

Snidge Scrumpin': Mapping smell and memory in the Black Country

Method and Results

In November 2018, two events took place as part of the Being Human Festival. The events were hosted at the Black Country Living Museum and Wolverhampton Art Gallery, and examined the connection between smell, memory and the Black Country. This document summarises important information about the methodology and data analysis, but a brief summary of the key findings is provided below.

Highlights

- It is difficult to identify a smell, but especially for smells of burnt rubber and faggots.
- Familiar smells are likely to be rated as intense and pleasant, and are better at eliciting memories.
- The smell of paint and Teddy Grays herbal tablets were particularly successful at prompting memories.
- Memories recalled in response to the smells were overwhelmingly likely to come from childhood.
- The smell of paint and Teddy Grays elicited higher quality memories in those who grew up in the Black Country in comparison to those who grew up elsewhere.
- Women rated smells as more intense than males, on average.
- Those aged between 45 and 54 recalled a greater number of memories than those aged 65 and over.

METHOD

Participants

Fifty-two participants volunteered for the experiment, with 35 individuals at the Black Country Living Museum and 17 individuals at Wolverhampton Art Gallery. There were 23 male and 29 female participants, and the majority identified as White British (81% of the sample; see Table 1 for a breakdown of ethnicity responses). Participants were typically aged 45 or over (see Table 2).

Table 1

Ethnicity Information

Ethnicity	Frequency
White British	42
Black or Black British Caribbean	1
Mixed White/Black Caribbean	1
White Irish	1
Black or Black British African	1
Other Asian background	1
Other White background	5

Table 2

Age category frequencies

Age category	Frequency
18-24	2
25-34	3
35-44	7
45-54	14
55-64	10
65+	16

Participants also reported their place of birth and residence during childhood and adolescence, along with their current residence. Answers were organised into 15 different regional categories. This included the Black Country (here classed as the regions in and surrounding Wolverhampton, Walsall, Dudley and West Bromwich), the nine regions of England (East England, East Midlands, London, North East, North West,

South East, South West, West Midlands and Yorkshire and the Humber), other UK (Northern Ireland, Scotland or Wales), Europe or outside Europe. Where participants lived across different regions, they were categorised as living in varied areas of the UK, or in varied areas of the UK and abroad. The West Midlands was categorised as regions in and around Birmingham, along with Herefordshire, Shropshire, Staffordshire, Warwickshire and Worcestershire, but not any of the Black Country regions.

The number of participants falling into each category is shown in Table 3, arranged according to locations of birth, childhood, adolescence and the present.

Table 3

Frequency of Location According to Age

Location	Birth place	Childhood	Adolescence	Present
<i>UK</i>				
Black Country	26	24	23	35
East Midlands	0	0	0	1
East of England	0	1	2	0
London	4	0	0	0
North East	1	1	1	0
North West	2	1	1	0
Other UK	1	1	0	0
Other West Midlands	5	9	12	11
South East	4	2	2	2
South West	0	1	2	2
Yorkshire and the Humber	2	2	1	0
Varied UK	N/A	3	1	1
<i>Abroad</i>				
Europe	4	3	3	0
Outside Europe	3	3	3	0
Varied	N/A	1	1	0
UK/International				

Materials

Eight different smells were created for the experiment. This included four general smells (lemon, paint, curry paste and carbolic soap) and four Black Country smells (canal water, burnt rubber, Teddy Grays herbal tablets and faggots). Small, numbered tubs were used as containers for each smell, but the contents were disguised and not visible when the tub was opened.

To record responses, an 18-page booklet was developed. This included questions concerning demographic information (age, gender, ethnicity and location), as well as questions that had to be answered in response to each smell.

For each smell, there were questions asking participants to identify the smell and rate it on familiarity, intensity and pleasantness. The ratings were on a seven-point scale (1 = "Not at all" and 7 = "Very"). The next set of questions asked participants to describe any memories evoked by the smell, state their age at the time of the event and rate the memory on its significance, detail and pleasantness (again on a seven-point scale). The final question assessed whether the memory could be tied to a specific place or location, and whether the memory came from the blind smelling of the tub or after the name was revealed. The last page of the booklet asked participants to identify smells and memories they associated with the Black Country.

Design and Procedure

After receiving information about the task and its purpose, participants provided their written informed consent. They then moved onto the main task, which was completed at tables seating four to seven

individuals. Participants had to select one of the tubs, open it and smell the contents, and then complete the appropriate parts of the questionnaire. Firstly, they tried to identify the smell and rate the smell on three dimensions. Next, they tried to recall a specific memory evoked by the smell, provide a brief description of the memory and date it. The memory itself was then rated on three dimensions and location information provided. If participants could place their memory somewhere in the Black Country, they were asked to add a sticker onto a map (with each sticker colour representing a particular smell). This was repeated until all eight smells had been experienced. During this first phase, the name of the smells had not been revealed (blind smelling). Once all participants had completed the initial smelling/recall attempt, the contents of all tubs were identified and participants were asked to respond to any smells that had not been completed in the first phase. Finally, they wrote down any smells and memories they could associate with the Black Country. The procedure took approximately 45 minutes.

