The Pathology of Imagination: Picturing the Worst

by

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THESIS ABSTRACT

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This pre-registered study evaluates the relationship between imagination and maladaptive personality traits using the Four-Factor Imagination Scale and Personality Inventory for DSM-5. Large-scale, multinational, cross-sectional data (N = 114,559) were collected from the SAPA-Project using a planned-missingness design. Functional sample size (pairwise-n = 600) was derived from the mean number of pairwise-complete administrations of all items. Significant associations were found between imagination and PID-5 facets saturated with negative affect and psychoticism. Extreme groups analysis demonstrated participants with non-normative levels of PID-5 Depressivity and Anxiousness had elevated levels of emotionally negative imagination (mean d =1.14, $p < 0.001$); non-normative Perceptual Dysregulation and Emotional Lability featured greater overall imaginative activity (mean d = 1.00, $p < 0.001$). Item-level analyses using machine learning revealed the content of PID-5 items predicted facet-level imagination scores, suggesting imagination features in some pathological traits. All statistical analyses are reproducible and publicly available in the Supplemental Materials file.

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INTRODUCTION

Imagination is a fundamental human ability which permeates our daily experiences, manifesting across contexts from the mundane to the grand narratives of myths and legends. Central to creativity, problem-solving, and foresight, imagination shapes our perceptions of reality and the cognitive schemas we use to interpret the world around us (Gotlieb et al., 2019; Vygotsky, 1991). As a multi-faceted construct, imagination involves varying levels of mental imagery, social cognition, mental simulation, emotion, and temporal exploration (Abraham, 2016), using combinations of existing memory to create an experience distinct from external sensory stimuli. Though widely recognized as a positively valanced construct, imagination plays a complex role in mental health (Nettle, 2001) and personality (Zabelina & Condon, 2020). The tendency to frequently and intensely envision negative future scenarios is a feature of clinical depression (Gotlib & Joormann, 2010; Zetsche et al., 2019) and anxiety (Wu et al., 2015), while difficulty in distinguishing imagination from reality plays a role in thought disorders such as schizophrenia (Rasmussen et al., 2022; Jardri et al., 2013). The intersection of imagination with psychopathology, as explored by Crespi (2020) and Ji et al. (2016), highlights the challenges associated with measuring such a complex construct and evaluating its impacts on mental health.

The Imaginative Process

Imagination is a cognitive function that encompasses various processes and is integral to human psychological functioning across a range of contexts. Abraham (2016) identifies five core categories that define imagination: perceptual/motor-related mental imagery, intentionality or recollective processing, novel combinatorial or generative processing, aesthetic phenomenology, and altered psychological states. This is extended by Crespi (2020), who asserts there are seven major components of imagination: pretend play, creativity, narratives and aesthetics, mental time travel, salience, mental imagery and sensory systems, and a neural system enabling imagination. These categories, grounded in both philosophical theory and empirical neuroscience, highlight the dynamic nature of imagination and its varied manifestations. In fact, evidence suggests that these elements of imagination are features in several other cognitive processes, such as mental simulation (Markman et al., 2012), mental time travel (Suddendorf, 1997), creativity (Currie & Ravenscroft, 2003), and perspective-taking (Batson, 2009). This interplay allows individuals to transcend the immediate present with novel thoughts about possible, past, and future scenarios. There is a considerable body of research which explores this interplay. Mullaly & Maguire (2014) emphasize that memory forms the foundation for such imaginative projections, enabling the construction of future scenarios based on past experiences. This predictive aspect of imagination ("foresight") is crucial for adaptive functioning (Taylor et al., 1998), often aligned with personal and social objectives through cognitive control mechanisms (Crespi et al., 2016). While the neuroscientific understanding of some aspects of imagination, such as imagery, is well-developed, others like altered states remain less explored. One key area in this ongoing exploration is the Default Mode Network (DMN; Buckner et al., 2008; Raichle et al., 2001), which Andrews-Hanna & Grilli (2021) have linked to various imaginative processes. Continual research into the facets of imagination is poised to uncover new insights and relationships, as underscored by the works of Abraham (2016) and Sassenberg et al. (2023). However, it's crucial to recognize that dysfunction in imagination, such as excessive daydreaming (Somer, 2002) or problematic psychological states (Abraham, 2016) can be maladaptive. This demonstrates the importance of imagination as both a cognitive function and an enduring source of individual differences across the lifespan.

The evolution in psychometric research towards multifactor, dimensional models reflects a significant shift in how imagination is measured. Historically, tools like the Torrance Tests of Creative Thinking (TCTT; Torrance, 1974) and Gough's (1979) Creative Personality Scale assessed imagination as a component of creativity while several other approaches have tended to treat it as a standalone, multidimensional construct. Notable examples include the Imaginal Processes Inventory (IPI; Singer & Antrobus, 1963; Singer & Antrobus, 1966), a cross-cultural measure by Feng et al. (2017), the Four-Factor Imagination Scales (FFIS; Zabelina & Condon, 2020), and the Dual-Factor Imagination Scale (DFIS; Sassenberg et al., 2023). The FFIS, in particular, offers a comprehensive evaluation of imagination, assessing the dimensions of Frequency (duration of time spent in imagination), Complexity (elaboration of imaginative activity), Emotional Valence (the emotional content of imagination), and Directedness (the extent to which imagination is goal-oriented). This framework's dimensional approach makes it well-suited to examining the role of imagination in adverse psychological outcomes.

Similarly, there is increasing recognition of the multi-faceted nature of personality dysfunction. In personality pathology, we refer to traits and behaviors that are pervasive, inflexible, and enduring, and which significantly impact an individual's social and emotional functioning (Widiger & Trull, 2007). A prominent assessment framework of personality pathology is the Personality Inventory for DSM-5 (PID-5; Krueger et al., 2012), a comprehensive assessment instrument aligned with the dimensional model of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013). The PID-5 evaluates both broad and specific maladaptive personality traits across 25 facets and five broader factors (for a complete list, see the Supplemental Materials, p. 13) offering insights into their structure and severity (Hopwood et al., 2013). This study utilizes the PID-5 to operationalize personality pathology, examining its association with various facets of imagination as measured by the FFIS. This approach, informed by findings that link the PID-5 with clinically significant psychopathology (Zimmermann et al., 2019; Miller et al., 2022) and psychological functioning (Wright et al., 2012; Anderson et al., 2018) allows for an examination of the pathological components of imagination.

The Current Study

This study explores the relationship between imagination and personality pathology; we also assess imagination at normative and non-normative levels of personality pathology. Imagination is measured with the Four-Factor Imagination Scale (FFIS) and personality pathology is assessed with the Personality Inventory for DSM-5 (PID-5).

