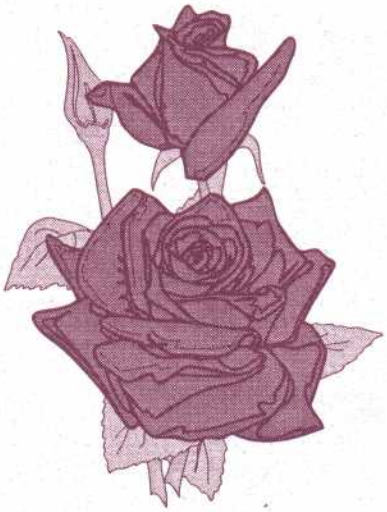
Is A Rose A Rose?



Objective analysis of olfactory identification ability in schizophrenia

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PSYCHOLOGY

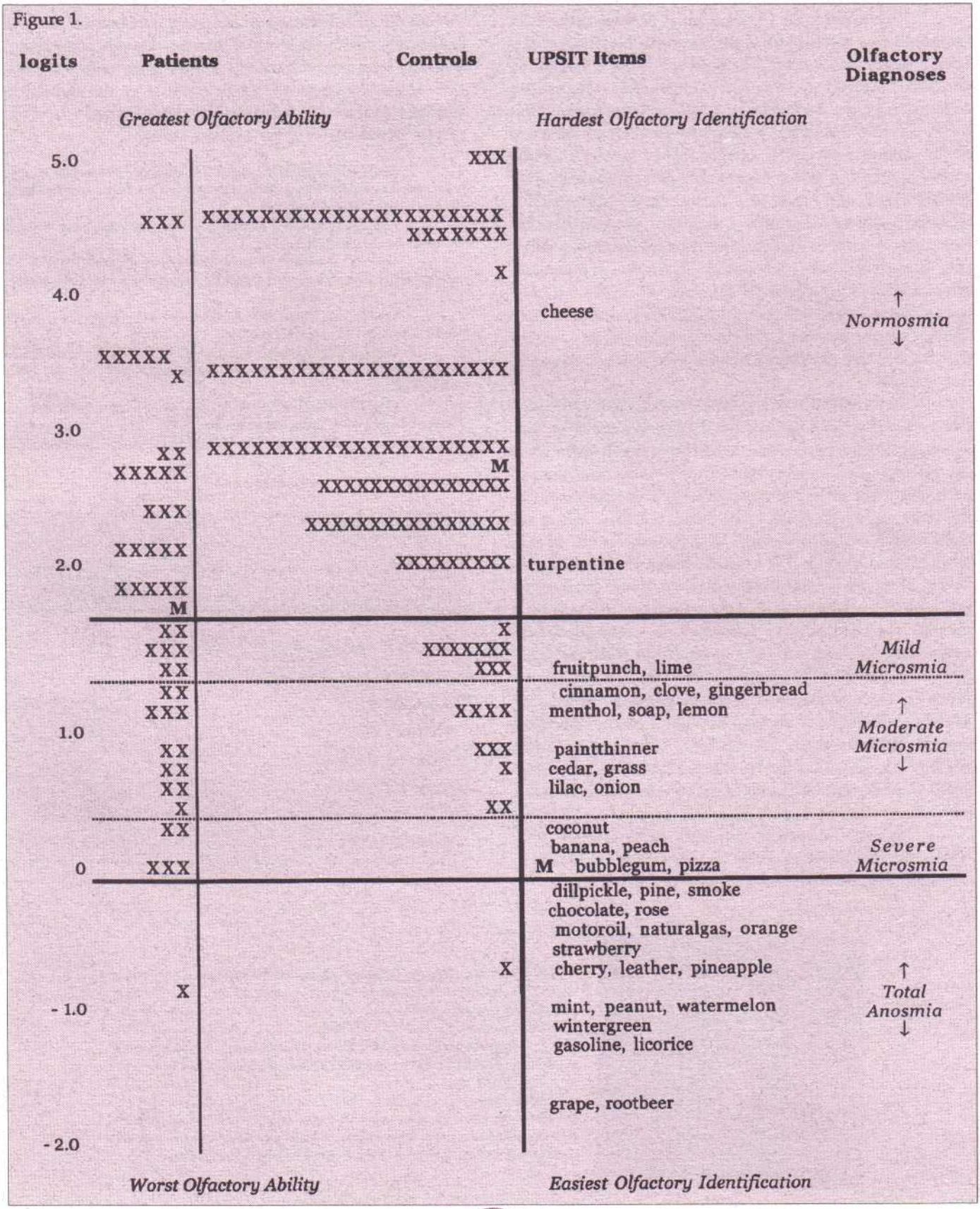
Do schizophrenics smell differently than other people? Indeed, there is evidence to suggest that schizophrenia patients have a unique sense of smell. Despite the fact that schizophrenics have intact olfactory acuity, up to 50% of male patients are reported to be impaired on the University of Pennsylvania Smell Identification Test (UPSIT) (1, 2, 3). This test of olfactory identification ability includes 40 items, each of which presents a scratch-and-sniff patch along with a list of four answer choices. (For example, one item reads, "This odor smells most like: a) chocolate; b) banana; c) onion; d) fruit punch.") Compared to healthy respondents, schizophrenia patients are repeatedly found to demonstrate impaired performance on the UPSIT. These findings, however, are based upon between-group comparisons of raw UPSIT scores and raw scores do not satisfy the basic specifications of measurement. Therefore, we decided to analyze the raw score data matrix from a sample of 54 schizophrenics and 133 healthy participants with the Rasch Model for dichotomous observations (4). The primary goal of our study was to verify that UPSIT items contribute to a single factor with sufficient spread along a discernible line of increasing difficulty to define a recognizable hierarchy of olfactory challenge. We also examined the clinical utility of the UPSIT (i.e., whether UPSIT items separate persons into five distinct levels of olfactory diagnosis as described in the test manual).

