence of animals (e.g. 'a bird, an eagle', 'a black creeping beast'). The AICT condition was considered to be a positive experience by 17 participants, while the narrative content of 7 participants were related to a negative experience (e.g. 'fear of dying, suffering and fear'). Content was also characterized by bodily sensations in 21 participants (e.g. 'shivers in my hands and my arms were moving') and perceptions in 19 participants (e.g. 'images, with a kind of spiral'). Metacognitive features were observed in 9 participants, 10 reported that the description of their experience was difficult to translate into words.

During the AICT-auditory condition, 7 participants reported the presence of features from nature, 8 the presence of one person, and 11 of one animal. Fifteen participants reported a negative experience related to the auditory stimulation (e.g. 'unpleasant, the beep was annoying', 'intrusive sound', 'the sound was annoying'), while 8 reported positive experiences. The 'perception' category was the most reported in the narratives during this condition ($n = 17$), with perceptions mostly focused on the auditory stimulation ('sound', 'noise', 'music', 'sound walk', 'songs'). Body sensations were also often present ($n = 17$) with reports of intense bodily sensations related to movement (e.g. 'I was flying', 'dancing', 'going up and down') and transformation (e.g. 'inside my body there was a kind of expansion', 'my head was becoming waves', 'my body was transmuting'). Five participants reported metacognitive elements and three participants reported that the description of their experience was difficult to translate into words (i.e. ineffability).

Statistical analysis revealed significant differences between conditions in the number of participants referring to particular categories: nature, animal, perception, body, metacognition, and ineffability. Detailed results are summarized in the Fig. 4 and Supplementary Table 3 in the Supplementary file.

Discussion

The aim of this prospective study was to investigate phenomenological reports of AICT, based on verbal narratives, and to compare them across different states of consciousness (i.e. rest/ordinary consciousness with and without auditory stimulation, imagination/memory of an AICT, and AICT conditions with and without auditory stimulation). First, significant differences were found in the total word counts across conditions, with longer lengths of reports for AICT and AICT-auditory conditions, compared to the three conditions in ordinary consciousness. These results highlight the particular richness of the individual's subjective experience during AICT. Second, textual analysis showed that the four classes (i.e. 1-AICT memory, 2-AICT experience, 3-ordinary conscious states, 4-AICT w/-w/o stimulation) were related to specific narratives, meaning that they were strictly related to specific narratives. More precisely, each class gathers narratives that are internally coherent and their content is distinct from each of the other classes. AICT speech was specific enough, not only to constitute a class of speech on its own (class 2) but also when it was combined with auditory stimulation (class 4; automatic combination done by the software like class 3). In other words, the software identified that AICT was a class of discourse that was clearly different from the other conditions (i.e. rest and imagination, both related to an ordinary conscious state). Similarly, the imagination condition also constitutes a class of discourse in its own (i.e. AICT memory class), even if they remember a previously experienced trance (i.e. AICT). The differences between the discourse classes thus suggest that there is a clear difference in participants' experience (imagination vs. AICT). The textual analysis used in this study highlights how words and expressions employed by participants were organized and interconnected within the corpus of each narrative and showed that this organization was different when participants were in an ordinary state of consciousness compared to trance states. Finally, the content analysis revealed that the AICT conditions were particularly rich regarding the participants' narrative reports, as revealed with the nine categories highlighted. Indeed, the presence of animals, and body perception, combined to less thoughts related to metacognition and higher difficulty to describe thoughts are specific to AICT condition.

We should also notice the non-significant tendency of nature features' presence in AICT narrative. This can be linked to previous studies reporting particular subjective phenomenology of shamanic trance, such as visualizations of animal and/or person during the trance experience, kinaesthetic perception, modified somatosensory perceptions, and an altered sense of self (Flor-Henry et al. 2017, Mainieri et al. 2017, Gosseries et al. 2020, Huels et al. 2021).