Examining this relationship will clarify the extent to which imagination can prove maladaptive in various contexts and tether our understanding of its potential pathologies to the substantial literature on the PID-5. For example, in disorders of affect, imaginative processes may promote persistent negative anticipatory thinking and catastrophizing, contributing to and exacerbating symptomatology. In cases of pathologically high psychoticism, such as schizophrenia, imagination may be difficult or impossible to distinguish from reality. In the Alternative Model for Personality Disorders (AMPD; American Psychiatric Association, 2013), thought disorder, internalizing, and overall impairment in functioning may be partially attributable to imagination. With its potential transdiagnostic ramifications (Krueger & Eaton, 2015), augmenting existing therapeutic modalities with additional consideration of imagination may enhance their effectiveness for treating a range of disorders. Imaginative processes are currently implicitly integrated in many efficacious clinical approaches, such as cognitive behavioral therapy, exposure therapy, and art therapy to target malformed cognitions (Hofmann et al., 2012), enhance resilience (Abramowitz et al., 2019), and promote creativity (Malchiodi, 2003). It follows that more formally mapping the relationship between imagination and personality pathology will be both theoretically and clinically valuable.

A major challenge of imagination research with large samples is the difficulty of collecting high-quality data from many participants when using assessment instruments with hundreds of survey items. The current work makes use of a personality assessment site that uses a planned-missing design (Revelle et al., 2017). It allows for the analysis of structural relations between the constructs of imagination and personality pathology without excessive burden on participants. While planned missingness designs are sub-optimal for many research questions, they are well-suited for the current work as they allow for a comprehensive and meaningful analysis of constructs that are challenging to measure with complete data (Condon & Mõttus, 2021).

Hypotheses

Given the exploratory nature of this research, our study is driven by the following pre-registered (https://osf.io/ntf9e/) hypotheses between the four factors of the FFIS and the twenty-five facets of the PID-5. Our hypotheses are also shown in Table 1.

FFIS Frequency

The duration of time spent in imagination is expected to show a strong positive association with Anxiousness, as frequently imagining catastrophic scenarios could promote persistent negative affect. Strong positive associations are also expected with Perceptual Dysregulation, Perseveration, and Suspiciousness, traits that are reminiscent of the symptoms of thought disorders, which imagination is known to be involved in (Crespi, 2020). Conversely, negative associations are expected with Restricted Affectivity and Anhedonia, traits which involve the suppression or absence of affect.

FFIS Emotional Valence

The emotional content of imagination is expected to show a strong positive association with Depressivity, Anxiousness, and Perseveration. These traits are emotionally saturated and suggest elevated levels of neuroticism, which emotionally charged imagination may exacerbate or promote. A moderate positive association is expected with Withdrawal due to the contributions imagining catastrophic scenarios makes to elements of anxiety and avoidance. A negative association is expected with Grandiosity, a trait reflecting lower levels of neuroticism and inflated self-image.

FFIS Complexity

The extent to which imagination is elaborated is expected to have a moderate negative association with Impulsivity, Risk Taking, and Submissiveness. Detailed imagined scenarios of the future support foresight, and traits that involve recklessness or disregard for downstream consequences of actions may be elevated by a lack of elaboration in imagination. A moderate positive correlation is expected with Suspiciousness, where imagination is used to address uncertainty in a potentially negative way.

FFIS Directedness

The degree to which imagination is goal-oriented is expected to have a moderate negative association with Distractibility and Impulsivity. These traits are negatively associated with conscientiousness, and imagining towards a defined end-goal requires intentionality and focus, which are positive correlates of conscientiousness. A weak negative association is expected with Perceptual Dysregulation, where imagination may be chaotic and disjointed, interfering with perception. A positive relationship is expected with Rigid Perfectionism, which is a trait that implicitly requires an end goal which may only be achieved through imagination.

Table 1. Hypothesized Associations Between the PID-5 facets and FFIS factors

Imagination Factor	PID-5 Facet	Hypothesis
Frequency	Withdrawal	Strong +
	Anxiousness	Strong +
	Perceptual Dysregulation	Moderate +
	Perseveration	Moderate +
	Suspiciousness	Weak +
Emotional Valence	Depressivity	Strong +
	Anxiousness	Strong +
	Perseveration	Moderate +
	Withdrawal	Moderate +
	Anhedonia	- Moderate
	Grandiosity	- Moderate
Complexity	Suspiciousness	Moderate +
	Risk Taking	- Moderate
	Impulsivity	- Moderate
Directedness	Rigid Perfectionism	Strong +
	Perceptual Dysregulation	- Weak
	Impulsivity	- Moderate
	Distractibility	- Moderate

METHOD

Participants and Procedure

Participants were 114,559 individuals who took part in an online survey (sapa-project.org) between 2017-02-07 and 2023-04-22 in exchange for customized feedback about their personalities. Approximately 66% of the participants self-identified as female, 33% as male, and 0.23% as other (0.83% did not respond to the item about gender). The average age in the sample was 31.30 years (*sd* = 14.10; *Mdn* = 26.00, *minimum* = 18.00, *maximum* = 90.00). With respect to geographic distribution, 232 nation states were represented and approximately 36.5% of respondents were from the United States. This included representation from all regions of the U.S. at a level similar to the distribution of residents. Tables 2 and 3 show the sample by ethnicity/race and educational attainment level, respectively.

Data for this study were determined to have exempt status by the University of Oregon Institutional Review Board (protocol #08212019.03) and participants gave consent prior to completing the survey.

Table 2. Race of U.S. Respondents in the Sample

Ethnicity	Participants	Percentage
White	23,327	75.9%
African American	1,469	4.8%
Two Or More Ethnicities	1,609	5.2%
Mexican	1,362	4.4%
Other Hispanic	766	2.5%
Chinese	339	1.1%
Other Asian	256	0.8%
Puerto Rican	289	0.9%
Indian	188	0.6%
Filipino	213	0.7%
Native American	203	0.7%
Korean	151	0.5%
Cuban	91	0.3%
Japanese	72	0.2%
Other Pacific Islander	37	0.1%
Native Hawaiian	31	0.1%
Alaskan Native	13	0.1%
Other	209	0.7%

Table 3. Educational Attainment Among Respondents

Educational Level	Participants	Percentage
Less than 12 years	2,374	2.2%
High school graduate	10,815	10.2%
Currently in college/university	29,823	28%
Some college/university, but did not graduate	8,473	8%
Associate's degree	4,257	4%
College/university degree	25,431	23.9%
Currently in graduate or professional school	4,673	4.4%
Graduate or professional school degree	20,479	19.3%

Note: 8,234 participants did not respond to the item about their educational attainment.

MEASURES

All measures were self-reported. Personality pathology was measured with the Personality Inventory for DSM-5 (PID-5; Krueger et al., 2012) and imagination was measured with the Four-Factor Imagination Scale (FFIS; Zabelina & Condon, 2020).

