Psychedelic Efficacy

How well might psychedelic drugs work to treat mental illness, compared with prescription psych meds? What insights can be drawn from anonymously-submitted psychedelic experience reports?

Why Study Psychedelics?

Therapeutic Uses

Intermittently used in conjunction with psychotherapy

History

Used for healing for thousands of years

De/criminalization

Criminalized in the 20th century. Recent, partial decriminalization

Advocacy

Decriminalization efforts benefit from wealth of information about effects relative to other drug treatment options

Investment

As psychedelics grow in accessibility, healthcare startups may wish to develop new variants based on past successes

Unconventional Use Case. . .

Due to the history of criminalization, there are fewer formal (i.e. double blind) studies on the efficacy of psychedelics for treating mental illness, relative to what is known about prescription medications. At least **quantitatively, knowledge about psychedelics is relatively opaque.**

We do, however, have a wealth of informal information shared about people's experiences using psychedelic drugs for the purpose of treating mental illness and otherwise feeling good.

For decades, people have submitted **narrative psychedelic experience reports** to Erowid, reddit, and other forums. These reports are often submitted anonymously and may contain little or no quantitative data that would be needed for cross-drug comparison.

. . . Unconventional Data Science Method

01 **Model to predict ratings based on reviews of psych meds**

Typically, a rating for a product's effect is easier to gather than a narrative review of that product. So why predict ratings based on the contents of reviews?

02 **Apply the model to new data: psychedelic experience reports**

In order to make statistical comparisons with narrative reports about psychedelics, we need to be able to assign ratings using this unconventional model.

01 NLP & Model Training

NLP = Natural Language Processing

Training Data

31,559 reviews of prescription psych meds

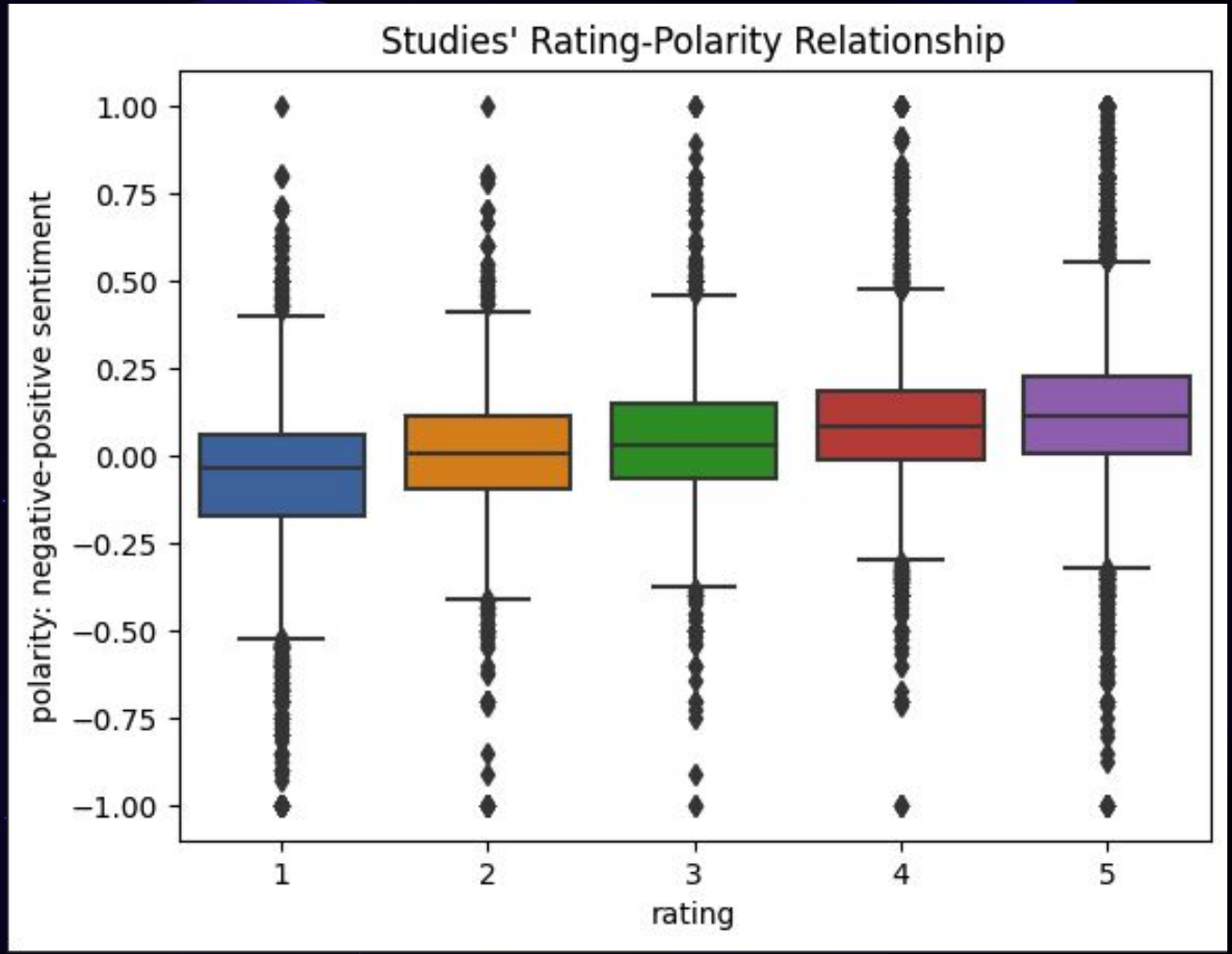
Original Features:

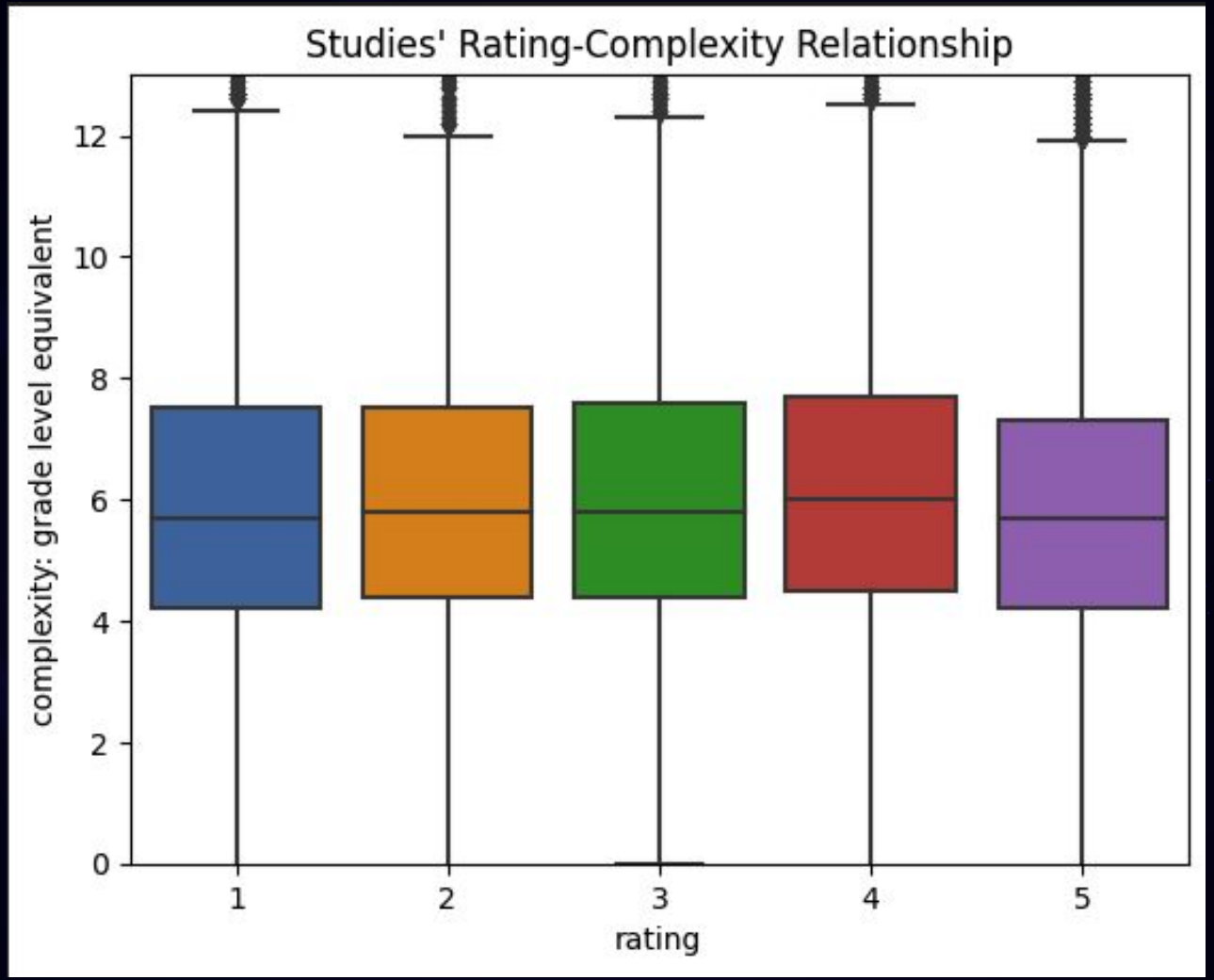
- Drug
- Condition being treated
- Date
- Narrative Review
- Rating

