Narrative Reports of Drug-Induced Ego Dissolution: A Quantitative Analysis

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### DISCLOSURE

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Drug-Induced Ego Dissolution

Early experimental studies:

• **Mescaline**: depersonalization-like, “final stage of egolessness” (Huxley)  
  Beringer 1927; Guttmann and Maclay 1937; Huxley 1954

• **LSD**: “feelings of non-existence”, fear of “impending dissolution”, feelings of disembodiment and feelings of unity with the universe  
  Anderson and Rawnsley 1954; Savage 1955; Bercel et al. 1956; Von Mering et al. 1955; Klee 1963; Sedman and Kenna 1964; Pahnke and Richards 1966

• **Psilocybin**: similar effects  
  Rümmele and Gnrss 1961; Pahnke 1966
Drug-Induced Ego Dissolution

Dittrich’s APZ questionnaire:

• “Visionary Restructuration”

• “Oceanic Boundlessness”: positively felt depersonalization, derealization and feelings of unity (e.g. “It seemed to me that my environment and I were one”)

• “Dread of Ego Dissolution”: distressing experiences of depersonalization, thought disorder, and loss of thought and body control (e.g. “I observed myself as though I were a stranger”)

(Dittrich 1975)
Drug-Induced Ego Dissolution

Higher score than placebo on OB/DED:

• Psilocybin
  Hasler et al. 2004; Griffiths et al. 2006;
  Griffiths et al. 2011; Cummins and Lyke 2013

• DMT/ayahuasca
  Riba, Rodríguez-Fornells, and Barbanoj 2002
  Gouzoulis-Mayfrank et al. 2005; Alonso et al. 2015

• Ketamine

• Salvinorin-A
  González et al. 2006; Maqueda et al. 2015
Drug-Induced Ego Dissolution

Scharfetter’s Ego Pathology Inventory (EPI):
• Ketamine and psilocybin increased global EPI scores
• ↑ individual scores for “Ego Demarcation” (blurring of self/world boundaries)
• ↑ individual scores for “Ego Consistency” (dissolution of the sense of being a single coherent self)

Scharfetter 1981
Vollenweider and Geyer 2001

A Quantitative Analysis of DIED
Possible limitations of questionnaires

• Small sample sizes (n=10–30)
• ED reduced to one or a few items
• Lexicon imposed by scientists
• “I experienced a disintegration of my self or ego” (Muthukumaraswamy et al. 2013)
• “I lost all sense of ego” (Lebedev et al. 2015)
• No formal definition of ED (what is the ‘ego’, the ‘sense of self’?)
Enter Erowid.org

- Created in 1995
- Curated database of narrative ‘trip reports’
- Metadata (dose, weight, age, gender)
- 20,000+ reports with hundreds of substances
- Open data which remains largely unexplored
Narrative reports vs. questionnaires

• Very large sample size (~100x bigger than the average experiment)
• Potentially rich descriptions (vs. short list of items)
• Bottom-up process (no lexical constraint)
• Wider sample diversity?
Data mining and quantitative Analysis

• Data mining: computer-assisted discovery of patterns in large data sets.

• Technology of text mining has significantly improved since the creation of Erowid.org

• Idea: use Natural Language Processing to automatize the discovery of semantic patterns in Erowid reports
Theoretical Problems

- Hard to extract data from natural language descriptions
- Erowid data can be especially noisy
- Ego dissolution is an elusive phenomenon, often deemed ineffable
Pipeline

Select substances

Scrape reports from Erowid.org

Single out reports of ego dissolution

Analyze reports of ego dissolution

Analyze the lexicon of ego dissolution
Pipeline

Select substances → Scrap reports from Erowid.org → Single out reports of ego-dissolution → Analyze reports of ego-dissolution → Analyse the lexicon of ego-dissolution
Pipeline

Select substances

Scrape reports from Erowid.org

Analyze the lexicon of ego dissolution

Single out reports of ego dissolution

Analyze reports of ego dissolution
Pipeline

Select substances

Scrape reports from Erowid.org

Single out reports of ego dissolution

Analyze the lexicon of ego dissolution

Analyze reports of ego dissolution
Pipeline

Select substances

Scraper reports from Erowid.org

Single out reports of ego dissolution

Analyze reports of ego dissolution

Analyze the lexicon of ego dissolution
Pipeline

Select substances → Scrape reports from Erowid.org → Single out reports of ego dissolution → Analyze reports of ego dissolution