Pathological Personality Traits. The 220 items of the PID-5 were used to assess the twenty-five maladaptive personality facets. The PID-5 measures five major domains of pathological personality traits: Negative Affectivity, Detachment, Antagonism, Disinhibition, and Psychoticism. Each of these domains is further divided into multiple facets. For example, the domain of Negative Affectivity includes facets such as Emotional Lability, Anxiousness, Separation Insecurity, and Depressivity. The PID-5 is used to help clinicians assess and diagnose personality disorders in accordance with the dimensional trait model proposed in the DSM-5 (Krueger et al, 2014). The PID-5 is a hierarchical assessment framework, with five broad domains and 25 facets (see the Supplemental Materials, p. 13 for a listing); each facet is measured with 4 to 14 items. Items were presented with a 6-point categorical scale, ranging from very inaccurate to very accurate. An example item from the Perceptual Dysregulation scale is *"Things around me often feel unreal, or more real than usual."*

Imagination. The 26 items of the Four-Factor Imagination Scale (FFIS; Zabelina & Condon, 2020) were used to assess imagination. These included scales for Frequency, Complexity. Emotional Valence, and Directedness. Response options for these items matched those used with the PID-5. An example item from the Frequency factor is *"I am lost in imagination most of the time."*

ANALYSES

This study uses bivariate correlations and machine learning to evaluate the relationship between imagination and personality pathology, using data collected with the Synthetic Aperture Personality Assessment (SAPA) procedure (Revelle et al., 2017). Additionally, the analyses include Item Response Theory (IRT) for scale accuracy, and an evaluation of the differences in imagination at normative and non-normative levels of personality pathology using the PID-5 clinical thresholds suggested by Miller et al. (2022). More detail is given below for each analytic method.

Synthetic Aperture Personality Assessment

In this procedure, a random subset of items from an overall item pool is administered to each participant. Analyses are then conducted on covariance and correlation matrices which are calculated using the pairwise-complete administrations of the items. In order for these matrices to be stable, the number of pairwise administrations of all items — the effective sample size —has to be sufficiently large (Condon et al., 2015). The number of pairwise administrations obtained in the present sample (M = 600.20; Mdn = 598.00; SD = 29.40) translates to an effective N of 600, which is large enough for these matrices to be stable.

Item Response Theory

Item Response Theory is a statistical model used to analyze individual responses to test items or questionnaires to understand item characteristics and estimate individuals' abilities or traits (Hambleton et al., 1991). Unlike classical test theory, which focuses on test scores, IRT quantifies the relationship between individuals' abilities and their likelihood of endorsing particular responses (Embretson & Reise, 2013). The application of IRT to the PID-5 and the FFIS serves to enhance the accuracy of its scale scores. This approach provides a detailed understanding of items and participant traits, enhancing the precision of psychological assessments. The IRT methodology in this context aids in accurate measurement of response patterns across varying levels of traits like imaginative frequency and depression, offering detailed information about the questionnaire items and the participant responses.

Extreme Groups Analysis

We assessed imagination across normative and non-normative levels of pathological traits. Utilizing the recommendations of Miller et al. (2022), we selected a conservative threshold of two standard deviations above the mean for each PID-5 facet as our threshold. We then split participants into groups above (non-normative group) and below (normative group) this threshold based on their IRT-scored PID-5 facet scores.

Independent Welch's t-tests were conducted using pairwise-complete data to compare IRT-scored FFIS scales between the two groups across all PID-5 facets. To account for the large number (100) of t-tests conducted, a Holm correction (Holm, 1979) was used to adjust the resulting *p*-values from the t-tests. Cohen's *d* was used as the measure of effect size when comparing imagination between groups.

Bivariate Correlations

Bivariate correlations were conducted following the IRT scoring to examine the relationships between the facets of PID-5 and the factors of FFIS. To counteract the risk of Type I errors due to multiple comparisons, a Holm correction was applied. This statistical adjustment reduces the likelihood that the observed associations are statistical artifacts.

Statistical Learning Techniques

Several statistical learning techniques were employed to predict FFIS scale scores from the content of PID-5 items. The raw responses to the 220 PID-5 items were used as predictors for the four FFIS scale scores, which had been scored using IRT. Models in these analyses were generally selected for their capacity to handle multicollinearity in the predictor variables and applicability to MCAR data. A brief explanation of each employed technique is presented below, along with its specific relevance to the data in this study.

BISCUIT

The Best Items Scale that is Cross-validated, Unit-weighted, Informative and Transparent (BISCUIT) method aligns with a 'best subsets' regression approach, ranking items based on their cross-validated correlation with the criteria, which in our case was conducted using bootstrapping ('bagging') for cross-validation (Revelle, 2023). The selection of bagging over k-fold cross-validation is advantageous in our context due to its effectiveness in reducing overfitting and improving model accuracy, especially in datasets with high variability and a large number of intercorrelated predictors. Although less conventional, this method was tailored to datasets collected using the SAPA procedure with similar missingness and structure to this study (Elleman et al., 2020), and was optimized for handling large amounts of missingness without necessitating imputation.

Ridge Regression

This is a regression technique that differs from standard linear regression by introducing a regularization parameter, lambda (λ), which imposes a penalty proportional to the sum of the squares of the coefficients (Hoerl & Kennard, 1970). This penalization moderates the coefficients, shrinking them towards zero, but not to zero as in Least Absolute Shrinkage and Selection Operator Regression (LASSO; Tibshirani, 1996). This shrinkage reduces the variance of the coefficients, enhancing the model's generalizability and stability. Ridge Regression is particularly useful in scenarios when the predictors are highly correlated, as is the case in our data. For our analysis, the lambda value was optimized through cross-validation to build a model that is resilient to overfitting.

Elastic Net

This method effectively blends the strengths of Ridge and LASSO regression, incorporating both L1 (LASSO) and L2 (Ridge) regularization penalties. This dual-penalty approach enables Elastic Net to manage the multicollinearity issue more efficiently than LASSO or Ridge alone (Zou & Hastie, 2005). It can handle correlated predictors effectively by grouping them, which is applicable when dealing with highly interrelated variables like the PID-5 facets. Furthermore, Elastic Net's capacity for feature selection is helpful in our context with a relatively high number of variables. It allows for a model that can select relevant predictors while also controlling for overfitting. By calibrating the balance between L1 and L2 penalties through cross-validation in our study, Elastic Net provides a solution that ensures the stability and predictive accuracy of our model.

Random Forest with Surrogate Splits

Random Forest is an ensemble learning method which constructs multiple decision trees and aggregates their outputs, enhancing prediction accuracy and stability. The addition of surrogate splits is particularly important here; it provides alternative splitting rules for instances with missing data, thereby preserving the integrity and accuracy of the analysis when the model encounters gaps in the data (Breiman et al., 1984). Moreover, by handling numerous and intercorrelated predictors efficiently, Random Forest with surrogate splits is suited to the complexity of our large number of predictors, the PID-5 items. The forest model presents an alternative to regression-based models like Elastic Net and is more well-suited to the structure of our dataset thanking to the addition of surrogate splits.

Tree Model with Gradient Boosting

We applied a second tree model using XGBoost (Extreme Gradient Boosting) to address the challenges posed by the multicollinearity among the PID-5 items. XGBoost is a gradient boosted tree model known for its effectiveness in sequential error correction through the addition of new trees (Chen & Guestrin, 2016). This method is particularly efficient in managing datasets with missing values and outliers. One of the key features of XGBoost is its regularization capability, helps to prevent overfitting when dealing with a large number of predictors. These features make a gradient boosted random forest model well-suited to our data.