Engineered Features:

- Text Complexity
- Review Length
- Subjectivity
- Sentiment Polarity
- Similarity with a Meta-Review
- Word Vector

Key Feature: Polarity



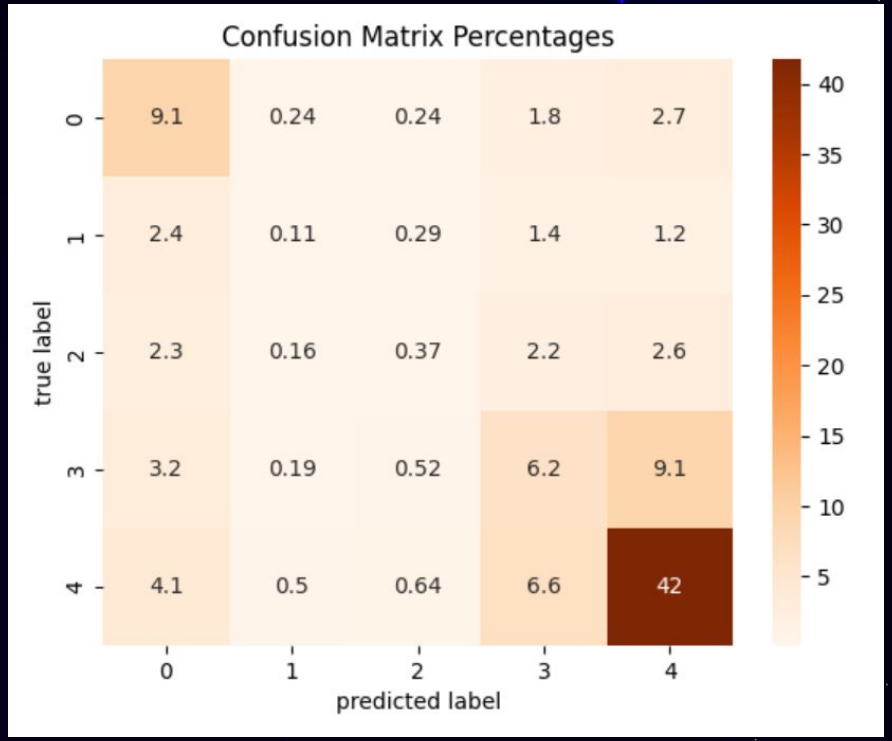


Next Most Predictive Feature: Complexity

Modeling

Complement Naive Bayes Classifier:

Performed better than any other classifiers and also better than a regression model which would have assigned ratings on a scale of 0.0-4 rather than as categories 0, 1, 2, 3, and 4.



Naive Model Metrics:

- Log Loss: 16.76 (lower is better)
- F1: 0.53 (higher is better)

Final Model Evaluation:

- Log Loss: 1.27
- Roc-auc: 0.75
- F1: 0.58
- Accuracy Best K w/ k=2: 0.73

02 Predict Ratings for Psychedelic Drugs

Psychedelic Experience Reports

4,562 reports scraped from erowid.org experience vaults

Drug Categories Targeted in Scraping				
Category:	Tryptamines	Pheneth-ylamines	Arylcyclo-hexylamines	Other Entheogens
Popular Examples:	LSD (Acid) Mushrooms DMT	MDMA (Molly) Mescaline 2C-X	Ketamine PCP PCE	Herbal Ecstasy Ibogaine Harmaline

All Psychedelic Drugs Included

'AET' ,'AL-LAD', 'ALD-52', 'ALEPH',, 'Aleph-4',, 'Allylescaline', 'AMT', 'Arylcyclohexylamines', 'Ayahuasca', 'Banisteriopsis caapi', 'BOD', 'BOH-2C-B', 'Bufotenin', 'Cacti - Mescaline-containing', 'DALT', 'Deschloroketamine', 'DET', 'DiPT', 'DMT', 'DMT-Containing', 'DMXE', 'DOB', 'DOC', 'DOET', 'DOF', 'DOI', 'DOIP', 'DOM', 'DON', 'DOPR', 'DPT', 'EIPLA', 'EPT', 'Escaline', 'ETH-LAD', 'Fluorexetamine', 'H.B. Woodrose', 'Harmaline', 'Harmine', 'Herbal Ecstasy', 'HOT-17', 'HOT-2', 'HOT-7', 'Huasca Brew', 'Huasca Brew Group', 'Huasca Combo', 'Huasca Group', 'HXE', 'Iboga Alkaloid Group', 'Ibogaine', 'Isoproscaline', 'Ketamine', 'LSA', 'LSD', 'LSM-775', 'LSZ', 'MALT', 'MDA', 'MDAI', 'MDE', 'MDMA', 'MEM', 'Mescaline', 'MET', 'Methallylescaline', 'Methoxetamine', 'Methoxpropamine', 'Mimosa ophthalmocentra', 'Mimosa spp.','Mimosa tenuiflora', 'MIPLA', 'MIPT', 'MMDA', 'MMDA-3a', 'MPT', 'Mushrooms', 'Mushrooms - G. spectabilis', 'Mushrooms - P. atlantis', 'Mushrooms - P. azurescens', 'Mushrooms - P. cubensis', 'Mushrooms - P. cyanescens', 'Mushrooms - P. mexicana', 'Mushrooms - P. semilanceata', 'Mushrooms - P. subaeruginosa', 'Mushrooms - P. tampanensis', 'Mushrooms - P. weilii', 'Mushrooms - Panaeolus cyanescens', 'MXiPr', 'PCE', 'PCP', 'Peyote', 'Phenethylamine', 'Phenethylamines', 'Phenethylamines - Other', 'PIPT', 'Proscaline', 'Psilocin', 'Psilocybin', 'S-Ketamine', 'Tabernanthe iboga', 'TCB-2', 'Tetrahydroharmine', 'TMA', 'TMA-2', 'TMA-6', 'Tryptamines - Substituted', '1B-LSD', '1cP-AL-LAD', '1cP-LSD', '1F-LSD', '1P-ETH-LAD', '1P-LSD', '1V-LSD', "2'-Oxo-PCE", '2-Fluorodeschloroketamine', '2-Me-DMT', '2C-B', '2C-B-Fly', '2C-C', '2C-CN', '2C-D', '2C-E', '2C-EF', '2C-G-N', '2C-H', '2C-I', '2C-IP', '2C-N', '2C-P', '2C-T', '2C-T-13', '2C-T-2', '2C-T-21', '2C-T-4', '2C-T-7', '2C-TFM', '3', '4-MD-PCP', '3-Cl-PCP', '3-HO-PCE', '3-HO-PCP', '3-Me-PCE', '3-Me-PCPy', '3-MEO-PCE', '3-MeO-PCMo', '3-MeO-PCP', '3-Methyl-PCP', '3C-E', '3C-P', '3F-PCP', '4-AcO-DALT', '4-AcO-DET', '4-AcO-DiPT', '4-AcO-DMT', '4-AcO-DPT', '4-AcO-EIPT', '4-AcO-EPT', '4-AcO-MALT', '4-AcO-MET', '4-AcO-MiPT', '4-AcO-MPT', '4-HO-DET', '4-HO-DiPT', '4-HO-DPT', '4-HO-EPT', '4-HO-MALT', '4-HO-MCPT', '4-HO-MET', '4-HO-MiPT', '4-HO-MPT', '4-HO-PIPT', '4-MeO-DMT', '4-MeO-MiPT', '4-MeO-PCP', '4-MTA', '4-PrO-DMT', '4C-D', '5-Chloro-AMT', '5-MeO-AET', '5-MeO-AMT', '5-MeO-DALT', '5-MeO-DET', '5-MeO-DiPT', '5-MeO-DMT', '5-MeO-DPT', '5-MeO-EIPT', '5-MeO-MALT', '5-MeO-MET', '5-MeO-MIPT', '5-MeO-PIPT', '5-MeO-TMT', '5-Methoxy-Tryptamine'

