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## Olfaction and Disgust as Predictors of Elevated Perfectionism

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# Olfaction and Disgust as Predictors of Elevated Perfectionism



Honors Thesis

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## Abstract

Odor detection and disgust sensitivity were once vital to survival by providing a means to assess if foods were safe for consumption. Along with odor detection and disgust sensitivity, obsessive-compulsive traits, such as checking, may have increased chance of survival by decreasing the likelihood of consuming contaminated foods leading to an evolutionary advantage (Rozin & Fallon, 1987). Current regulations that prevent the distribution of spoiled and contaminated foods in developed societies make these processes less necessary to survival today; as a result, obsessive compulsive traits that may have once been advantageous may now be pathological. Neural connections also suggest a relation between obsessive-compulsive traits, olfaction, and disgust. This study examined associations between obsessive compulsive personality traits (e.g. rigid perfectionism), odor detection sensitivity, perceived odor pleasantness and disgust sensitivity. The sample included 79 undergraduate students who were assessed for odor detection sensitivity, perceived odor pleasantness, and completed the NEO Personality Inventory-3 (NEO-PI-3; McCrae, Costa & Martin, 2005), the Personality Inventory for DSM-5 (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012), and the Disgust Scale-Revised (Haidt, Mccauley & Rozin, 1994). It was hypothesized that elevated perfectionism would be associated with lower odor detection sensitivity, lower odor pleasantness scores, higher disgust scores, and higher neuroticism. No hypotheses were supported; however, higher rigid perfectionism was significantly associated with greater odor detection sensitivity. This study provides further understanding of relationships between perfectionism, disgust and olfaction. The findings of this study indicate that rigid perfectionism may contribute to other aspects of OCD and OCPD.

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## **Introduction**

The sense of smell, also known as olfaction, is an important tool for the safety and health of many species. In the past, olfaction had a larger role in human survival by characterizing odors as “disgusting” to help distinguish foods that were safe to eat from those that were contaminated. Greater disgust sensitivity or compulsive checking of food safety may have once provided an edge in survival. However, this type of compulsive behavior is not always an asset. This behavior is less necessary in first world countries because food is now typically obtained in grocery stores where regulations exist to prevent the distribution of spoiled or contaminated foods.

Compulsive checking and rigid perfectionism are components of both obsessive-compulsive disorder (OCD) and obsessive-compulsive personality disorder (OCPD). Associations between rigid perfectionism personality traits and olfactory function are of interest because impaired sense of smell is associated with OCD. As little is known about associations between rigid perfectionism, disgust sensitivity, odor detection threshold, and perceived odor pleasantness, this study investigated relations between these variables in a college student sample.

### **Obsessive-Compulsive Disorder and Obsessive-Compulsive Personality Disorder**

Obsessive Compulsive Personality disorder is characterized by rigid, stubborn and controlling behavior. It is one of the most prevalent personality disorders with an estimated 2.1-7.9 percent affected (American Psychiatric Association, 2013).

Perfectionism is an additional component of the disorder which includes inflexible

behavior, and the inability to focus on the big picture (American Psychiatric Association, 2013). Obsessive Compulsive disorder affects approximately 1.2 percent of the American population and symptoms include unwanted obsessive and compulsive behaviors (American Psychiatric Association, 2013). These obsessions and compulsions are time consuming; interfering with daily habits. The primary difference between these two disorders is that OCD symptoms include time consuming obsessions and repetitive rituals that are experienced as abnormal, while these symptoms are not experienced as problematic by those with OCPD. For example, persons with OCD repeatedly check a list because they are afraid of what happens if they do not, while a person with OCPD believes repeatedly checking the list is beneficial (Mancebo, Eisen, Grant & Rasmussen, 2005). These two disorders are similar in that they both are characterized by anxiety, fear and perfectionism. One study found that the subsets of perfectionism which are most prevalent in individuals with OCD are concern over mistakes, doubts about actions, concern over parental expectations and parental criticism (Sassaroli, Lauro, Ruggiero, Mauri, Vinai & Frost, 2008). Individuals with OCPD have higher rankings of perfectionism than OCD patients across these sub scales (Halmi, et. al, 2005). Co-occurrence of OCD and OCPD is low and estimated to be only 20-25 percent (Mancebo, Eisen, Grant, & Rasmussen, 2005).