Missing Data and Model Performance

Missing data were addressed using imputation of the mean when conducting ridge regression and Elastic Net. The missing values are filled with existing information from the data to allow for more thorough analyses. Although imputation is a useful tool, it does not necessarily enhance our understanding of the data that is missing (Horton & Lipsitz, 2001). Instead, it provides a method to analyze the data that is available. In the context of our study, imputation allowed us to proceed with regularization algorithms which would be impossible otherwise. It is crucial to acknowledge that while regularization models are not optimal for scenarios with high missingness, they are not known to be severely impaired by imputation (Little & Rubin 2019). The use of imputation in our analysis was not aimed at reconstructing the unavailable data, but rather at ensuring that the existing data could be effectively utilized to detect existing relationships. By doing so, we were able to maintain the integrity of our analyses, leveraging these methods to give us meaningful insights based on the data at hand.

Our data were split into training (70%) and testing (30%) sets randomly to facilitate model validation. The performance of each model was gauged using the coefficient of determination (r^2), providing a standardized metric for comparing the explanatory power of different models.

Statistical analyses were conducted using R (R Core Team, 2023). All analyses and statistical code are provided with commentary in the Supplemental Materials (https://osf.io/qsefp/).

RESULTS

Descriptive statistics for all 25 facets of the PID-5 are shown in Table 8 of the Supplemental Materials. The scale score means, generated using the IRT parameters and T-scoring procedure described in Shryock et al. (2023), ranged from a minimum of 47.2 (*se* = 0.1) for Irresponsibility to a maximum of 54.4 (*se* = 0.1) for Emotional Lability; thus, all scale means were within 0.5 SDs of the estimated norms from a similar sample.

As IRT parameters for the FFIS have not previously been reported, it was necessary to first evaluate the unidimensionality of these scores (see Table 9 in the Supplemental Materials). Omega hierarchical estimates for FFIS-Frequency ($\omega_{\text{hierarchical}} = 0.89$) and FFIS-Emotional Valence ($\omega_{\text{hierarchical}} = 0.77$) suggested high unidimensionality; the estimates for FFIS-Directedness ($\omega_{\text{hierarchical}} = 0.69$) and FFIS-Complexity ($\omega_{\text{hierarchical}} = 0.66$) were lower but still adequate for IRT scoring. Figures 4 to 8 of the Supplemental Materials show the reliability and informativeness of these scale scores across the ranges of the latent traits; in all 4 cases the scale performs best in the middle range of the distribution (+/-1 SD of the mean). Descriptive statistics for the resulting FFIS scales are shown in Table 10 in the Supplemental Materials.

When is Imagination Pathological?

Our analysis revealed significant differences in imagination scale scores at normative and non-normative levels of the PID-5 facets. With our selected threshold of two standard deviations above the PID-5 facet means, the group with normative levels of personality pathology was much larger (mean $n = 9{,}708$, $min = 5{,}574$, $max = 15{,}400$, $sd = 1{,}530$) on average than the non-normative group (mean $n = 260$, $min = 24$, $max = 664$, $sd = 135$). This gulf in size can be attributed to the conservative threshold and low incidence of extreme levels of personality pathology. Two factors from the FFIS, Frequency and Emotional Valence, were particularly elevated at extreme levels of pathological traits, as shown in Table 4 below.

Emotional Valence was significantly different across 21 PID-5 facets ($m_{normative} = 50.612$, $m_{non\text{-}normative} = 54.130$). The emotional content of imagination was particularly negative at non-normative levels of Depressivity ($m_{normative} = 50.275$, $m_{non\text{-}normative} = 59.905$, $d = 1.30$, $p < 0.001$), Anhedonia ($m_{normative} = 50.558$, $m_{non\text{-}normative} = 58.293$, $d = 1.01$, $p < 0.001$), and Anxiousness ($m_{normative} = 50.654$, $m_{non\text{-}normative} = 58.253$, $d = 0.98$, $p < 0.001$). Perseveration demonstrated the opposite pattern, pairing with lower levels of Emotional Valence ($m_{normative} = 50.911$, $m_{non\text{-}normative} = 44.080$, $d = 0.88$, $p < 0.001$). Overall, personality pathology saturated with negative emotion was concurrent with significant elevations in emotionally negative imagining.

Table 4. Differences in Imagination Scale Scores between Participants with Normative and Non-Normative Levels of PID-5 Traits

PID-5 Facet	FFIS Frequency			FFIS Emotional Valence		
	Normative Mean (t-scored)	**Non-Normative Mean (t-scored)**	**Cohen's d**	**Normative Mean (t-scored)**	**Non-Normative Mean (t-scored)**	**Cohen's d**
Anhedonia	50.223	55.953	**0.70***	50.558	58.293	**1.01***
Anxiousness	50.317	56.188	**0.71***	50.654	58.253	**0.98***
Attention Seeking	50.297	54.843	**0.55***	50.629	52.401	**0.23***
Callousness	50.218	53.573	**0.41***	50.454	53.149	**0.35***
Deceitfulness	50.188	55.810	**0.68***	50.574	54.128	**0.46***
Depressivity	50.090	57.060	**0.86***	50.275	59.905	**1.30***
Distractibility	50.182	57.546	**0.90***	50.494	57.131	**0.86***
Eccentricity	50.108	57.586	**0.92***	50.491	55.194	**0.61***
Emotional Lability	50.299	58.073	**0.94***	50.683	56.371	**0.73***
Grandiosity	50.342	49.021	0.16	50.774	53.687	0.37
Hostility	50.242	56.320	**0.75***	50.465	55.701	**0.68***
Impulsivity	50.172	58.332	**0.98***	50.623	56.447	**0.74***
Intimacy Avoidance	50.360	53.856	**0.42***	50.706	54.003	**0.42***
Irresponsibility	50.422	47.763	0.32	50.834	46.059	**0.61***
Manipulativeness	50.227	54.096	**0.46***	50.808	52.738	0.25
Perceptual Dysregulation	50.042	58.577	**1.06***	50.313	57.626	**0.96***
Perseveration	50.465	44.284	**0.75***	50.911	44.080	**0.88***
Restricted Affectivity	50.212	53.941	**0.45***	50.644	53.466	**0.36***
Rigid Perfectionism	50.192	53.399	**0.39***	50.632	54.147	**0.45***
Risk Taking	50.249	53.092	**0.35***	50.604	50.943	**0.04***
Separation Anxiety	50.251	55.191	**0.59***	50.591	56.392	**0.75***
Submissiveness	50.397	50.147	0.03	50.897	48.678	0.28
Suspiciousness	50.244	55.740	**0.66***	50.623	55.727	**0.66***
Unusual Beliefs	50.111	55.402	**0.64***	50.519	53.918	**0.43***
Withdrawal	50.263	55.442	**0.63***	50.555	54.818	**0.55***

Note. ∗ = $p < 0.05$ after the Holm correction in the Welch's t-test. For a listing of the *n* for each group, see the Supplemental Materials.