- Analyse the lexicon of ego dissolution
- Concordance
- Word clusters
- Word vectors

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Pipeline

1. Select substances
2. Scrape reports from Erowid.org
3. Single out reports of ego dissolution
4. Analyze reports of ego dissolution

Analyse the lexicon of ego dissolution

KWIC
Topic modeling

Concordance
Word clusters
Word vectors
Select substances → Scrape reports from Erowid.org → Single out reports of ego dissolution → Analyze reports of ego dissolution

- Analyse the lexicon of ego dissolution
  - Concordance
  - Word clusters
  - Word vectors

- KWIC
- Topic modeling

- Keyword extraction
- Topic modeling
- Qualitative analysis
Selected substances

- LSD
- psilocybin (mushrooms)
- ayahuasca
- DMT
- 5-MeO-DMT
- ketamine
- salvia divinorum
Scraping the data

- Including drug combinations: 5,577 reports
- Excluding drug combinations: 3,546 reports

Number of reports per substance (excl. drug comb.)

- mushrooms: 1025 reports
- salvia: 1208 reports
- DMT: 218 reports
- 5-MeO-DMT: 224 reports
- ketamine: 148 reports
- LSD: 625 reports
- ayahuasca: 98 reports
I. Lexicon of Ego Dissolution

Select substances ➔ Scrape reports from Erowid.org

Analyse the lexicon of ego dissolution

1. Concordance
2. Word clusters
3. Word vectors
Lexicon of ego dissolution

Concordance: look for specific occurrences in the corpus

- "ego": 1427
- "ego death": 130
- "ego loss": 71
- "ego dissolution": 10

No. of occurrences without combinations: 927
No. of occurrences with combinations: 1427

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Lexicon of ego dissolution

Concordance: look for specific occurrences in the corpus

Occurrences for 100,000 words

- salvia
- mushrooms
- LSD
- ketamine
- DMT
- ayahuasca
- 5-MeO-DMT

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Lexicon of ego dissolution

Word clusters (bigrams):

Word clusters with 'ego'

- ego death: 177
- ego loss: 82
- ego-death: 33
- ego-loss: 30
- ego dissolution: 17

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Lexicon of ego dissolution

Word vectors: machine learning algorithm (word2vec) to transform all words in the corpus into n-dimensional vectors

• Allows us to perform algebra on words (such as vector addition)
• Can preserve complicated semantic patterns, such as analogies
Lexicon of ego dissolution

Word vectors:

Vectors most similar to [ego] + [death]

- Insanity
- Identity
- Rebirth
- Birth
- Fear
- Self
- Consciousness
- Terror
- Enlightenment

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Lexicon of ego dissolution

PCA plots of word vectors most similar to [ego]

- consciousness
- existence
- soul
- imagination
- psyche
- conscience
- awareness
- identity
- self
- rebirth
- sanity
- insanity
- knowledge
- ego
- reality

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Lexicon of ego dissolution

PCA plots of word vectors most similar to [ego]+[death]

- humanity
- dissolution
- rebirth
- enlightenment
- birth
- sanity
- identity
- existence
- consciousness
- self
- knowledge
- loss
- terror
- death
- ego
- fear

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II. Isolating reports of ego dissolution

1. Keywords in context (KWIC)
2. Topic modeling (LDA)
Keywords in context (KWIC)

Process:
1. Take typical descriptions of ego dissolution
2. Try to identify (contextual) semantic patterns
3. Come up with optimal set of keywords associated with context words
4. “Validate” the results with keyword extraction
Keywords in context (KWIC)

- Keywords: “ego”, “self”
- 100 context words (e.g. “dissolve”, “drift”, “gone”, “die”)
- Context horizon: 4 words left/right

“context_word word1 word2 keyword”
“keyword word1 word2 context_word”
“keyword context_word”
Keywords in context (KWIC)

Percentage of reports singled out by KWIC method

- mushrooms: 7.71%
- salvia: 6.46%
- DMT: 7.34%
- 5-MeO-DMT: 10.71%
- ketamine: 5.41%
- LSD: 5.76%
- ayahuasca: 11.22%
Keywords in context (KWIC)

Percentage of all reports describing ego dissolution according to the KWIC method:

• Including drug combinations: 7.7% of reports
• Excluding drug combinations: 7% of reports
Validation with keyword extraction

Keyness = frequency of a word in the text when compared with its frequency in a reference corpus.

A word which is *positively* key occurs *more* often than would be expected by chance in comparison with the reference corpus.