Our findings suggest that the UPSIT has succeeded in defining a distinct olfactory identification construct for both schizophrenics and healthy participants. (Item separation indices for the SZ and control groups are 1.70 and 2.49, with corresponding reliability estimates of .74 and .86.)

In **Figure 1**, person ability and item difficulty are expressed in logits and plotted relative to one another (with higher logits representing greater item difficulty and greater person ability). Notice the extent to which the healthy controls (mean, 2.92 logits) manifest better olfactory identification ability on average than the schizophrenics (mean, 2.03 logits). However, the two distributions contain a lot of overlap so that no single cut-off point is available to exclude all controls and also detect most schizophrenics. Even the schizophrenic mean (at about 2 logits) subsumes 26 supposed healthy controls.

Doty (5) reports that the UPSIT "has proved valuable in screening sensory panels in the food and beverage industries, including the water works industry, where a distinction between persons with average or mediocre smell function and those with a more highly developed sense of smell is required." Considering the marked ceiling effect illustrated in **Figure 1**, the utility of the UPSIT in making such a distinction seems unlikely. Our findings show that the average ability of each participant is more than one standard deviation above the average item difficulty. Indeed, nearly half of the controls have an ability estimate above that of the hardest item. Upon examining the item distribution in **Figure 1**, it is clear that the UPSIT does not provide sufficient coverage of olfactory identification ability at the high end. In a region where a majority of both schizophrenic and healthy respondents fall, there are two wide gaps, suggesting that the test does not incorporate enough difficult items to discriminate among higher levels of olfactory ability. Therefore, the capacity of the UPSIT to distinguish average from superior senses of smell is limited.