Table 4 (continued)

PID-5 Facet	FFIS Complexity			FFIS Directedness		
	Normative Mean (t-scored)	Non-Normative Mean (t-scored)	Cohen's d	Normative Mean (t-scored)	Non-Normative Mean (t-scored)	Cohen's d
Anhedonia	50.262	50.821	0.08	50.175	50.538	0.05
Anxiousness	50.251	49.479	0.11	50.088	50.802	0.10
Attention Seeking	50.299	50.048	0.04	49.974	53.761	**0.52***
Callousness	50.219	49.904	0.05	49.976	51.643	**0.23***
Deceitfulness	50.267	49.076	0.17	50.049	53.202	**0.43***
Depressivity	50.153	51.007	0.12	50.12	49.877	0.03
Distractibility	50.144	51.017	0.13	50.107	49.689	0.06
Eccentricity	50.252	48.695	0.23	50.015	53.117	**0.43***
Emotional Lability	50.280	49.811	0.07	50.046	50.860	0.11
Grandiosity	50.178	50.595	0.06	50.029	44.403	**0.76***
Hostility	50.245	50.440	0.03	50.025	52.749	**0.37***
Impulsivity	50.186	51.247	0.15	50.045	51.646	0.22
Intimacy Avoidance	50.205	50.714	0.07	50.045	51.762	0.23
Irresponsibility	50.198	47.749	0.35	50.174	54.518	0.59
Manipulativeness	50.333	49.301	0.15	49.977	54.724	**0.64***
Perceptual Dysregulation	50.245	50.817	0.08	50.080	52.560	**0.34***
Perseveration	50.277	47.876	**0.35***	50.083	51.880	0.25
Restricted Affectivity	50.204	51.223	0.15	49.949	53.248	**0.45***
Rigid Perfectionism	50.175	51.398	0.18	49.952	54.339	**0.61***
Risk Taking	50.233	49.619	0.09	50.041	53.136	**0.43***
Separation Anxiety	50.287	50.936	0.09	50.082	51.468	0.19
Submissiveness	50.271	49.273	0.14	50.004	52.878	**0.39***
Suspiciousness	50.256	50.323	0.01	49.993	52.901	**0.40***
Unusual Beliefs	50.257	49.147	0.16	49.918	54.817	**0.67***
Withdrawal	50.229	51.161	0.13	50.042	51.637	0.22

Note. ∗ = $p < 0.05$ after the Holm correction in the Welch's t-test. For a listing of the *n* for each group, see the Supplemental Materials.

Frequency was significantly different for 22 of the 25 PID-5 facets ($m_{normative}$ = 50.245, $m_{non\text{-}normative}$ = 54.450). Imaginative frequency was particularly elevated at extreme levels of Perceptual Dysregulation ($m_{normative}$ = 50.042, $m_{non\text{-}normative}$ = 58.577, d = 1.06, $p < 0.001$), Impulsivity ($m_{normative}$ = 50.172, $m_{non\text{-}normative}$ = 58.32, d = 0.98, $p < 0.001$), and Emotional Lability ($m_{normative}$ = 50.299, $m_{non\text{-}normative}$ = 58.073, d = 0.94, $p < 0.001$). The opposite was again found with Perseveration ($m_{normative}$ = 50.465, $m_{non\text{-}normative}$ = 44.284, d = 0.75, $p < 0.001$), which came with reduced Frequency. High levels of pathological traits related to psychoticism, impulsivity, and instability in mood featured significantly greater amounts of time spent imagining.

In contrast, FFIS Directedness was less differentiated by levels of PID-5 traits, with 14 of 25 showing significant but moderate differences ($m_{normative}$ = 50.040, $m_{non\text{-}normative}$ = 52.086). Complexity demonstrated no differences between the non-normative or normative groups ($m_{normative}$ = 50.236, $m_{non\text{-}normative}$ = 50.067), with only one of the 25 PID-5 facets (Perseveration) differing significantly at a small effect size (d = 0.35).

While the thresholds employed in this study are not strictly clinical, they are empirically supported (see Miller et al., 2022) and are statistically similar to Miller et al.'s clinical cutoffs, if not more strenuous. The 2SD threshold we employed is more conservative than Miller et al.'s recommendation of 1.5SD, ensuring our non-normative group is characterized by extreme levels of pathological traits. Illustrating this point, approximately 98% of our sample fell within normative ranges of personality pathology. Furthermore, psychopathological symptoms are associated with impairment and distress regardless of if they are above or below a diagnostic threshold (Roberts et al., 2015; Fergusson et al., 2005). Our analysis is structured to assess how imagination is differentiated between normative and pathologically high levels of PID-5 traits, providing information about how imagination may present as emotionally negative or excessively frequent in a clinical context.

Correlations Between Imagination and Personality Pathology

The correlational analysis highlighted a consistent pattern of associations between imagination measures and maladaptive traits, particularly in the strong correlations between the PID-5 and the FFIS Emotional Valence scale (see Table 5). Emotionally saturated facets such as Depressivity, Anxiousness, Anhedonia, and Emotional Lability were strongly positively correlated with emotional valence of imagination (coefficients ranging from 0.38 to 0.53, $p < .001$). Imaginative frequency demonstrated a similar overall profile to imaginative emotional valence, additionally showing a cluster of associations with Eccentricity, Distractibility, and Perceptual Dysregulation (coefficients ranging from 0.40 to 0.43, $p < 0.001$), traits characterized by cognitive biases and distorted perception. No associations of notable size were found with imaginative complexity (all coefficients less than from 0.1). Imaginative directedness showed associations with moderate effect sizes to traits tapping multiple distinct constructs, such as Rigid Perfectionism, Unusual Beliefs and Experiences, and Risk Taking (coefficients ranging from 0.22 to 0.13, $p < 0.001$). These results partially support our hypotheses, especially those on the associations between the PID-5 and FFIS Frequency and Emotional Valence, and are shown in Table 5 below.

Table 5. Associations Between the PID-5 facets and FFIS factors

PID-5 Facet	Frequency	Emotional Valence	Complexity	Directedness
Anhedonia	**0.27***	**0.43***	**0.07***	−0.03
Anxiousness	**0.38***	**0.50***	0.02	0.05
Attention Seeking	**0.13***	**0.08***	−0.03	**0.13***
Callousness	**0.12***	**0.12***	0.02	0.02
Deceitfulness	**0.23***	**0.21***	0.01	**0.07***
Depressivity	**0.36***	**0.53***	**0.06***	**−0.06***
Distractibility	**0.40***	**0.37***	**0.06***	**−0.06***
Eccentricity	**0.43***	**0.30***	**−0.07***	**0.14***
Emotional Lability	**0.38***	**0.38***	**0.07***	**0.07***
Grandiosity	**−0.08***	−0.04	0.00	**−0.19***
Hostility	**0.25***	**0.29***	0.04	**0.08***
Impulsivity	**0.28***	**0.25***	**0.06***	0.02
Intimacy Avoidance	**0.10***	**0.13***	0.06	−0.02
Irresponsibility	**−0.23***	**−0.25***	−0.06	0.04
Manipulativeness	**0.07***	0.01	−0.07	**0.13***
Perceptual Dysregulation	**0.41***	**0.36***	0.03	**0.10***
Perseveration	**−0.30***	**−0.35***	**−0.09***	−0.04
Restricted Affectivity	**0.07***	0.05	**0.07***	**0.07***
Rigid Perfectionism	**0.11***	**0.15***	0.04	**0.22***
Risk Taking	0.04	**−0.05***	−0.05	**0.11***
Separation Anxiety	**0.17***	**0.26***	**0.07***	0.01
Submissiveness	**−0.12***	**−0.21***	**−0.10***	0.05
Suspiciousness	**0.22***	**0.27***	0.02	**0.10***
Unusual Beliefs	**0.23***	**0.16***	−0.04	**0.22***
Withdrawal	**0.22***	**0.26***	**0.07***	**0.06***

Note. ∗ = p < 0.05 after the Holm correction.