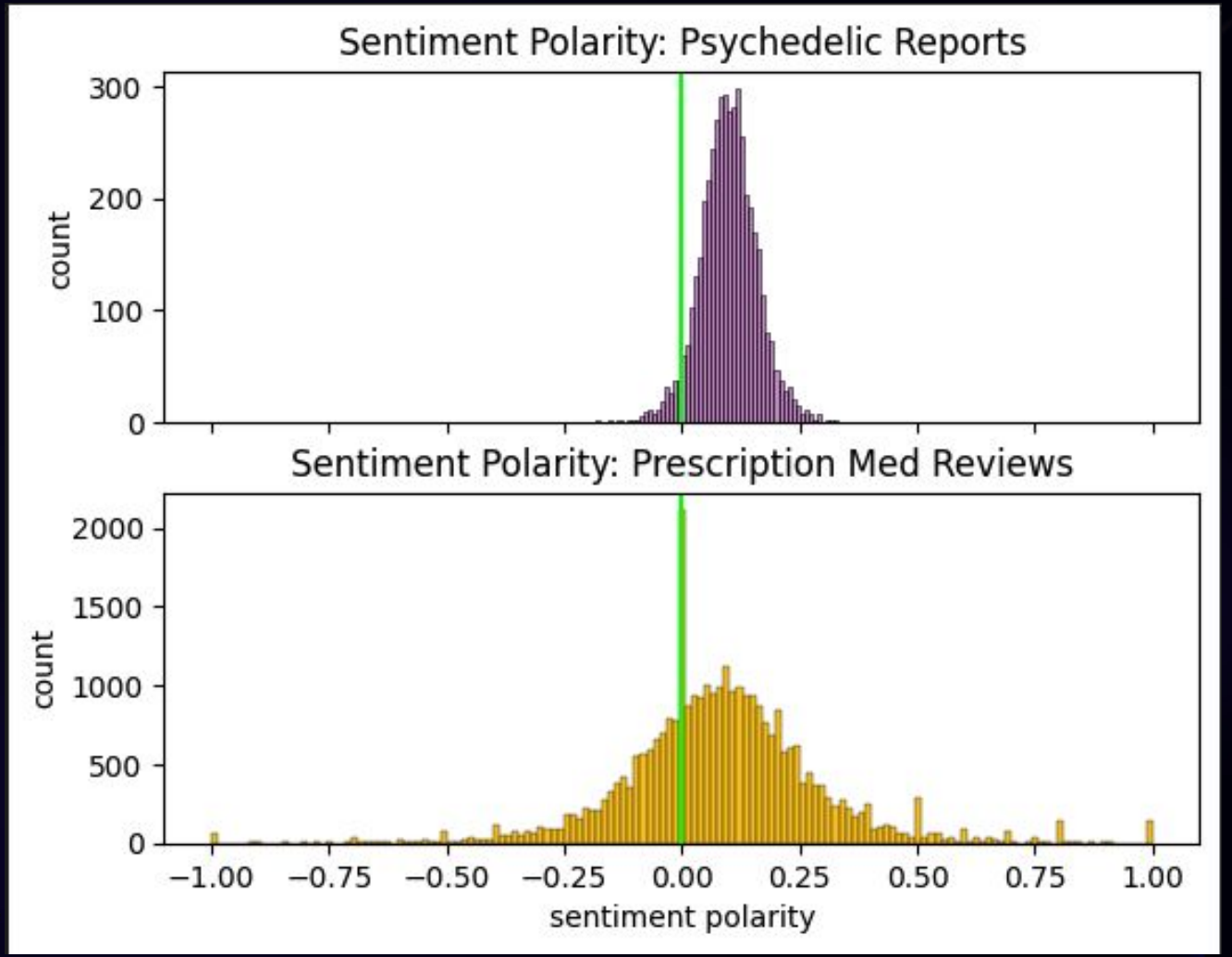
Results

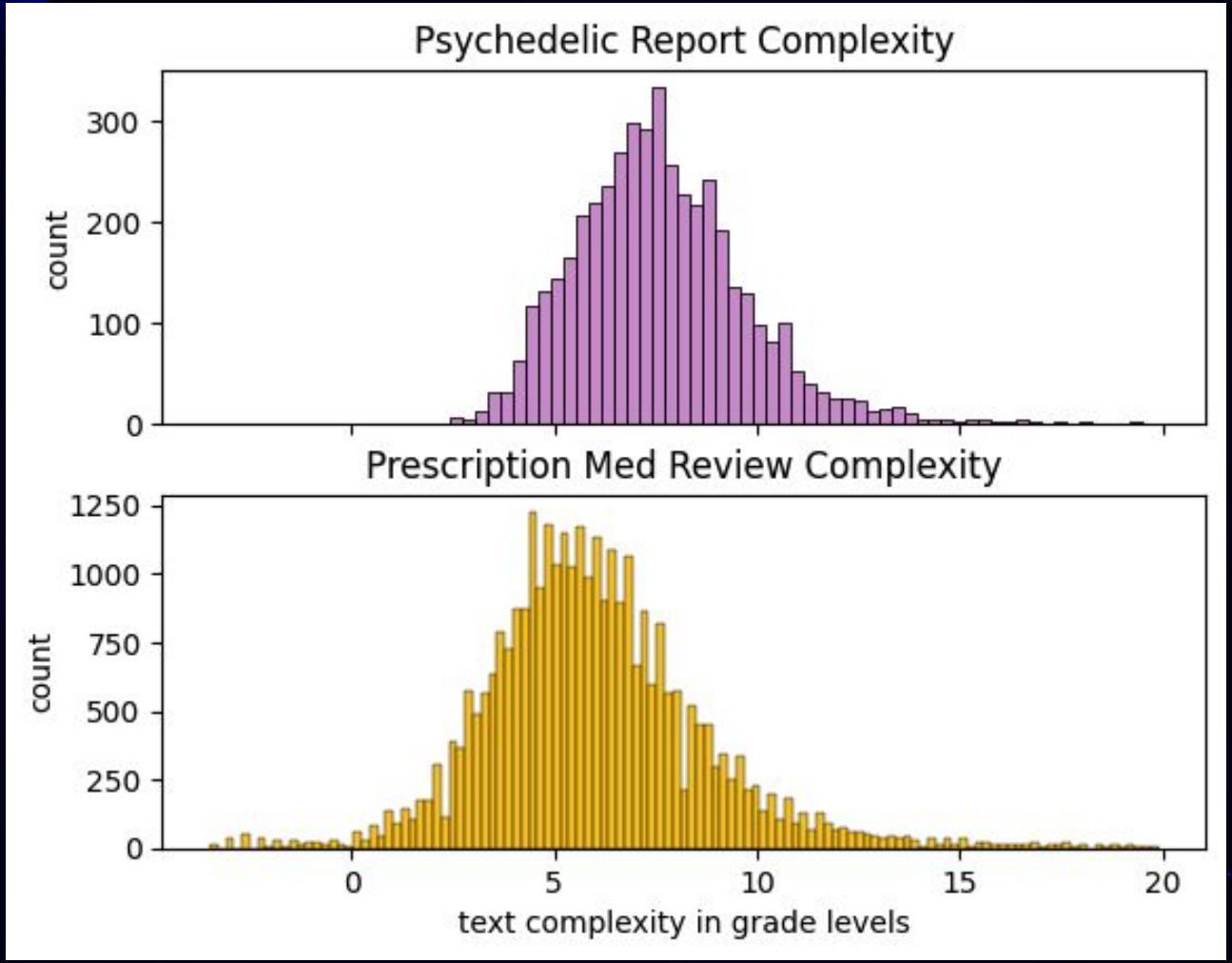
Average Ratings	
Psych Meds	Psychedelics
3.93	4.49

Potential Explanations:

- **Straightforward**: People have more positive experiences with psychedelics.
- **Source**: Erowid does include “bad trips” but may be skewed toward psychedelic enthusiasts.
- **Sensitivity**: More sophisticated NLP techniques could lead a model to more accurately pick up on key features that may be associated with lower ratings.