Interestingly, our result on the phenomenology of AICT shares some common characteristics with other MSCs. For example, the phenomenology of hypnosis is also characterized by alterations in body sensations, a modified sense of reality and mental imagery (Cardeña 2005, Varga et al. 2017). However, we can also notice some differences, like the presence of intense darkness or brightness perception and a loss of spontaneous mental activity reported during hypnosis, which was not observed in our dataset (Tart 1970). Some common features can be observed between AICT and narrative reports of near-death experiences (NDEs) [i.e. body perceptions, presence of persons, negative emotion, extrasensory perception (Martial et al. 2020)] and experienced as a pleasant in the majority of the cases (van Lommel et al. 2001). These two MSCs also seem quite different in their phenomenology. NDEs are mostly characterized by features such as the presence of light, a tunnel, love, remembering, among others (van Lommel et al. 2001). These elements are not reported in our sample of participants. Another recent study showed that NDEs and AICT shared features that are not reported in our study, such as modification of time perception and a sense of harmony or unicity (Martial et al. 2020). This can be explained by methodology differences between the two studies. In the first study, we used questionnaires to assess characteristics of the memory of one past intense AICT experience. In the present study, however, we focused on free reports (rather than questionnaires) collected directly after the experience (i.e. no time delay between the experience of AICT, for example, and the recording). We note that this sense of unity was also reported by highly hypnotizable individuals (Tart 1970). Individuals experiencing a MSC with psychotropic use also reported a particular phenomenological experience characterized by specific narrative content (e.g. entity/animal appearance, exploring other environments) (Michael et al. 2021). Other self-induced MSC are characterized by subjective reports clearly different from control conditions (e.g. hypnosis vs. non-hypnotic state), particularly with alterations in perception, meaning and imagery (Cardeña 2005), or even different phenomenology among the same practice (i.e. meditation) depending on the intention of the person (Louchakova-Schwartz 2013).

This study has some limitations. The limited sample of the participants and the fact that we only investigated one type of trance (AICT) does not allow for generalization of the results. In addition, we should specify that participants were recruited by the leader of an AICT training programme (C.S.) based on her own judgement of expertise. Future studies could propose specific criteria of AICT expertise, such as, for example, a minimum duration of practice and minimum practice frequency during the last 6 months. As described in the 'Methods' section, all participants were interested in AICT and have read about AICT through C.S.'s books and testimonies relating her story about Mongolian shamanic experience. Our participants could thus be influenced by the indirect suggestions received throughout these readings (e.g. feeling of being possessed by an animal, meeting with unknown people). In addition, during the training workshop, participants were exposed to both the sound loops and vocalizations of AICT instructors, usually mimicking animal noises or sounds and singing unknown melodies or talking an unknown language during their own AICT. One can argue that this constitutes suggestion and learning that could influence the frequency of nature or animal content reported by the participants included in this study. Supporting this hypothesis, a recent study has compared two types of trance practices developed by leader trained in shamanic communities (Grégoire et al. 2024). The first, AICT, is described in this article. The induction of the second practice, named the Mahorikatan trance (MT), is based on slow dance movements. In this study, while several similarities were observed between these two practices (e.g. expression of emotions, modification of perceptions, a feeling of unity), only AICT participants reported the production of sounds, songs, screams, and unknown language, which were not observed in the practice of MT participants. These last results can be suggested to be related to the difference in the induction technique between these two trances and to the suggestions and explanations provided by each team leader. Thanks to the present study, it is nevertheless the first time that narrative report analysis has been used to highlight that AICT is a state different from an ordinary state of consciousness by itself, and that it is clearly different from imagination (even though the imagination condition was about a past intense trance). Another limitation is the fact that the present participants were all Western, majority female and with a relatively high education level (i.e. also qualified as W.E.I.R.D.), with different durations of AICT practice, thereby limiting our ability to extrapolate the present results.

Future studies should further investigate the different thematic or main features of AICT by proposing a design that allows for better characterization. For example, the type of person and or animal present in the narrative during this kind of trance state. Also to try to elaborate a description of the relationships between each feature observed in these narratives. In addition, studies should also measure the neural correlates of this peculiar state. The combination of neurophysiological measures with phenomenological recordings could be informative regarding the difference between AICT, as a specific state of consciousness, and ordinary states of consciousness (e.g. imagination or resting state). Future studies should also correlate the content of AICT narratives with apriori and beliefs regarding AICT, as well as the presence of a spiritual practice and/or beliefs before AICT learning, and the socio-cultural context of practitioners.

In conclusion, our study is a pioneer in the phenomenological characterization of this trance state practice, developed by a leader trained in a Mongolian shamanic community. The findings suggest that AICT generates a change in the subjective experience with richer phenomenology, and that it constitutes a class of discourse on its own, with specific categories and a clear dissociation from other states of consciousness. Specifically, we showed that the content of AICT narratives is characterized by the presence of nature, animals, body modifications, as well as the difficulty to describe thoughts.