### **Disgust and Fear**

Disgust is a basic emotion believed to have evolved in order for humans to prevent potential health hazards. For example, a person typically avoids food that has strange colors, as well as keeping distance from animals that appear diseased such as

those appearing feverish and unhealthy (Curtis, 2016). Disgust is associated with foods and can cause physical nausea once a source established as 'disgusting' is digested. The basis of disgust in relation to food includes ideation about where the food is from and its history. This ideation includes thought about the possibility of contamination from the food (Rozin & Fallon, 1987). Fear evolved for different reasons than disgust. Fear is a mechanism that is used to deal with danger. Abnormal fear responses have evolved into different phobias and intense fears. These fears are typically centered on ancestral fears that are no longer as relevant today, such as thunder (Ohman & Mineka, 2001). Fear and disgust sensitivity are heightened in some psychiatric disorders, including phobic disorders and OCD (Cisler, Olatunji & Lohr, 2009).

### **Disgust and fear in OCD and OCPD**

The appraisal of objects and situations is altered in those with OCD and OCPD causing irrational fear or disgust of objects that cause no harm. For instance, one study found that individuals with more OCD symptoms are more likely to be more sensitive to potentially disgusting stimuli compared to healthy controls (Olatunji et al., 2007). Another study found that after exposure to a potentially disgusting or fearful object, disgust was significantly higher in those with contamination based OCD while pre-exposure to the potentially fear inducing or disgusting object was not significantly different (Olatunji, Wolitzky-Taylor, Willems, Lohr & Armstrong, 2009). Fear evolved to assess danger or threats while disgust evolved to appraise objects for contamination and disease (Rozin & Fallon, 1987; Stein, Liu, Shapira, & Goodman, 2001). Therefore, having feelings of

disgust towards an odor may be advantageous for deciding between safe and unsafe foods for survival.

## **Olfaction**

Olfaction's importance to humans has changed throughout time. Olfaction was more heavily utilized for determining the safety of foods became a component of human life. Today the Food and Drug Administration regulates the safety of foods for consumption. Even with this change, olfaction is still important to humans. Humans are able to follow scent trails, determine if certain foods are suitable for consumption by associating the odor with previous experiences, and learn dangerous odors (Stevenson, 2010). There are multiple hypotheses of how different odors are perceived. Two prevailing hypothesis are the lock and key mechanism (Pauling, 1974) and the vibrational mechanism (Wright, 1964). The lock and key mechanism explains odorants as having different shapes that fit into receptors due to their specific shape and thus activating them. The vibrational frequency mechanism explains the ability to discern different odorants by the different atomic frequencies of odorants. This explanation does not entirely depend on shape because an odorants shape can have a different mass depending on the chemical makeup of the odorant (Gane, Georganakis, Maniati, Vamvakias, Ragoussis, Skoulakis, & Turin, 2013).

## **Brain activity in olfaction, disgust and OCD**

Hyperactivity of the orbitofrontal cortex (OFC) and insula have been implicated in OCD. The OFC functions as a center in the brain that processes rewards and punishments

(Kringelbach & Rolls, 2004). Those diagnosed with OCD continue a certain action obsessively until they are pleased with the results, a possible indication that the OFC is not processing that the task should be rewarded. The insula is found to correlate with experiences of disgust and found to be the location of the primary taste cortex (Naqvi, Rudrauf, Damasio, & Bechara, 2007). Individuals with OCD also have hyperactivation in the insula when they are introduced to disgusting pictures (Shapira et. al, 2003). The olfactory pathway involves both the OFC and the insula. Olfactory fibers span to the OFC and there are also projections to the anterior insula (Vokshoor, 2017). The orbitofrontal cortex and the insula are common features of OCD, disgust and olfaction.

### **Behavior associated with olfactory impairment**

Individuals with OCD are less accurate in their identification of odors compared to healthy participants (Barnett, Maruff, Purcell, Wainwright, Kyrios, Brewer & Pantelis, 1999), which may be the result of a disruption of odor processing in the orbitofrontal cortex. Olfactory loss interferes with determining potential dangers such as spoiled foods, gas leaks, and smoke. Olfactory loss also impacts satisfaction with life by altering the way usually pleasurable experiences, such as eating out, are perceived. Less joy in eating certain foods has also been associated with impaired olfaction because the sense of smell is involved in the flavors detected from food (Miwa, Furukawa, Tsukatami, Costanzo, DiNardo, Reiter, 2001).