FFIS Frequency generally aligned with PID-5 facets as hypothesized. Associations with a large effect size were found with Eccentricity (r = 0.43), Distractibility (r = 0.40), Emotional

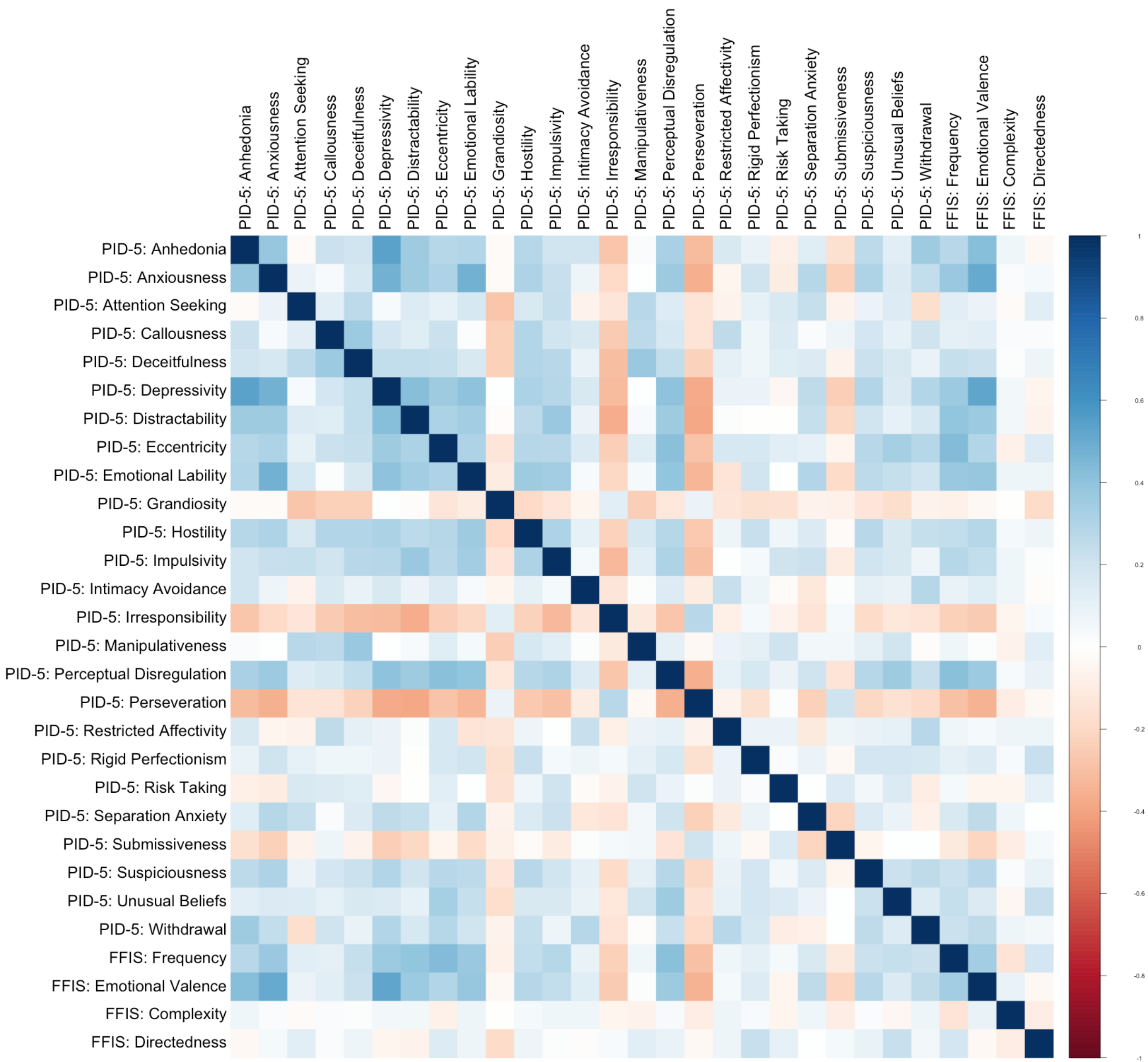
Lability (*r* = 0.38), and Depressivity (*r* = 0.36), all significant at $p < 0.001$. Moderate effect sizes were found in associations with Impulsivity (*r* = 0.28), Anhedonia (r = 0.27), and Hostility (*r* = 0.25) were observed. Small to moderate-small effects were found for the remaining PID-5 facets ($0.1 < r < 0.25$). Null associations were found with traits like Restricted Affectivity, Manipulativeness, and Risk Taking.

FFIS Emotional Valence was the most strongly associated with the PID-5. Associations with a large effect sizes included Emotional Lability (*r* = 0.38), Distractibility (*r* = 0.37), and Perceptual Dysregulation (*r* = 0.36), all significant at $p < 0.001$. Moderate associations were seen with Eccentricity (*r* = 0.30), Hostility (*r* = 0.29), Suspiciousness (*r* = 0.15), Separation Anxiety (*r* = 0.26), and Rigid Perfectionism (*r* = 0.15), while Grandiosity, Manipulativeness, and Risk Taking showed null associations.

Regarding FFIS Complexity, the results did not support the specified hypotheses. The strongest correlations were with Submissiveness (*r* = -0.10), Withdrawal (*r* = 0.08), and Emotional Lability (*r* = 0.07). Impulsivity and Risk Taking showed null associations, and Suspiciousness had no significant association.

Partial support was found for the hypothesized associations with FFIS Directedness. The correlation with Rigid Perfectionism (*r* = 0.22) was weaker than anticipated, and an unexpected positive association was noted with Perceptual Dysregulation (*r* = 0.10). Other significant correlates included Unusual Beliefs and Experiences (*r* = 0.22), Eccentricity (*r* = 0.14), and Grandiosity (*r* = -0.19).

Figure 1. Correlations Among the FFIS Factors and PID-5 Facets



Predicting Imagination from Maladaptive Traits

Using the content of the PID-5 items as predictors, the BISCUIT algorithm best predicted the Frequency ($r^2 = 0.27$) and Emotional Valence ($r^2 = 0.31$) factors from the FFIS. Regularization models and random forests exhibited structurally similar but weaker predictive ability. FFIS Complexity was not effectively predicted by any algorithm ($r^2 < 0.01$), and FFIS Directedness was only weakly predicted, with BISCUIT ($r^2 = 0.06$) as the top performing model.