Acknowledgements

We thank the participants for their participation in the study, as well as TranceScience Research Institute, Francis Taulelle, François Feron, Audrey Breton, Solène Fauvet, Sélima Chibout, Clément Delcamp, and Audrey Wolff. We also thank Adeline Deward (www.illuminesciences.be) for her help with the figures creation. The study was supported by the University and University Hospital of Liège and its Algology Interdisciplinary Center, the Belgian National Funds for Scientific Research (FRS-FNRS – Télévie), the BIAL Foundation, the MIS FNRS (F.4521.23), the European Union's Horizon 2020 Framework Programme for Research

and Innovation under the Specific Grant Agreement No. 945539 (Human Brain Project SGA3), the Mind Science Foundation, the European Commission, the fund Generet, the King Baudouin Foundation, AstraZeneca foundation, the Leon Fredericq foundation, Belgium Foundation Against Cancer (Grants Number: C/2020/1357), and the Benoit Foundation. O.G. is research associates at FRS-FNRS.

Author contributions

A.V. and O.G. planned and designed the study; C.S. recruited the participants, A.V., O.G., C.M., and J.A. acquired the data; A.Bic., L.S., and F.R. transcribed the audio recordings; M.C.C., A.Bio., A.V., and O.G. analysed the data; A.V., M.C.C., A.Bio., O.G. interpreted the results. A.V., O.G., and A.Bio. wrote the manuscript. All authors contributed to the editing of the manuscript.

Supplementary data

Supplementary data is available at *Neuroscience of Consciousness* online.

Conflict of interest

C.S. is the founder of the TranceScience Research Institute of Paris.

Funding

None declared.

Data availability

The data used in this experiment are available upon reasonable request to the corresponding author with appropriate procedures.

References

Anastasia J, Wahbeh H, Delorme A *et al*. A qualitative exploratory analysis of channeled content. *Explore NY* 2020;**16**:231–6.

Bekinschtein TA, Dehaene S, Rohaut B *et al*. Neural signature of the conscious processing of auditory regularities. *Proc Natl Acad Sci USA* 2009;**106**:1672–7.

Cardeña E. The phenomenology of deep hypnosis: quiescent and physically active. *Int J Clin Exp Hypn* 2005;**53**:37–59.

Cardeña E. Altered consciousness in emotion and psychopathology. In: Cardeña E and Winkelman M (eds), *Altering Consciousness: Multidisciplinary Perspectives: History, Culture, and the Humanities; Biological and Psychological Perspective*. Santa Barbara: Praeger, 2011, 279–99.

Cardeña E, Schaffler Y, van Duijl M. The other in the self. In: Dorahy MJ, Gold SN and O'Neil JA (eds), *Dissociation and the Dissociative Disorders: Past, Present, Future*, 2nd edn. New York: Routledge, 2022, 421–32.

Castillo M-C. Content analysis in clinical psychology. In: *Les Méthodes Qualitatives En Psychologie Clinique Et Psychopathologie, Dunod*. Malakoff: Univers Psy, 2021.

Charjan DS, Pund MA. Pattern discovery for text mining procedure using taxonomy. *Int J Eng Ext Technol Res IJEETR* 2013;**4**:4550–5.

Csikszentmihalyi M. *Flow: The Psychology of Optimal Experience*. New York: Harper Perennial, 1990.

El Karoui I, King J-R, Sitt J *et al*. Event-related potential, time-frequency, and functional connectivity facets of local and global auditory novelty processing: an intracranial study in humans. *Cereb Cortex* 2015;**25**:4203–12.

Flor-Henry P, Shapiro Y, Sombrun C. Brain changes during a shamanic trance: altered modes of consciousness, hemispheric laterality, and systemic psychobiology. *Cogent Psychol* 2017;**4**:1313522.

Ghiglione R, Blanchet A. *Content Analysis and Contents of Analysis*. Malakoff: Dunod, 1991.

Gosseries O, Fecchio M, Wolff A *et al*. Behavioural and brain responses in cognitive trance: A TMS-EEG case study. *Clin Neurophysiol* 2020;**131**:586–8.

Gosseries O, Marie N, Lafon Y *et al*. Exploration of trance states: phenomenology, brain correlates, and clinical applications. *Curr Opin Behav Sci* 2024;**58**:101400.

Grégoire C, Sombrun C, Lenaif P *et al*. Phenomenological characteristics of auto-induced cognitive trance and Mahorikatan® trance. *Neurosci Conscious* 2024;**2024**:niae024.

Harner M. *The Way of the Shaman*. New York: Harper Collins, 1990.

Huels ER, Kim H, Lee U *et al*. Neural correlates of the shamanic state of consciousness. *Front Hum Neurosci* 2021;**15**:610466.

Kawai N, Honda M, Nishina E *et al*. Electroencephalogram characteristics during possession trances in healthy individuals. *Neuroreport* 2017;**28**:949–55.