### **Personality traits in OCD and OCPD**

Personality traits associated with OCPD and OCD are the anxiousness facet on the neuroticism domain as well as all facets in the conscientiousness domain of the NEO-PI-

R (Lynam & Widiger, 2001; Rector, Hood, Richter, & Bagby, 2002). While excessive conscientiousness today is not beneficial in most cases as it contributes to an over-excessiveness in work it may have been beneficial in the past. When determining contamination in food in the past excessive conscientiousness could be beneficial for survival. The presence of perfectionism in OCD and OCPD is also of interest in this study as it is one of the defining traits in the disorders (American Psychiatric Association, 2013).

Despite the presence of perfectionism in both disorders not much is known about associations between rigid perfectionism, disgust, and olfactory function. To address this gap, this study investigated relations between rigid perfectionism, odor detection sensitivity, perceived odor pleasantness, and disgust sensitivity.

The present study proposed the following hypotheses:

Hypothesis 1: Higher self-reported levels of rigid perfectionism will be correlated with lower odor detection sensitivity.

Hypothesis 2: Higher self-reported rigid perfectionism will be correlated with decreased odor pleasantness ratings.

Hypothesis 3: Higher rigid perfectionism will be correlated with higher self-reported levels of contamination based disgust sensitivity.

Hypothesis 4: Higher rigid perfectionism will be correlated with higher neuroticism.

## Methods

### Participants

Participants included 37 male and 40 female undergraduate students ( $n = 79$ ) from a private Midwestern university who were between the ages of 18 and 23. The study was approved by the University of Dayton Department of Psychology Research Review and Ethics Committee. Informed consents were obtained from all participants.

### Measures

**Demographics.** Demographic information including sex, age, smoking habits, and the date of last menstruation were collected.

**Rigid Perfectionism.** Rigid perfectionism was measured with the *Personality Inventory for DSM-5* (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012), a 220-item self-report measure of maladaptive personality traits. The Rigid Perfectionism facet is comprised of 11 items and test-retest reliability for the facet is excellent ( $\alpha = .90$ ; Krueger et al., 2012).

**Neuroticism.** Neuroticism was measured with the *NEO Personality Inventory-3* (NEO-PI-3; McCrae, Costa & Martin, 2005), a 240-item self-report measure of the five major normative personality domains of neuroticism, extraversion, openness, conscientiousness and agreeableness. Test-retest reliability is excellent for the Neuroticism domain ( $\alpha = .91$ ; McCrae et al., 2005).

**Disgust sensitivity.** The *Disgust Scale- Revised* (DS-R; Haidt, McCauley, & Rozin, 1994; Olatunji et al., 2007) is a 25-item self-report measure of disgust sensitivity.

The scale measures three kinds of disgust: 1) core, 2) contamination, and 3) animal remainder disgust. Core disgust is disgust that instinctually is offensive such as eating worms contamination based disgust is disgust that is based on the fear of contagion and animal reminder disgust which is disgust that reminds humans of their origins from animals (Olatunji, et al. 2007). The contamination subscale will be used in this study. The test-retest reliability of the DS-R is high at ( $\alpha = .87$ ) (van Overveld, de Jong, Peters & Schouten, 2011).

**Odor Detection Threshold.** The *Sniffin' Sticks Odor Detection Threshold* test (Burghart Instruments; Hummel, Sekinger, Wolf, Pauli, & Kobal, 1997) utilizes marker-like devices; 32 are odorless and 16 contain n-butanol dilutions. The participant is blindfolded before the test begins. The pens are administered by a test administrator in sets of three (2-odorless, 1- n-butanol dilution). Each pen is waved under the participant's nose for approximately five seconds. When a participant correctly determines the pen containing n-butanol the set is repeated. If correctly identifying the pen containing n-butanol a second time the next set is presented which contains a greater dilution of n-butanol. If the participant incorrectly determines the pen containing n-butanol the next set presented contains less dilution of n-butanol. The staircase method is used for the order of the pen sets until there are seven reversals (a reversal occurs when a participant correctly identifies n-butanol twice in a row or when they incorrectly identify the odor). Higher scores from the average of the last four reversal points indicate more sensitivity to odors, higher odor sensitivity. Test-retest reliability ranges from moderate to high at ( $\alpha = .43-.85$ ) (Albrecht, J., 2008).