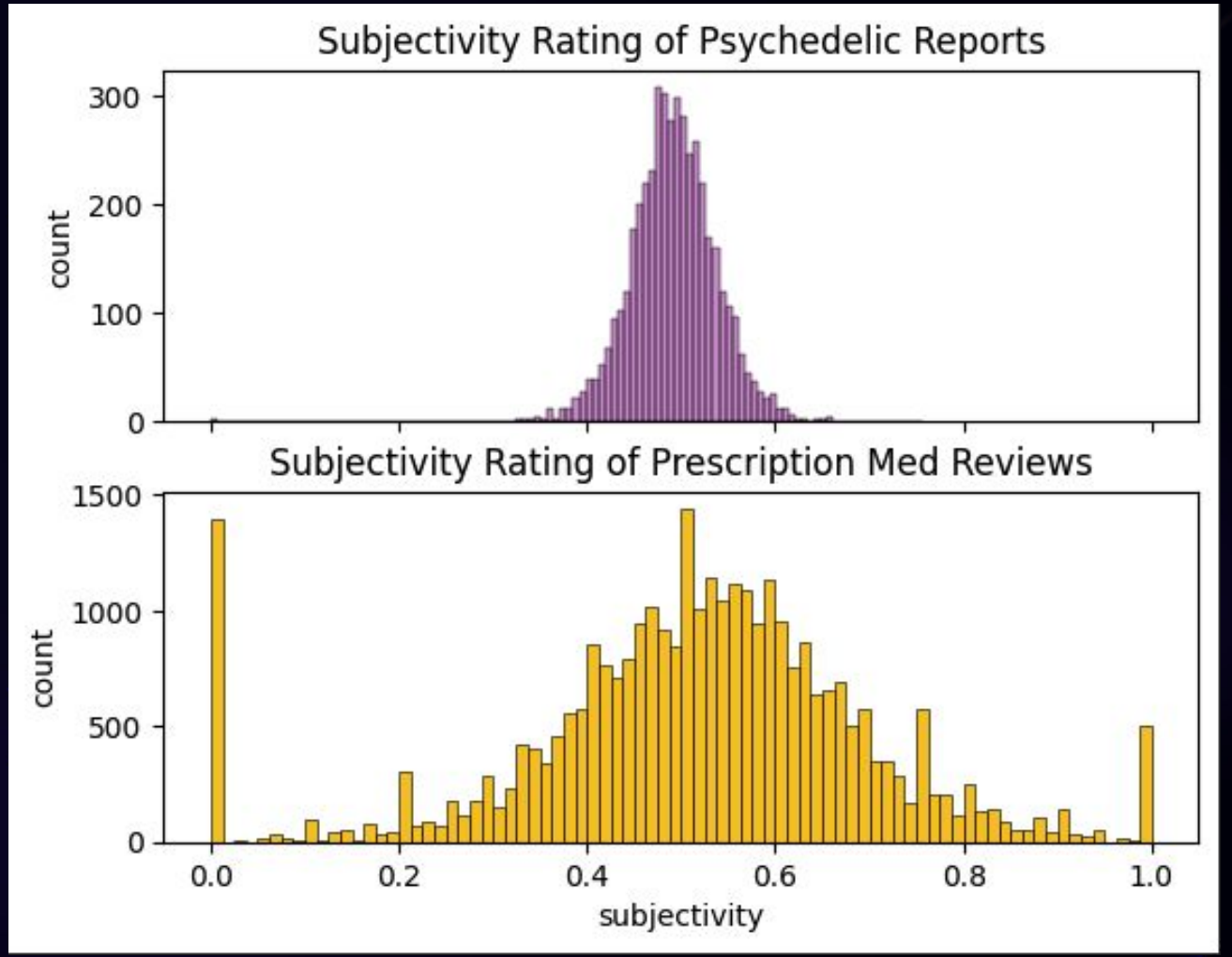
Compare on Key Metric: Polarity

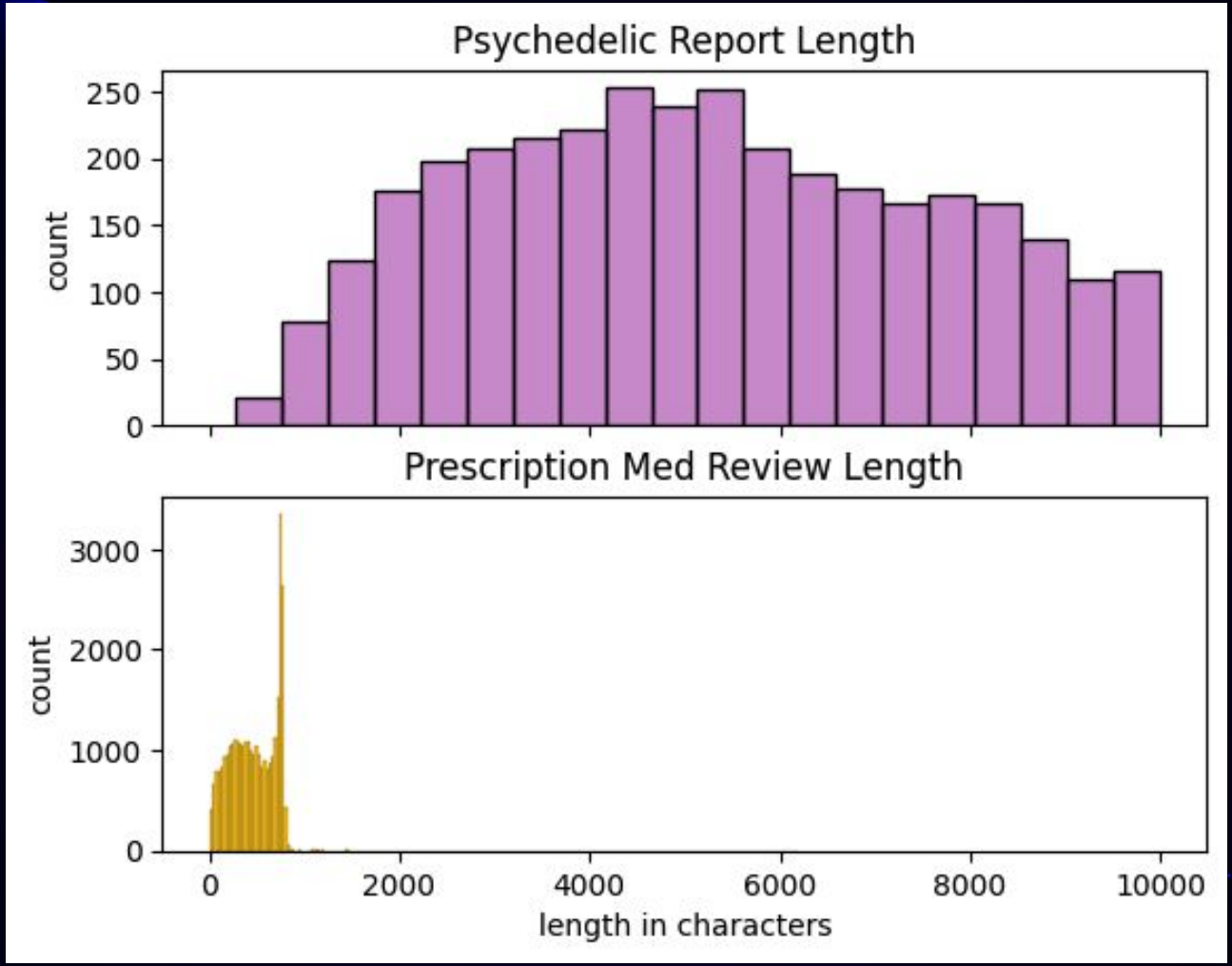




Other Comparisons: Complexity

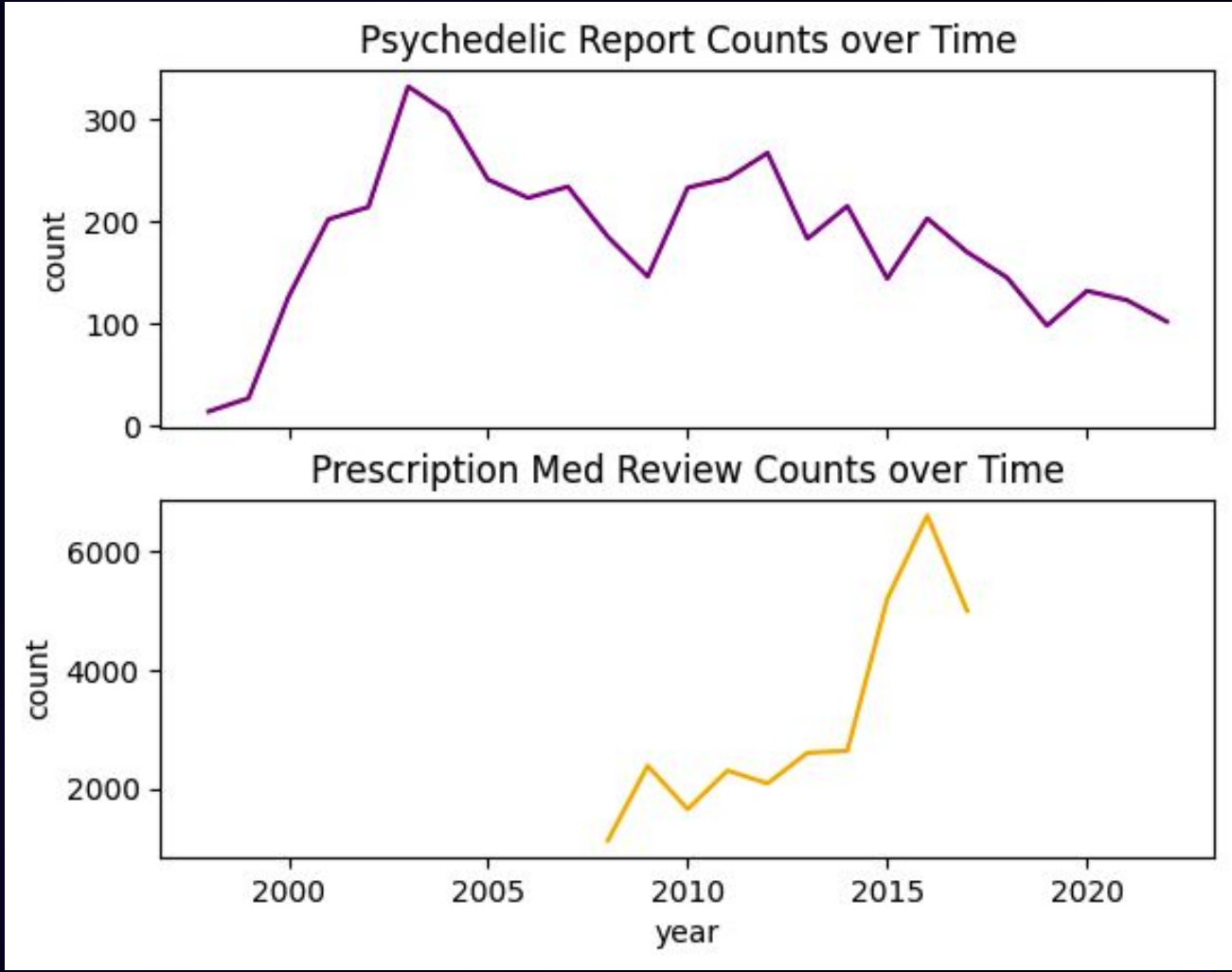
Other Comparisons: Subjectivity



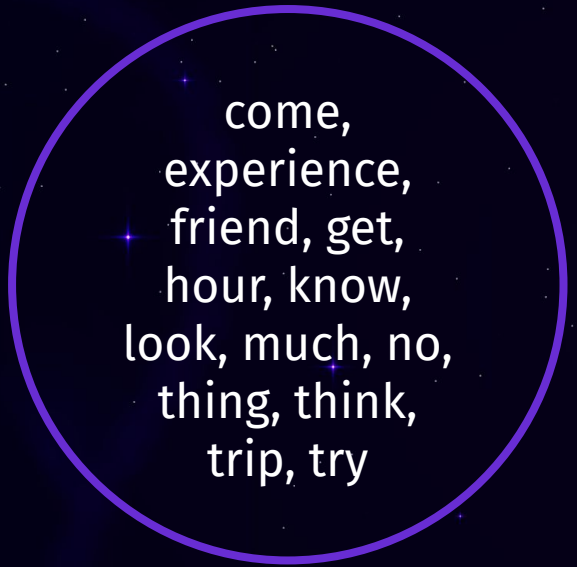


Other Comparisons: Length

Other Comparisons: Submission Year