Each statistical learning model was trained on a training dataset consisting of 70% of the overall data (mean pairwise-n = 420), and a holdout testing dataset consisting of 30% of the data (mean pairwise-n = 180) was used to evaluate model performance. Imputation was used to address missingness for the regularization algorithms on both the training (n_{imputed} = 80,288) and testing data (n_{imputed} = 34,331). The coefficient of determination r^2 was used to evaluate effect size for each machine learning algorithm and was calculated using the predict() function from the *stats* package (R Core Team, 2023). The results are shown below in Tables 6 and 7.

Table 6. Predictive Performance of Machine Learning Algorithms (r^2)

FFIS Factor	BISCUIT	Ridge Regression	Elastic Net	Random Forest	Boosted Forest
Frequency	0.27	0.10	0.10	0.08	0.11
Emotional Valence	0.31	0.11	0.11	0.11	0.14
Complexity	0.01	0.01	0.01	0.00	0.01
Directedness	0.06	0.03	0.03	0.02	0.04

Table 7. Best Maladaptive Personality Items Predicting Imagination (using BISCUIT)

Imagination Factor	PID-5 Facet	Predictive Items selected via BISCUIT (descending order)
Frequency	Eccentricity	My thoughts often go off in odd or unusual directions.
	Perceptual Dysregulation	I often zone out and then suddenly come to and realize that a lot of time has passed.
	Perceptual Dysregulation	I have periods in which I feel disconnected from the world or from myself.
Directedness	Grandiosity	I have outstanding qualities that few others possess.
	Unusual Beliefs and Experiences	Sometimes I can influence other people just by sending my thoughts to them.
	Unusual Beliefs and Experiences	I have some unusual abilities, like sometimes knowing exactly what someone is thinking.
Emotional Valence	Depressivity	I often feel just miserable.
	Depressivity	I often feel like a failure.
	Depressivity	I often feel like nothing I do really matters.
Complexity	Unusual Beliefs and Experiences	I often see unusual connections between things that most people miss.
	Risk Taking	I avoid anything that might be even a little bit dangerous. (R)
	Manipulativeness	I can certainly turn on the charm if I need to get my way.

Note. (R) indicates the item is reverse-coded.

FFIS Frequency was most strongly predicted by the content of PID-5 items using the BISCUIT algorithm (r^2 = 0.27), with ridge regression (r^2 = 0.10), elastic net (r^2 = 0.10), XGBoost (r^2 = 0.11), and Random Forest (r^2 = 0.10) performing nearly identically.

FFIS Emotional Valence was also best predicted with BISCUIT (r^2 = 0.31), with ridge regression (r^2 = 0.11), LASSO (r^2 = 0.11), and elastic net (r^2 = 0.11) performed similarly. XGBoost (r^2 = 0.14) slightly outperformed the regression-based models.

FFIS Complexity was not predicted by the content of the PID-5 items. All algorithms delivered a null result of (r^2 = 0.01).

FFIS Directedness was predicted only weakly by the PID-5. It is best predicted with BISCUIT (r^2 = 0.06), with a familiar pattern emerging with ridge regression (r^2 = 0.03), LASSO (r^2 = 0.03), elastic net (r^2 = 0.03), and XGBoost (r^2 = 0.04) performing similarly.

DISCUSSION

Imaginative emotional valence and frequency are strongly linked with personality pathology and are differentiated by pathologically high levels of maladaptive traits. Both Frequency and Emotional Valence were overall similar in their associations with the emotionally saturated facets of the PID-5. Frequency additionally correlated with thought-disorder like traits featuring cognitive biases and perceptual dysregulation. This indicates the potential contributions of imagination to affective psychopathology and thought disorders, as established by prior research (Crespi, 2020; Andrews-Hanna & Grilli, 2021) and further suggests imaginative emotional valence and frequency play meaningful roles in psychopathology.

Directedness and Complexity, in contrast, showed modest to null associations with personality pathology and were consistent across normative and extreme levels of personality pathology. Complementing these findings, our statistical learning techniques successfully predicted aspects of imagination from the content of maladaptive trait items. Even if imagination is not directly assessed, the PID-5 provides some information about its characteristics, particularly its emotional content and duration. This predictive capacity, aligning with our correlational results and threshold analysis, suggests there is utility in considering imaginative processes in clinical settings.

When is Imagination Maladaptive?

This study identified significant differences in imagination between groups above and below a threshold delineating normative and non-normative levels of the PID-5 facets, chosen at 2 standard deviations above the IRT-scored facet means. Specifically, the Emotional Valence of imagination in the non-normative group was elevated across most PID-5 facets, with Depressivity, Anhedonia, and Anxiousness featuring particularly emotionally negative imagination. This finding is consistent with Crespi's (2020) observations about imagination's role in emotional processing in affective disorders. Our findings suggest imagination can be pathological when its emotional content is excessively negative.

Similarly, the Frequency of imagination was overall higher in the non-normative group. This observation corroborates research by Brébion et al. (2008) and Currie (2000, 2003), which links excessive imaginative engagement to psychopathology. Facets like Perceptual Dysregulation and Eccentricity showed the most pronounced differences, suggesting that increased frequency of imagination, regardless of its emotional content, may be a significant feature in psychoticism-like traits (Daniel & Mason, 2015) and also in affective disorders (Crespi, 2020; Hach et al., 2014) and impulsivity. Understanding the underlying mechanisms behind heightened imaginative frequency in affective and thought-disorder related personality pathology, such as default mode network activity (Whitfield-Gabrieli & Ford, 2012), could provide insights into its role in clinical contexts.

In contrast, FFIS Directedness and Complexity showed only moderate differences between normative and non-normative levels, indicating these aspects of imagination might be more consistent across different psychological profiles. This stability, reflected in the foundational FFIS research by Zabelina & Condon (2020), suggests that the directed and complex nature of imaginative processes may not significantly differ for varying levels of personality pathology.

Imaginative Correlates of Personality Pathology

The strong association between imaginative emotional valence and personality pathology found in our study aligns with the literature connecting imagination to affective psychopathology (Abraham, 2016; Cicero et al., 2021; Phillips & Morley, 2023). This trend, especially pronounced for emotionally saturated traits like Depressivity and Anxiousness, indicates that negative imaginative content might feature in and exacerbate affective disorders. The link between imagination and maladaptive traits such as neuroticism and depression (Roelofs et al., 2008) suggests a potential role for therapeutic interventions focusing on altering patterns of negative imagination.

The Frequency of imagination also showed significant correlations with personality pathology, particularly in traits associated with psychoticism. This finding indicates that the excessive engagement in imagination can be maladaptive regardless of its emotional content. High imaginative frequency is linked to cognitive patterns seen in schizophrenia-spectrum psychopathology and depression (Beaty et al., 2017; Fenton et al., 1997; Nordgaard et al., 2021; Rasmussen et al., 2021), suggesting excessive imagination might manifest in distorted perceptions (Cicero et al., 2021; Somer et al., 2017) and cognitive biases (Carver & Scheier, 1990; Kahneman and Tversky, 1974; Pearson et al., 2008).

One notable exception to these patterns was found with Perseveration, which was strongly negatively associated with both Frequency and Emotional Valence. This may be explained by perseveration anchoring individuals to specific thought patterns (Crider, 1997), reducing the risks associated with over-engagement in imaginative processes. However, on the whole, both Frequency and Emotional Valence were strongly positively associated with maladaptive traits.