King JR, Faugeras F, Gramfort A *et al*. Single-trial decoding of auditory novelty responses facilitates the detection of residual consciousness. *Neuroimage* 2013;**83**:726–38.

Kumar GP, Panda R, Sharma K *et al*. Changes in high-order interaction measures of synergy and redundancy during non-ordinary states of consciousness induced by meditation, hypnosis, and auto-induced cognitive trance. *Neuroimage* 2024;**293**:120623.

Laing RD. *The Divided Self: an existential study in sanity and madness*. London: Penguin, 1967.

Leech NL, Onwuegbuzie AJ. An array of qualitative data analysis tools: a call for data analysis triangulation. *School Psychol Quat* 2007;**22**:557–84.

Louchakova-Schwartz O. Cognitive phenomenology in the study of Tibetan meditation: phenomenological descriptions versus meditation styles. In: Gordon S (ed.), *Neurophenomenology and Its Applications to Psychology*. New York: Springer, 2013, 61–87.

Mainieri AG, Peres JFP, Moreira-Almeida A *et al*. Neural correlates of psychotic-like experiences during spiritual-trance state. *Psychiatry Res Neuroimaging* 2017;**266**:101–7.

Martial C, Simon J, Puttaert N *et al*. The Near-Death Experience Content (NDE-C) scale: development and psychometric validation. *Conscious Cogn* 2020;**86**:103049.

Michael P, Luke D, Robinson O. An encounter with the other: a thematic and content analysis of DMT experiences from a naturalistic field study. *Front Psychol* 2021;**12**:720717.

Oohashi T, Kawai N, Honda M *et al*. Electroencephalographic measurement of possession trance in the field. *Clin Neurophysiol* 2002;**113**:435–45.

Oswald V, Vanhaudenhuyse A, Annen J *et al*. Autonomic nervous system modulation during self-induced non-ordinary states of consciousness. *Sci Rep* 2023;**13**:15811.

Peres JF, Moreira-Almeida A, Caixeta L *et al*. Neuroimaging during trance state: a contribution to the study of dissociation. *PLoS One* 2012;**7**:e49360.

Reinert M. Un logiciel d'analyse lexicale (ALCESTE). *Cah Anal Donnees* 1986;**11**:471–84.

Rock A. Phenomenological analysis of experimentally induced visual mental imagery associated with shamanic journeying to the lower world. *Int J Transpers Studies* 2006;**25**:45–55.

Santarpia A. Textual analysis softwares. In: Bioy A, Castillo MC and Koenig M (eds.), *Les Méthodes Qualitatives En Psychologie Clinique Et Psychopathologie*. Malakoff: Dunod, 2021, 288.

Santiago-delefosse M, BruChez C, Gavin A *et al*. Critères de qualité des recherches qualitatives en sciences de la santé. À propos d'une analyse comparative de huit grilles de critères de qualité en psychiatrie/psychologie et en médecine. *L'évolution Psychiatrique* 2015;**80**:375–99.

Scelles R. Apports de logiciels d'analyse de données textuelles (ADT) dans les procédures d'analyse de contenu d'entretiens semi-directifs de recherche : alceste et hyperbase. *Bulletin de Méthodologie Sociologique* 1997;**57**:25–48.

Sims A. *Symptoms in the Mind. An Introduction to Descriptive Psychopathology*, 2nd edn. Cambridge: Cambridge University Press, 1995.

Sombrun C. Les esprits de la steppe-Avec les derniers chamanes de Mongolie. 2012.

Tart CT. Transpersonal potentialities of deep hypnosis. *J Transpers Psychol* 1970;**2**:27–40.

van Lommel P, van Wees R, Meyers V *et al*. Near-death experience in survivors of cardiac arrest: a prospective study in the Netherlands. *Lancet* 2001;**358**:2039–45.

Varga K, Kekecs Z, Myhre PS *et al*. A neutral control condition for hypnosis experiments: 'wiki' text. *Int J Clin Exp Hypn* 2017;**65**:429–51.

Wahbeh H, Butzer B. Characteristics of English-speaking trance channelers. *Explore* 2020;**16**:304–9.

Wallis RJ. Queer shamans: autoarchaeology and neo-shamanism. *World Archaeol* 2000;**32**:252–62.

Waterman D, Elton M, Kenemans JL. Methodological issues affecting the collection of dreams. *J Sleep Res* 1993;**2**:8–12.

Neuroscience of Consciousness, 2024, 10(1), niae036 , DOI: https://doi.org/10.1093/nc/niae036, Research Article
Received 27 July 2023; revised 2 October 2024