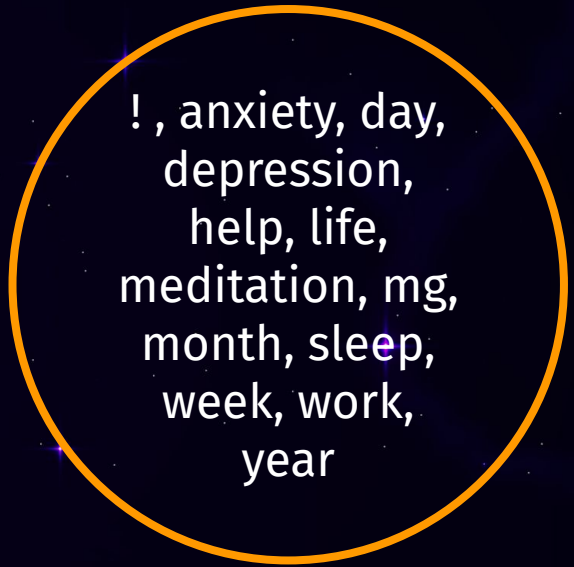
Comparing Words Used in Each Dataset



More Common in Psychedelic Experience Reports

Appear in Both Sets' Top 20 Most Common Words

effect
feel
go
like
start
take
time



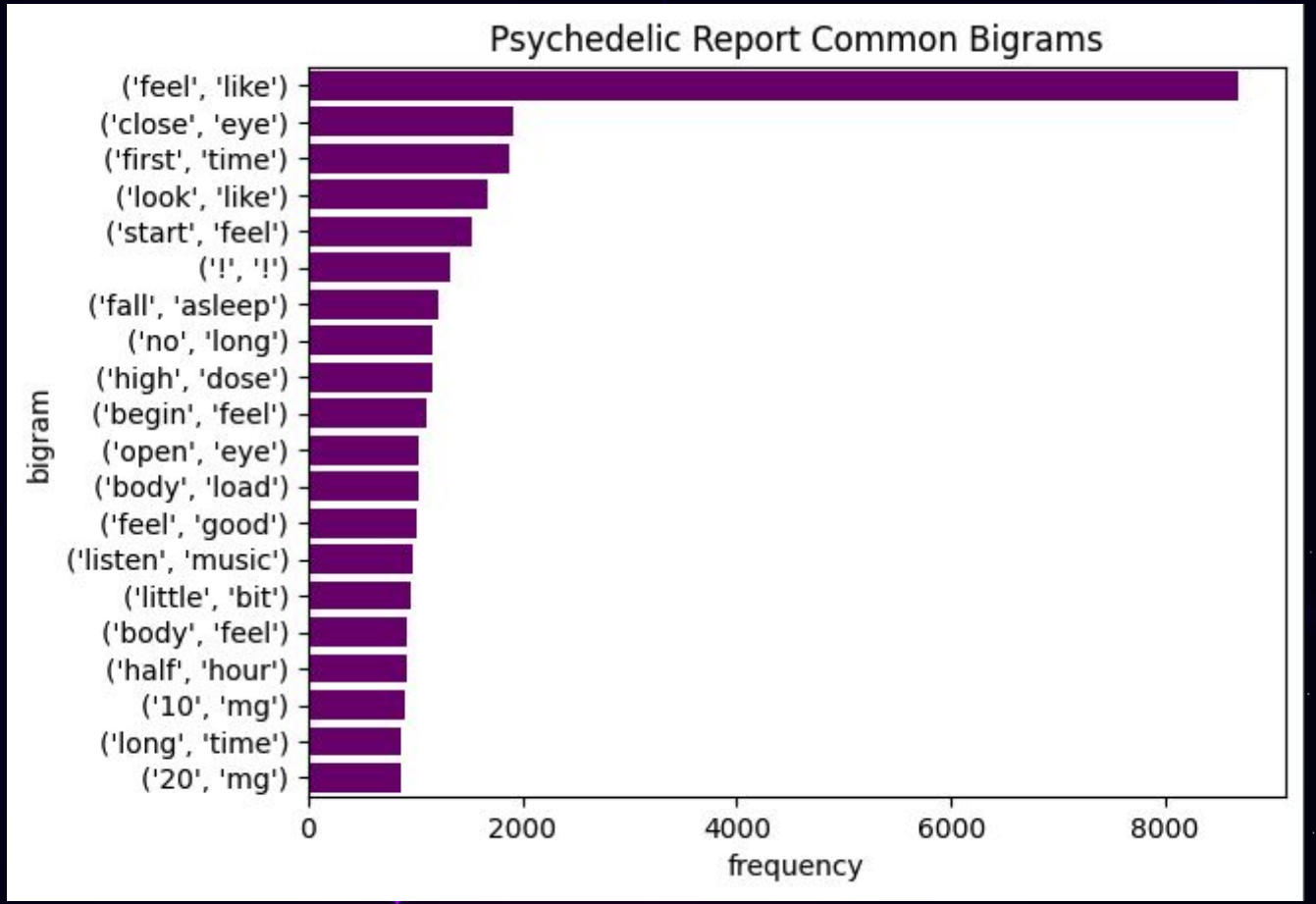
More Common in Prescription Psych Med Reviews