**Odor Identification.** The *Sniffin' Sticks odor identification test* (Burghart Instruments; Hummel et al., 1997) contains 16 pens with different odors. Each pen is administered by a test administrator by waving the pen under the participant's nose for approximately three seconds. After which four options for odors are read. After identifying the odor smelled, participants are asked to rate the pleasantness and unpleasantness of the odor administered on two 5 point Likert scales, 1 being the least pleasant or least unpleasant, and 5 being the most pleasant or most unpleasant.

### **Procedures**

Participants first signed up for the study on the SONA system which grants research credit for participation in a research study. The informed consent and general overview of the study were read to the participant before asking for their signature for participation. The demographic was distributed after signed consent. Sniffin Sticks odor detection test was the first olfaction test administered. Two administrations (A and B forms) of the test was done in order to counter balance the results. The A administration started at a higher concentration of n-butanol than B administration. The Sniffin Sticks odor identification test was administered afterwards which did not require blindfolding participants. Three personality questionnaires were distributed afterwards. A and B administration was involved. The difference in administration was whether the NEO-PI-3 was completed first or the PID-5 was completed first, last the DS-R was completed. Participants were debriefed once the questionnaires were completed.

## Results

### Preliminary Analyses

Data was analyzed using SPSS 23.0 software. All variables were analyzed for skewness and kurtosis, which were found to be within acceptable ranges indicating that the variables were normally distributed. Means and standard deviations were calculated for all variables in the study (see Table 1 for results).

Table 1. Means and standard deviations for rigid perfectionism and possible variables associated with rigid perfectionism

|                       | <u>M</u> | <u>SD</u> |
|-----------------------|----------|-----------|
| Rigid perfectionism   | 1.03     | 0.71      |
| Odor sensitivity      | 7.48     | 1.86      |
| Odor pleasantness     | 1.57     | 0.49      |
| Contamination disgust | 1.41     | 0.76      |
| Neuroticism           | 53.84    | 9.25      |

### Primary Analyses

All hypotheses were tested using Pearson correlations. Hypothesis one, which stated that higher rigid perfectionism would correlate with decreased odor sensitivity was not supported. Contrary to the hypothesis, results indicated that higher rigid perfectionism was significantly associated with greater odor detection sensitivity ( $r = .25$ ,  $p = .03$ ). Hypothesis two stated that higher rigid perfectionism would correlate with lower odor pleasantness was not supported ( $r = .01$ ,  $p = .90$ ). Hypothesis three, that contamination disgust and rigid perfectionism would be positively correlated, was also

not supported ( $r = .09, p = .47$ ). Hypothesis four which stated that higher rigid perfectionism would correlate with higher neuroticism was also not supported ( $r = .19, p = .11$ ).

## Discussion

This study examined if certain traits associated with OCD and OCPD also correlate with rigid perfectionism which is a personality trait of OCD and OCPD. Disgust sensitivity and neuroticism were two variables analyzed for associations with rigid perfectionistic character. Odor sensitivity and odor pleasantness were also analyzed to determine if there was an association with rigid perfectionism. None of the proposed hypotheses were supported, but a significant correlation was found between more rigid perfectionism and more odor sensitivity.

Contrary to hypothesis one, that higher self-reported levels of rigid perfectionism will be correlated with less odor detection sensitivity, it was found that higher reported levels of rigid perfectionism correlated with more odor detection sensitivity. This finding suggests that having more odor detection sensitivity is linked with perfectionistic traits in a nonclinical sample. Microsmia is associated with individuals with OCD (Barnett et al., 1999). Olfactory performance is also associated with OFC volume in those with psychopathic traits, including those found in anxiety disorders (Barnett et al., 1999). It is unknown if people with higher reported levels of rigid perfectionism who do not meet criteria for OCD have altered OFC function. Perhaps there is different activation of the OFC in those that have higher levels of perfectionism, which could support findings for

the significant positive correlation between odor detection sensitivity and rigid perfectionism. Therefore, it would be interesting to explore OFC functioning between those with rigid perfectionism in a nonclinical sample and those in a clinical sample with OCD and rigid perfectionism.