Mirroring their limited differences in the non-normative and normative groups, the Directedness and Complexity of imagination displayed only modest or minimal associations with personality pathology. The stability of these facets across varying levels of multiple traits (Zabelina & Condon, 2020) suggests that they may represent more fundamental, less pathology-sensitive aspects of imagination. While the mechanisms underlying these null findings are not clear, they may be important in further understanding the psychological properties of imagination.

Our findings reveal the relationship between various facets of imagination and personality pathology is primarily driven by imaginative frequency and emotional valence, suggesting both are significant factors in mental health. This provides a foundation for more seriously considering imaginative processes in clinical assessments and interventions, potentially leading to more tailored and effective treatment modalities. Initial steps in treatment might involve assessing the content and frequency of a patient's imagination, followed by cognitive restructuring techniques to modify harmful imaginative patterns.

Despite its role in pathological traits, many of the observed relationships between imagination and personality pathology are moderate. Many of the aforementioned arguments can be reversed and applied to explain these effect sizes. Imagining emotionally saturated content tends to result in elevated levels of negative affect, but this can be viewed as an adaptive mechanism shielding the individual from greater potential consequences. Individuals may be able to avoid harmful situations, circumvent maladaptive behaviors, and act with foresight during adverse circumstances thanking to their ability to imagine emotionally negative outcomes. The promotion of negative affect by imagination is not inherently harmful. It can serve as a powerful protective cognitive mechanism at proper dosages. However, when this process is extreme, inflexible, or emotionally inconsistent with reality, it presents pathologically and associates with a range of maladaptive traits.

Predicting Imagination from Pathological Traits

Machine learning techniques revealed the FFIS factors are moderately (though consistently) predicted from the content of the PID-5 items. Items from PID-5 facets with strong zero-order correlations to FFIS Frequency and Emotional Valence unsurprisingly accounted for a significant portion of the variance in each. This was consistent across various algorithms, including regularization (Elastic Net, Ridge Regression) and random forests (Surrogate Splits and Boosted Forests). Mirroring our correlational findings, emotionally saturated content in items like “I often just feel miserable” and “I often feel like a failure” from the Depressivity facet proved robustly predictive of Emotional Valence. The link between Frequency and psychoticism was also further substantiated by the predictive power of thought disorder-like content such as “My thoughts often go off in odd or unusual directions” from the Eccentricity facet and “I have periods in which I feel disconnected from the world or from myself” from the Perceptual

Dysregulation facet. This suggests imagination is a feature in perceptual distortions (Rasmussen & Parnas, 2015), escapism (Anderson, 2003), dissociation, or other psychoticism-like traits (Hersch, 2003).

While the r^2 values from the statistical learning approaches are moderate, taking their square root reveals strong correlations between the PID-5 items and FFIS; when using BISCUIT, the 220 PID-5 items correlated with Emotional Valence at $R = 0.56$ and Frequency at $R = 0.52$, surpassing the magnitude of any of the facet-level zero-order correlations. This suggests personality pathology accounts for a significant part of the variance in imagination. It follows from our analyses that the content of the PID-5 items can be used to indirectly assess imaginative Frequency and Emotional Valence, though their predictive power is moderate. This dual assessment may be beneficial in understanding how imagination features in and possibly exacerbates aspects of personality disorders, potentially offering a more comprehensive perspective in therapeutic settings.

Limitations

In our analysis using the PID-5 clinical threshold recommendations from Miller et al. (2022), participants were categorized into non-normative and normative groups based on PID-5 facet scores. While this methodological approach facilitated a systematic comparison, it is worth noting that being above the 2SD threshold we employed is not equivalent to a formal diagnosis. Miller et al.'s thresholds, provided in the format of means and standard deviations, are derived using a 0 – 4 response format to the PID-5, while our study uses a 1 – 6 response format; as a consequence, they cannot be directly applied in this research. Our inability to employ their specific thresholds motivated our selection of a conservative (2SD) line of demarcation between normative and non-normative levels of personality pathology, per the recommendations they present in their study.

With respect to measurement, the criterion validity of the FFIS may be impacting many of the strongest relations with the PID-5. To some extent, the FFIS Emotional Valence scale is a measure of depression, specific to imagination-related processes and behaviors. Our results support this as the Depressivity subscale from the PID-5 exhibited the strongest correlation to imagination of any PID-5 facet. It seems that both scales may capture a single, shared construct rather than distinct features.

Moreover, concerns have arisen regarding the FFIS's Complexity subscale's unidimensionality, as it demonstrated a borderline omega hierarchical ($\omega_{\text{hierarchical}} = 0.66$) for IRT scoring. This raises the question of whether complexity is truly capturing the depth of imagination. To elaborate imagination, it may be necessary to engage in imagination for an extended duration with intentionality, factors that are captured in the FFIS Frequency and Directedness factors respectively. The absence of significant associations between imaginative complexity and the PID-5 further deepens these uncertainties. Furthermore, the FFIS likely does not provide a holistic picture of imagination (Sassenberg et al., 2023). It overlooks features like somatic imagination, which encompasses the imaginative sensation of physical experiences like touch, and narrative imagination, which reflects an individual's inclination to construct abstract conceptions of alternative realities. The prospect that the FFIS omits these, and other potentially meaningful facets of imagination, suggests the need for further exploratory research on the ways that maladaptive traits and the imaginative process intersect.

A further limitation to our results stems from the need for imputation with several of the statistical learning algorithms (i.e., regularization algorithms like ridge regression). Given the high degree of missingness, the imputed values may understate the degree of variability in participant responses as they reflect the means of the data collected. While the large degree of missingness in these data are well-suited to the exploratory correlational analyses, the structure of the data makes some of the statistical tools used in its analysis suboptimal for the desired task of predicting the FFIS with PID-5 items.

However, it is again worth noting that despite its limitations in this context, imputation does not result in the erroneous detection of non-existent effects (Van Buuren, 2018). It does not generate new structural patterns in the data, and instead allows us to use powerful statistical learning methods to detect existing relationships in the data more effectively. In our study, the BISCUIT algorithm (which did not use imputation) outperformed the other algorithms significantly, which may be attributable to the fact that this algorithm was crafted from data with similar structure and level of missingness to the data in this study. This suggests the true patterns in the data may be best revealed by BISCUIT, which demonstrates the largest effect sizes across all facets of imagination.

CONCLUSION

This study provides a basic understanding of how and when imagination is maladaptive: when it is excessively frequent, saturated with negative emotion, or not goal oriented. The clear differences identified between non-normative and normative groups highlight imagination's potential role in both diagnosing and treating personality disorders. Future research should focus on understanding these dynamics and explore the effectiveness of targeting specific features of imagination during interventions. Additional research may also place these findings in context: picturing the worst may prompt behavioral and cognitive adjustments that prevent the worst from actually transpiring. Our findings contribute to the evolving understanding of imagination in mental health, suggesting future research into imagination will prove useful for both personality theory and clinical practice.

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