What about Bigrams? (two-lemma phrases)

Appear in Both Sets' Top 20 Most Common Bigrams

!!
fall asleep
feel like
10 mg
20 mg

lemma = basic version of a word, similar to a root word



Bigrams

Appear in Both Sets' Top 20 Most Common Bigrams

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feel like
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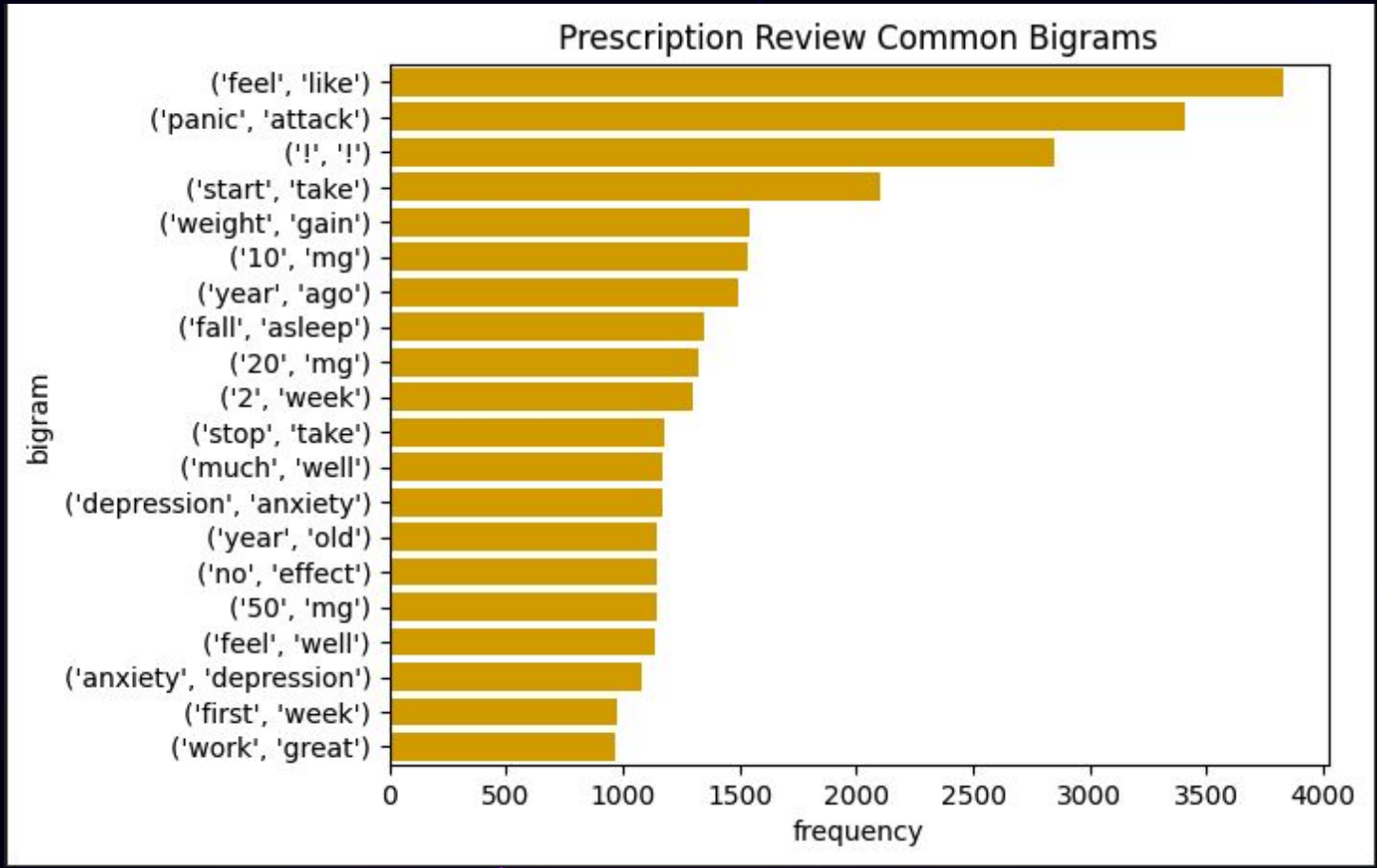
20 mg

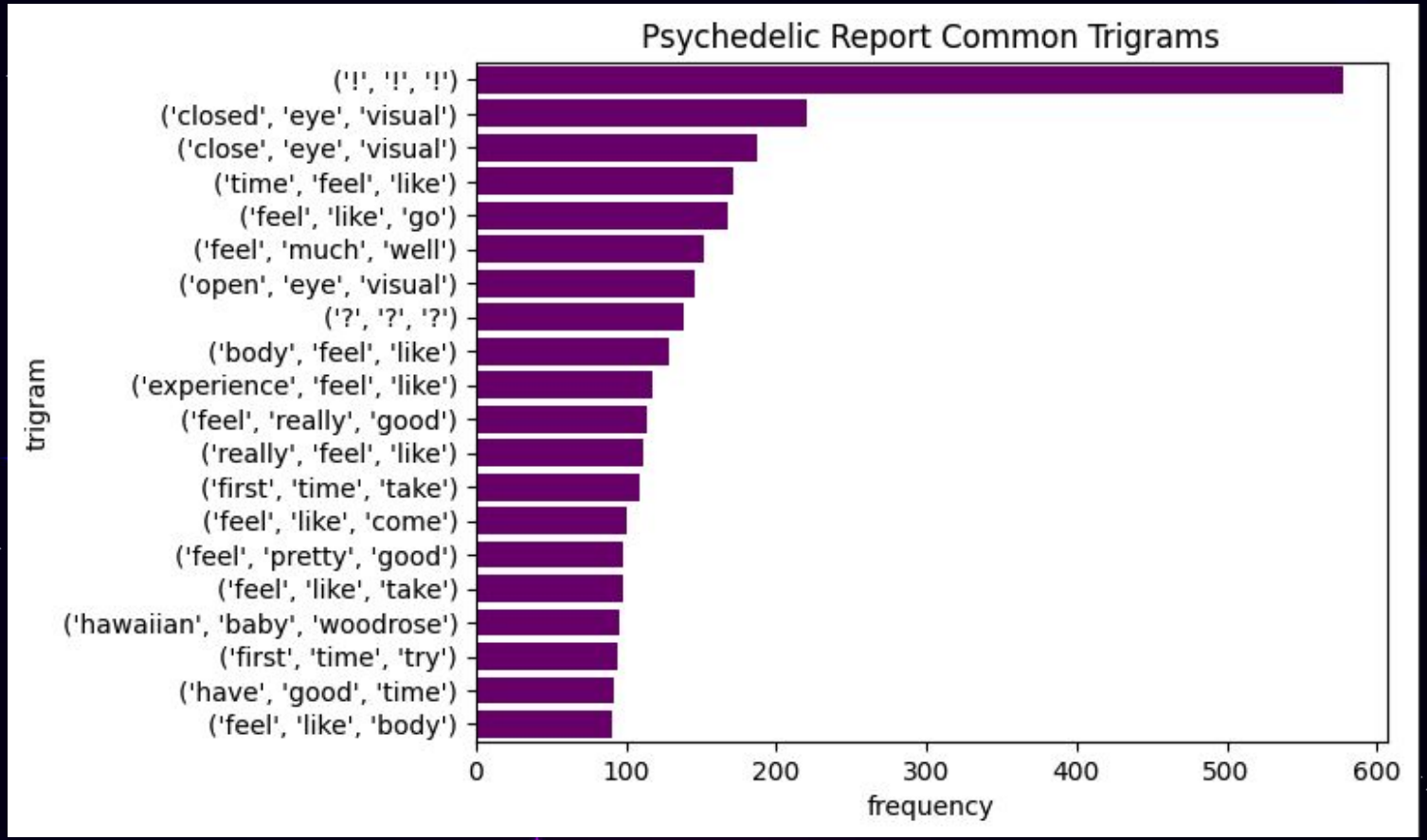


And Trigrams?