Hypothesis two predicted that higher self-reported rigid perfectionism would be correlated with decreased odor pleasantness ratings and was not supported. This finding is consistent with the previous finding of an association between increased odor detection sensitivity and higher rigid perfectionism. Individuals with impaired olfactory function report approximately 50 percent satisfaction with life, while those with improved olfaction reported 87 percent satisfaction with life (Miwa et al., 2001). Impaired olfaction affects the ability to discern pleasant smells therefore satisfaction with life may be affected as well. Those experiencing greater lack of physical and social pleasure have lowered life satisfaction (Ritsner, Arbitman, & Lisker, 2011). One study found that a clinical sample of individuals with OCD had significantly higher total perfectionism scores than healthy participants respectively (Frost & Steketee, 1997). It is possible that in an OCD clinical sample where olfactory impairment may be more prominent, rigid perfectionism might be related to lower odor pleasantness .

Hypothesis three, that higher rigid perfectionism would be correlated with higher self-reported levels of contamination based disgust, was not supported. The contamination disgust scores amongst those with higher rigid perfectionism were lower than expected. Previous studies show that disgust sensitivity correlates more strongly with washing symptoms, than other symptoms, including obsessive, hoarding, order, neutralizing and checking symptoms (Bieke, Olatunji, Armstrong, Ciesielski, Bondy, &

Broman-Fulks, 2009). Washing symptoms and how often a person may wash due to their sensitivity to disgust may be more accurately measured if there was a correlation between rigid perfectionism and a person's propensity to feel disgusted in situations. The Disgust Scale-Revised measures the sensitivity to specific situations whereas a propensity scale would measure how often a person responds with disgust. Since the Disgust-Scale Revised only measured the response in certain situations the scale did not take into account how often a person is disgusted in response to certain situations (Cisler, Brady, Olatunji, & Lohr, 2009).

Hypothesis four predicted that higher rigid perfectionism would be correlated with higher neuroticism and was not supported. Rigid perfectionism is a personality trait that correlates with self-oriented, other oriented, socially prescribed forms of perfectionism (Stoeber, 2014). Previous studies did find significant correlations between neuroticism and two types of perfectionism, socially prescribed perfectionism and self-oriented perfectionism as well as with rigid perfectionism (Hewitt, Flett, & Blankstein, 1991; Thomas, Yalch, Krueger, Wright, Markon, & Hopwood, 2012). The sample did not yield similar results as other studies in the association between neuroticism and perfectionism.

### **Limitations and Future Directions**

There were several limitations to this study. First, the sample size used in this study was small. A larger sample size could provide more power to detect significance. Another limitation was the present study's use of college students, which may limit the

generalizability of the results. Additionally, there were some limitations with the questionnaires used in this study. The Disgust Scale-Revised measures the likelihood a person would experience disgust in certain situations which does not measure how often a person has the propensity to be disgusted. The Disgust Scale-Revised is related to washing concerns in OCD while the Disgust-Propensity Scale predicts obsessive thoughts (Nicholson, Barnes-Holmes, 2012). Obsessive symptoms in OCD may be related to rigid perfectionism, which is why a propensity scale for disgust in association with perfectionism should be explored in future research. The Multidimensional Perfectionism scale (Hewit, Flett, Turnbull-Donovan, & Mikail, 1991) measures self-oriented, other-oriented and social prescribed perfectionism. Using a questionnaire more specific to different types of perfectionism instead of the PID-5, which assesses rigid perfectionism the personality trait, may yield more significant results in relation to the personality trait of neuroticism while rigid perfectionism did not. The two personality traits of neuroticism and rigid perfectionism did not correlate in this study, but a previous study has shown that different facets of neuroticism correlate with perfectionism traits (Stoeber, 2014).

## **Conclusion**

The present study found that rigid perfectionism was associated with more sensitivity to detect odors, but was not related to neuroticism, disgust sensitivity, or odor pleasantness. The present results of a positive correlation between with rigid perfectionism and odor detection sensitivity are not consistent with studies in OCD and OCPD, which find

decreased odor sensitivity (Barnett et al, 1999). Future research that measures odor detection sensitivity in people with OCD and OCPD in comparison with a healthy population is necessary to further corroborate this association. Overall, rigid perfectionism did not have similar correlations to those that are in OCD and OCPD. The findings of this study indicate that rigid perfectionism in OCD and OCPD may contribute more to other attributes of the disorders.

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