Reference corpus = all reports
Validation with keyword extraction

Top keywords (by keyness)

- ego
- death
- loss
- self
- reality
- experience
- consciousness
- human
- subconscious
- spiritual
- existence
- meditation
- surrender
- universe
Metadata

• Metadata are too noisy in most cases
• Average dose of dried mushrooms for ego dissolution experiences is 3.4g (not significantly higher than global average)
Pitfalls of the KWIC method

• Potential false positives:
  – Meta-discourse about ego dissolution (e.g. “I expected to have an ego dissolution experience, but did not”).
  – Folk theorizing about the ‘self’ or ‘ego’ which is not part of description of the experience.
  – Bag of context words might be too inclusive

• Potential false negatives: risk of leaving out other means of describing ego dissolution
Latent Dirichlet allocation (LDA) = topic modeling algorithm that generates topics based on word frequency from a set of documents.
Topic Modeling with LDA

• In essence, LDA is a technique that facilitates the automatic discovery of themes in a collection of documents.

• While word vectors models word-to-word relationships, LDA models document-to-word relationships.

• Importantly, LDA relies on unsupervised learning.

• However, the number of topics has to be chosen.
Topic Modeling with LDA

Show time: visualization of LDA models of Erowid reports with 20, 100 and 200 topics
III. Analyze reports of ego dissolution

1. Keyword extraction
2. Topic modeling
3. Qualitative analysis
Automatic methods of analysis

Erowid corpus

KWIC method
Reports related to ego dissolution
Topic modeling with LDA

Topic modeling with LDA
Reports related to ego dissolution
Keyword extraction
LDA with KWIC results

• LDA is not very illuminating on such a small data set

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# Keyword extraction for LDA topics

## Topic n°86 (defining words)

1. ego
2. consciousness
3. state
4. death
5. sense
6. fear
7. physical
8. level
9. psychedelic
10. conscious
11. concept
12. longer
13. fully
14. total
15. knowledge
16. identity
17. aware
18. awareness
19. loss
Keyword extraction for LDA topics

Keywords for topic documents

- consciousness
- ego
- death
- physical
- reality
- conscious
- awareness
- phase
- knowledge
- being

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Keyword extraction for LDA topics

Topic n°15 (defining words)

1. universe 11. word
2. existence 12. form
3. infinite 13. god
4. space 14. earth
5. exist 15. consciousness
6. human 16. Infinity
7. moment 17. entire
8. part 18. idea
9. world 19. matter
10. eternity

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Keyword extraction for LDA topics

Keywords for topic documents

- universe
- existence
- infinite
- exist
- eternity
- consciousness
- space
- infinity
- reality
- planet
- bang
- eternal

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Qualitative analysis: loss of self-awareness

[21 years old, ~15g of psilocybe sclerotia]

“It felt as if ‘I’ did no longer exist. There was purely my sensory perception of my environment, but sensory input was not translated into needs, feelings, or acting by ‘me’. Also, I felt disconnected from my physical being, my body.”
Qualitative analysis: loss of self-awareness

[18 years old, DMT]

“Experienced a completely alternate reality from the usual one. No recollection nor awareness of the ‘usual’ reality while in this state. Complete lack of self-awareness. Forgetting that I was a male, a human, a being on Earth – all gone, just infinite sensations and visions.”

“[I experienced a] total loss of consciousness (not in the medical sense, ‘knocked unconscious’, but in the ‘sense of being/self/awareness’).”

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Qualitative analysis: loss of self-awareness

[21 years old, 200µg of LSD]

[While listening to music through headphones] “It felt as if I was sinking deeper and deeper, the ‘space’ occupied by my mind shrank until nothing, at which point I was no longer really conscious and just had pure experience of the music.”

“I think it is mostly a loss of awareness and thought until nothing is left but pure experience.”

“I think I was not self-aware for long stretches, but occasionally returned to awareness and became aware of the experience just transpired.”

“I think it is very comparable to the semi-lucid dreamlike state often achieved before drifting to sleep, but nothing like the full dream state in which you are self aware.”
Qualitative analysis: loss of self-awareness

[21 years old, ~100μg of LSD]

“‘I’ don’t exist, but my consciousness does. It’s as if it is just kind of shooting around space rather chaotically. I remain aware of things, but not of my body or anything physically around me. I am always aware that I'm undergoing this alteration up until the peak. At the peak you just stop caring and forget about pretty much everything it was to be human.”
Qualitative analysis: loss of self-awareness

[DMT, unknown dose]

“It felt as if my mind’s frame rate slowed down, then stopped... total ‘whiteout’ and/or no memory for several hours.”