Appear in Both Sets' Top 20 Most Common Trigrams

!!!
"feel like go"
"feel much well"

Note: high-frequency words like "it," "the," removed



Trigrams

Appear in Both Sets' Top 20 Most Common Trigrams

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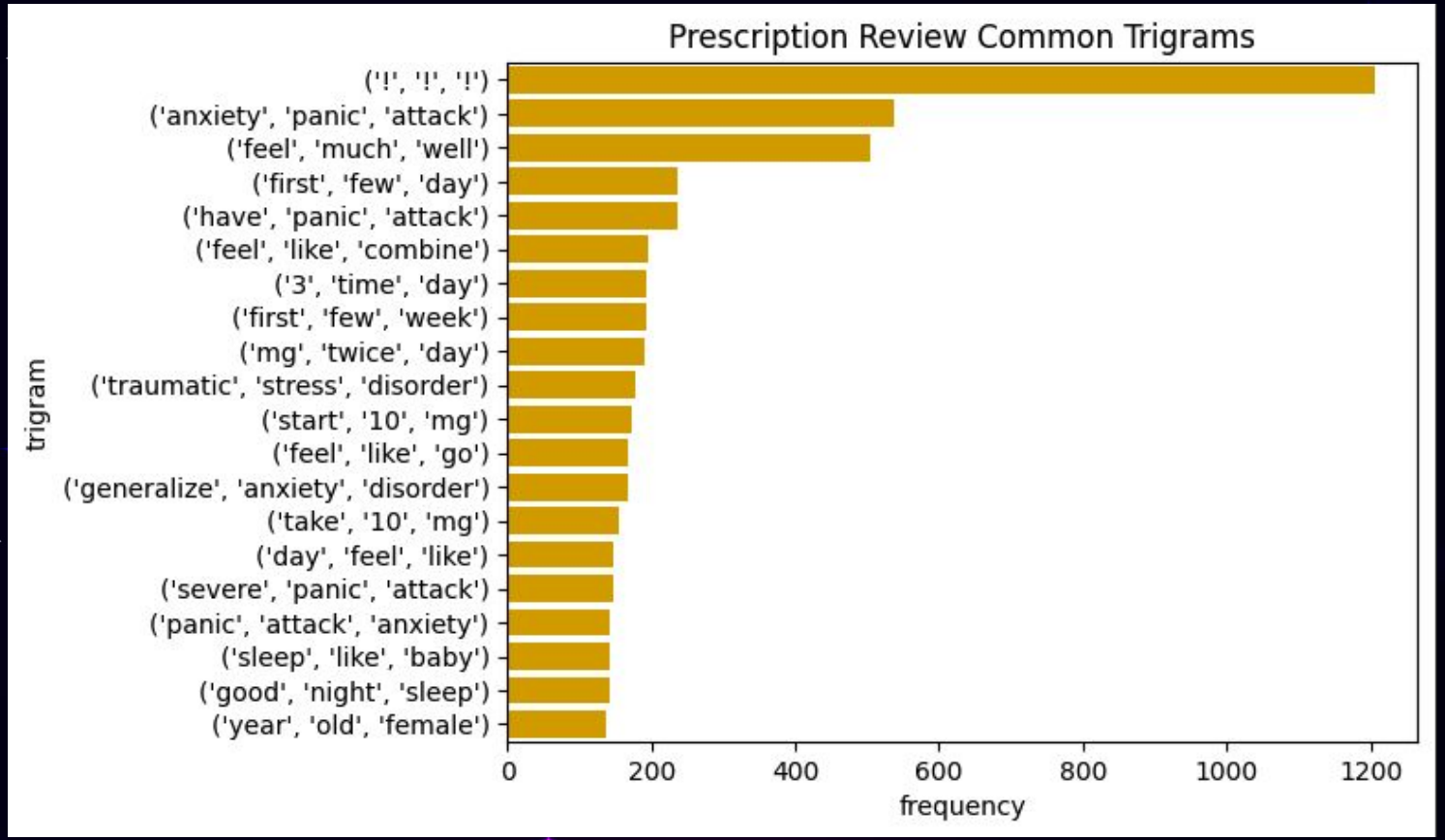


Recommendations

Healthcare

Explore further applications of psychedelic drugs, which have time and again been shown to work as well as or better than benzos, SSRIs, etc. for common mental illnesses for many people.

Advocacy

Pursue decriminalization of all drugs. This report suggests favorable effects of psychedelics. Nobody has my permission, however, to use my work to spread myths about psychedelic drug users being wiser, safer, etc. than users of any criminalized substances. Nobody should be punished for putting things in their bodies in an attempt to relieve suffering or feel well, whether or not they succeed.

Research

Conduct further studies of therapeutic applications for psychedelic drugs, as this analysis indicates promise for their efficacy but could be improved upon methodologically.