Figure 1.


logits
Patients
Controls
UPSIT Items
Olfactory Diagnoses
Greatest Olfactory Ability
Hardest Olfactory Identification
5.0
4.0
3.0
2.0
1.0
0
- 1.0
- 2.0
cheese
turpentine
fruitpunch, lime
cinnamon, clove, gingerbread
menthol, soap, lemon
paintthinner
cedar, grass
lilac, onion
coconut
banana, peach
bubblegum, pizza
dillpickle, pine, smoke
chocolate, rose
motoroil, naturalgas, orange
strawberry
cherry, leather, pineapple
mint, peanut, watermelon
wintergreen
gasoline, licorice
grape, rootbeer
Normosmia
Mild Microsmia
Moderate Microsmia
Severe Microsmia
Total Anosmia
Worst Olfactory Ability
Easiest Olfactory Identification

According to the UPSIT manual, persons can be separated into five levels of olfactory diagnosis based upon raw UPSIT score, age, and sex. In **Figure 1**, these standardized cut-offs correspond to the horizontal lines and corresponding olfactory diagnoses are italicized. Rasch person separation statistics measure the UPSIT's ability to discriminate olfactory ability among a particular sample. They are 1.81 for the schizophrenics and .96 for the controls with corresponding reliability indices of .77 and .48. Because the UPSIT score distribution is skewed for healthy participants, standard error has been used in order to illustrate the levels of significant difference in smell ability for each sample. A distance of 3 standard errors implies a significant difference at the 95% confidence level and is indicated in **Figure 1** by solid horizontal lines. Our findings suggest that the UPSIT discriminates three — rather than five — levels of olfactory identification ability among these respondents.

Item difficulty was reported in one study of Parkinson's Disease patients, with patients misidentifying some items (i.e., lemon, pizza, wintergreen, rose, clove) more readily than others (6). Interestingly, our schizophrenic sample did not perceive these particular items to be the most difficult (corresponding item measures are +1.16, -0.04, -1.10, -0.46, +1.16). There are many reasons why patient groups might be expected to differ in terms of item difficulty. For example, target smells differ in intensity, pleasantness, and familiarity of the scent. Further, the test is multiple-choice format with items repeated throughout the test. Therefore, olfactory acuity, attention, memory, and executive function (e.g., perseverative tendency) might each contribute to unique UPSIT profiles for individual patient groups. When item statistics for the schizophrenia group were based upon the item calibrations of the healthy control group, some items showed significant misfit. These items (turpentine, menthol, peach, rose, grape) should be reevaluated for accuracy of presentation and relevance of "wrong" options (e.g., distracter analysis).

In sum, the items of the UPSIT define a single factor of olfactory identification ability and are sufficiently spread to articulate three distinct levels of olfactory identification. Although the UPSIT was not found to separate persons into five statistically significant levels of olfactory identification ability, it clearly separates persons into at least three statistically distinct levels. However, the test is too easy for the majority of respondents and is limited in its ability to discriminate between persons of average to above-average ability.

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Table 1.

	Controls (N = 54)	Schizophrenics (N = 133)
Mean	2.92	2.03
Standard Deviation (SD)	1.05	1.26
Standard Error of Mean	.09	.17
Real RMSE	.76	.61
Adjusted SD	.72	1.10
Person Separation	.96	1.81
Person Reliability	.48	.77
Item Separation	2.49	1.70
Item Reliability	.86	.74

Kelly Minor is a third-year graduate student at Northwestern University studying clinical psychology (specializing in neuropsychology). Her research primarily focuses on cognitive and behavioral deficits — particularly those believed to involve prefrontal brain dysfunction of schizophrenia patients. The CIC Traveling Scholar Program afforded her the opportunity to take coourses at the University of Chicago — and more importantly, according to Kelly — to meet Ben Wright.

Kelly's hobbies vary according to the time of year. In the summer months, she spends weekend mornings searching garage sales for antiques, and her afternoons refinishing them. In the winter, a perfect weekend includes a day of cooking and baking, then an evening at home watching foreign films.