“The ‘me’ that processes awareness stopped existing. I considered it a stripping away of my typical experiential filters at the time.”

“I would say it was like the ‘awareness without judgement’ state [of dreams], but so powerful it was even erasing the sense of self totally.”
Qualitative analysis: loss of self-awareness

[21 years old, ~300µg LSD]

“The visuals were getting ridiculous, and... there was no difference in vision whether [my] eyes were closed or not. This was however just the build-up for the ego-death: after hopelessly fighting the drugs for maybe 10 minutes, the body suddenly just gave up and collapsed. Reality was suddenly or slowly... getting reduced to a simple cube slowly rotating and levitating within another stationary cube. The rotating cube was being observed from one corner on the inside of the stationary cube. There was... no sounds from the ‘outside world’ (which at this point did not exist), just a constant high-pitched tone. No memories either. ‘I’ (if I could call the observer here ‘I’ or not, I don’t know) simply was, as pure consciousness, and the cube-within-cube was pure reality. The only two things which existed. (There was no thought either, just consciousness). This state, which I would call ego-death, lasted for maybe somewhere between 5 minutes and 2 hours... After what like could have been one hour... I was still in the cube-reality, but there was slowly emerging an ‘I’ that was in that reality. I was slowly able to form simple thoughts, and retrieve simple memories. Examples of simple memories retrieved at first: —I may have taken LSD and too much hash... —There may or may not be trees around me.”
Qualitative analysis: feeling of dying

[21 years old, ~4.5g of psilocybe cubensis]

“I was on my knees, bowed forward staring down the shower drain in a posture similar to the child’s pose in yoga. As I watched the water circling down the drain, I felt that my consciousness was draining with it. It felt as if all colour, then all form, then all meaning was leeching out of my experience. It felt something like a candle or match dwindling out. I was absolutely convinced that this is what it felt like to die.”
Qualitative analysis: loss of self/world boundary

[22 years old, 30g of psilocybe sclerotia]:

“At this point, after what I can only describe as a rush, I felt myself mould into the world around me (not myself but my mind or soul, not a part of my body). I felt that, on reflection, I was simply everything and everything was everything, which is hard to describe.”
Qualitative analysis: loss of self/world boundary

[1–2 tabs of LSD, <200µg]

“Have you seen how when you add milk to your coffee it starts to blend slowly until everything becomes the same colour? That's what it felt like. My mind started to blend with everything. I wanted to talk to my girlfriend and let her know what I was going through, but every time I felt like talking to her I always came to the same conclusion that it would be pointless to do so because somehow we were connected and if I wanted to talk to her I had to look for her within me, not on the phone. I felt as a single dot in the universe. I stopped thinking about my body and my mind. I was pure consciousness. I started wondering if other people were something different from me or if we were all the same thing. I couldn't be certain that other people had a consciousness similar to mine. I really wished they did, but somehow it felt as if were all the same thing.”
Qualitative analysis: loss of body ownership

[~2g psilocybe mushrooms]

“I went for a walk under the stars in a park and looked down at my hand and didn’t feel anything that would indicate that this was my hand I was looking at. I saw the cuff of my alpaca hoodie and my e-cigarette and I thought ‘oh, that looks very interesting’, having lost any context that I normally feel with it.”
Qualitative analysis: loss of body ownership

[21 years old, ~15g of psilocybe sclerotia]

“I felt disconnected from my physical being, my body.”
“I remained aware of my own thoughts and sensory perception, I lost sense of my physical presence.”
Qualitative analysis: loss of body ownership

[21 years old, ~300μg LSD]

“When trying to sit up, [I] noticed that there was a 3–4 seconds ‘delay’ from when the senses sense something, to when I sensed that. So I would sit up, then 3 seconds later I would see myself sit up and feel myself sit up. There was also the same delay from when I wanted to do something with my hands for example, there would be delay from when I sent the signal to my hand, to when the hand did things.”
Conclusion: future directions

• Get better descriptions (open-ended interviews)
• Better NLP methods to (a) isolate descriptions of ED and (b) analyze them. Might require parsing grammar, which is a hard task (cf. meta-discourse issue).
• Use these methods to compare ED induced by psychedelics, ED induced by dissociative anesthetics, and ED induced by KOR agonists (salvia).
Thank you!

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