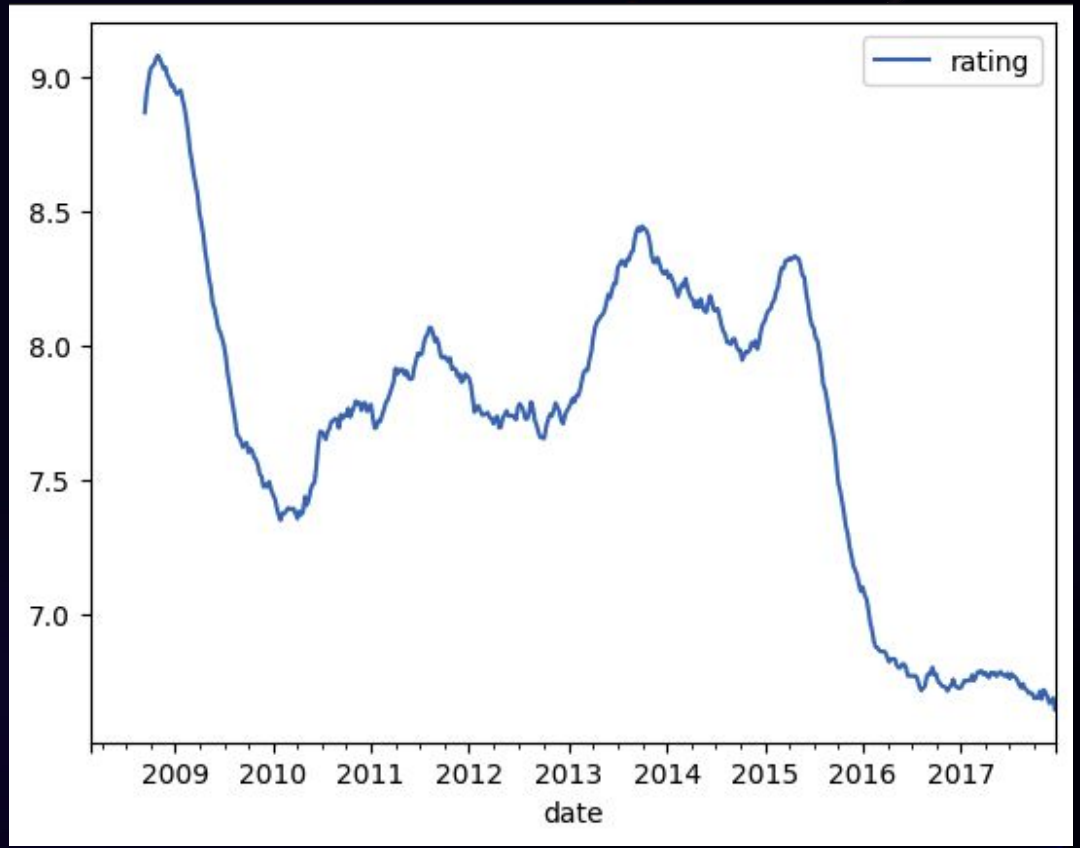
Next Steps

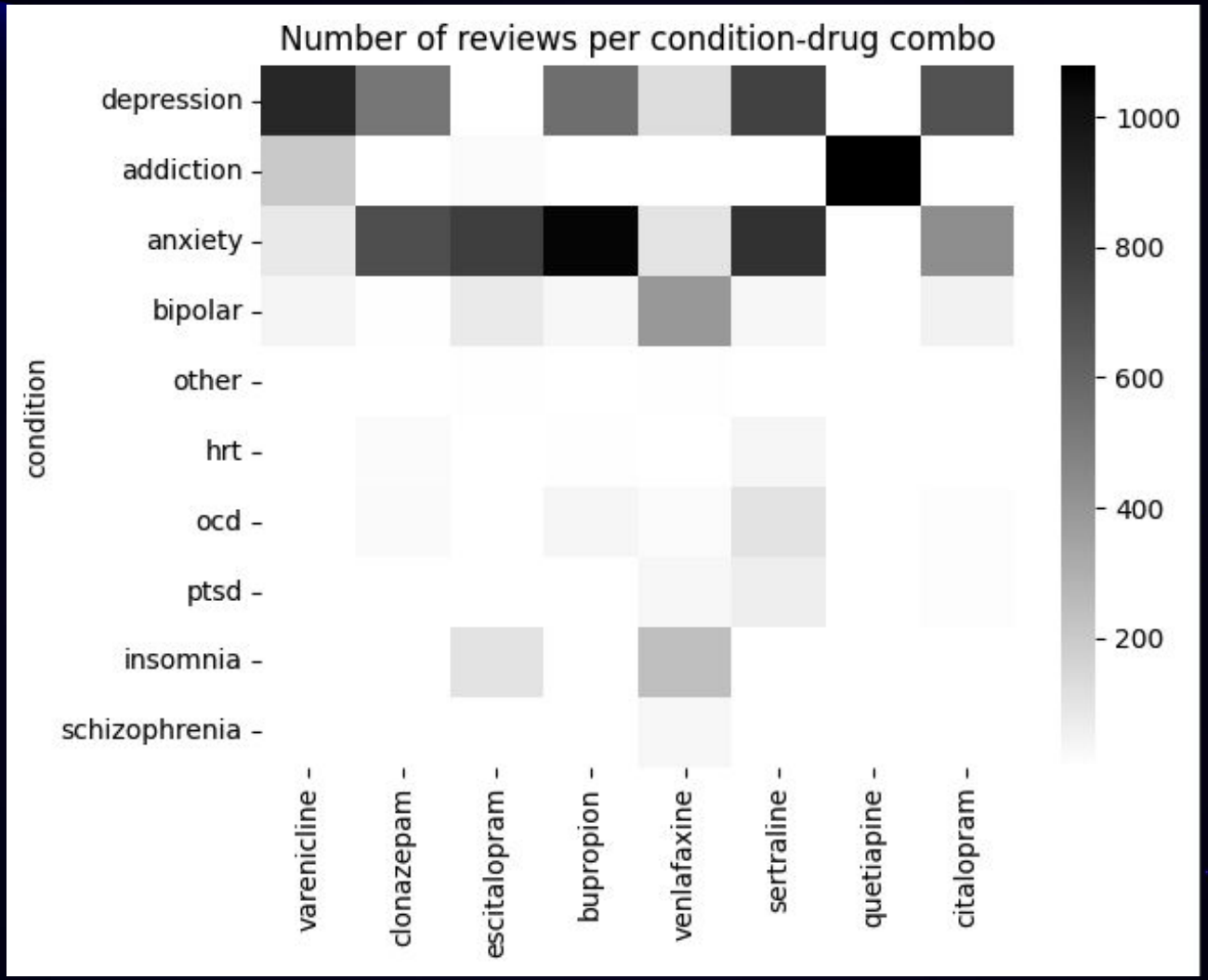
1. **Improve Model:** Shift from word vectorization to word embeddings, to better pick up on nuances in text meaning and accommodate for differences in words used across datasets.
2. **Expand Dataset:** For now, the only psychedelic experience reports analyzed were scraped from Erowid. Psychonaut Wiki or Reddit are other rich sources of narrative data. These could prove more similar to prescription med reviews in their distribution of sentiment polarity, complexity, length, etc. If that were the case, it would improve reliability of predicted ratings.
3. **Broaden Application:** Information about common words, bigrams, and trigrams were included here because I find them fascinating and assume others may as well. A deeper analysis of the words and phrases present in reviews associated with high ratings may provide insights into the types of features people appreciate in substances. This knowledge could inform drug development and marketing strategies.

Interesting Discoveries Along the Way

Prescription Psych Meds' Average Rating Over Time on a Scale of 1-10.

- What happened in 2009 and 2016?
- (No months had average ratings under 6.5.)
- No such major variation over time exists among the psychedelic reports' ratings.



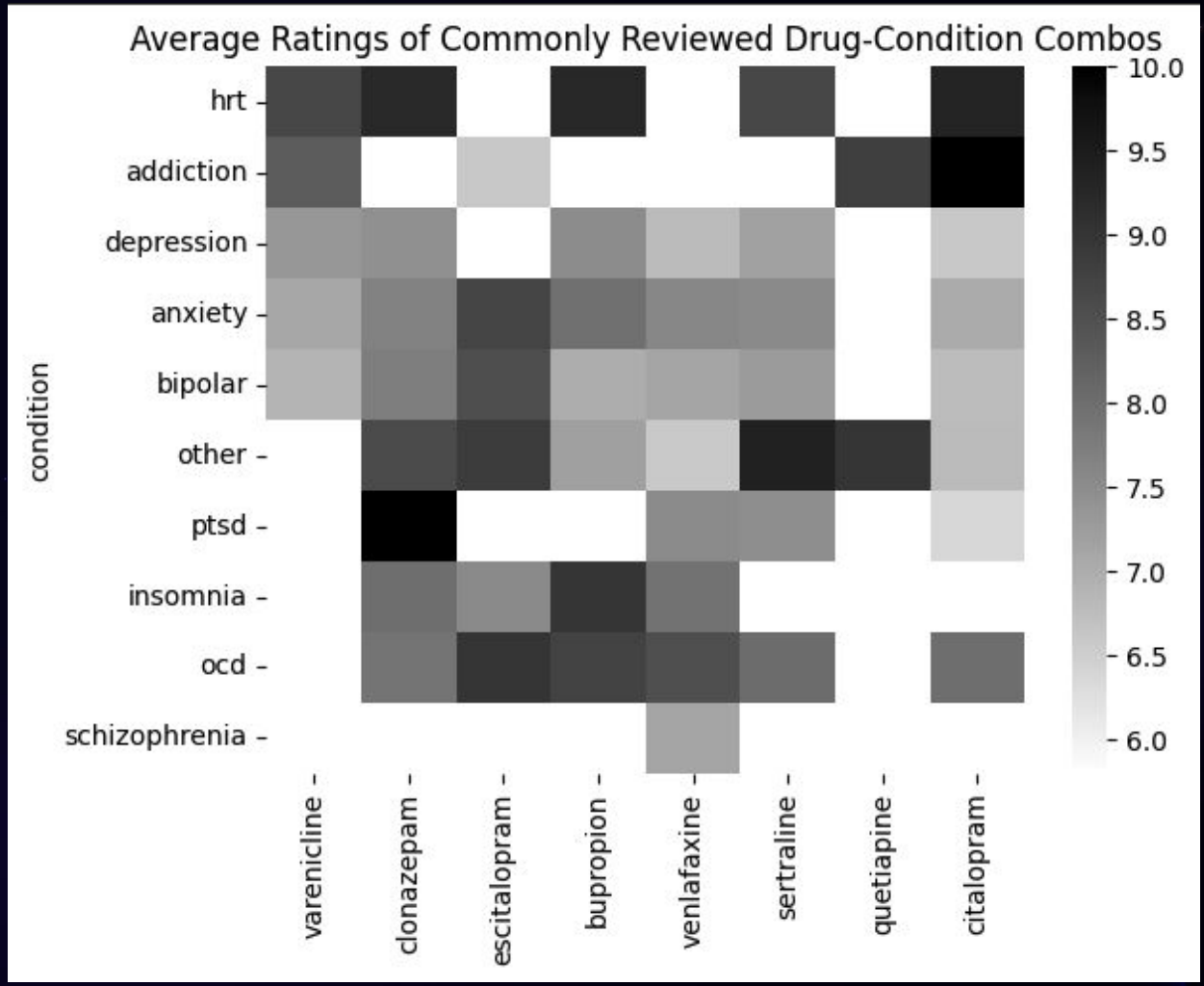


Most Commonly-Reviewed Prescriptions Used to Treat Most Common Conditions

Varenicline: smoking cessation agent
Clonazepam: benzodiazepine
Escitalopram: SSRI (selective serotonin reuptake inhibitor)
Bupropion: NDRI (norepinephrine & dopamine reuptake inhibitor)
Venlafaxin: SSRI
Sertraline: SSRI
Quetiapine: antipsychotic
Citalopram: SSRI

Relative efficacy of various drugs popular for treating common conditions

(1-10 scale; plain white = drug not applicable for that condition)



Thanks

Do you have any questions?
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