One of the main variables of interest was the type of smell, and whether it had been categorised as general or specific to the Black Country. In addition, and due to the link between smell and childhood memory, the place in which participants had spent their childhood was particularly relevant. Participants were therefore placed into one of two childhood location groups: those who spent their childhood in the Black Country ($N = 24$) or those who had grown up elsewhere ($N = 28$). These variables were an important component of the subsequent analysis.

RESULTS

Fiver major areas were explored when analysing the data:

- The ability to identify smells.
- Ratings of the smells on familiarity, intensity and pleasantness.
- The ability of smells to evoke autobiographical memories.
- The age at which recalled memories were formed.
- Ratings of the significance, detail and pleasantness of recalled memories.

Identifying smells

Participants were asked to state what they thought each tub contained, based purely on the smell. Scoring of responses was generous, with roughly accurate answers being classed as correct. Missing responses were classed as incorrect. The proportion of correctly identified smells was then computed for each participant. On average, participants were correct less than half of the time ($M = 0.44$, $SD = 0.20$), but there were differences according to the type of smell. A 2 (smell: Black Country vs. general) x 2 (childhood location: Black Country vs. other) mixed ANOVA found a significant main effect of smell, $F(1, 50) = 27.29$, $p < .001$, $\eta_p^2 = 0.35$, caused by poorer accuracy for Black Country ($M = 0.35$) than general ($M = 0.54$) smells. The main effect of childhood location, $F(1, 50) = 1.91$, $p = .173$, $\eta_p^2 = 0.04$, and the interaction, $F(1, 50) = 2.68$, $p = .108$, $\eta_p^2 = 0.05$, were both non-significant. However, as seen in Table 4, two of the Black Country smells were particularly difficult to identify (participants were far less likely to correctly identify smells of burnt rubber and faggots), whereas the smell of paint was more likely to be correctly identified than not.

Table 4

Mean Proportion of Responses for Correctly Identifying Each Smell and Associated Chi-Square Results

Tub	Mean proportion correct (<i>SD</i>)	Chi-square
1: Lemon	0.56 (0.50)	$\chi^2(1) = 0.69$, $p = 0.405$
2: Canal water	0.52 (0.50)	$\chi^2(1) = 0.08$, $p = 0.782$
3: Paint	0.67 (0.47)	$\chi^2(1) = 6.23$, $p = 0.013^*$
4: Burnt rubber	0.11 (0.32)	$\chi^2(1) = 30.77$, $p < 0.001^*$
5: Teddy Grays herbal tablets	0.56 (0.50)	$\chi^2(1) = 0.69$, $p = 0.405$
6: Curry paste	0.44 (0.50)	$\chi^2(1) = 0.69$, $p = 0.405$
7: Carbolic soap	0.50 (0.50)	$\chi^2(1) = 0$, $p = 1$
8: Faggots	0.17 (0.38)	$\chi^2(1) = 22.23$, $p < 0.001^*$

* = significant result.

Ratings of the smells

The ratings of smell familiarity, intensity and pleasantness were assessed using a one-way repeated measures ANOVA, with the descriptive statistics being shown in Table 5. Differences were found among the eight smells in their familiarity, $F(7, 280) = 10.15$, $p < .001$, $\eta_p^2 = 0.20$, intensity, $F(7, 266) = 5.60$, $p < .001$, $\eta_p^2 = 0.13$ (Greenhouse-Geisser corrected), and pleasantness, $F(7, 252) = 24.06$, $p < .001$, $\eta_p^2 = 0.40$.

Table 5

Mean Ratings (SD) of Familiarity, Intensity, and Pleasantness for Each Smell

Tub	Familiarity	Intensity	Pleasantness
1: Lemon	5.25 (1.67)	5.23 (1.29)	5.44 (1.40)
2: Canal water	4.90 (1.57)	5.08 (1.51)	3.08 (1.51)
3: Paint	5.78 (1.31)	5.74 (1.26)	3.71 (1.80)
4: Burnt rubber	3.77 (1.95)	4.61 (1.71)	2.79 (1.40)
5: Teddy Grays herbal tablets	5.68 (1.54)	5.76 (1.20)	5.47 (1.43)
6: Curry paste	4.90 (1.77)	5.42 (1.64)	4.21 (1.83)
7: Carbolic soap	4.76 (1.99)	5.32 (1.57)	4.02 (1.86)
8: Faggots	5.33 (1.51)	4.98 (1.42)	4.78 (1.58)

Sidak post-hoc tests found that the smell of burnt rubber was significantly less familiar than all other smells (with the exception of carbolic soap, where the difference was marginal, $p = .061$). Burnt rubber was also rated as significantly less intense than paint ($p < .001$) and Teddy Grays ($p = .006$). Additionally, the smell of faggots was rated as significantly less intense than Teddy Grays ($p = .004$) and paint ($p = .021$). For pleasantness, a variety of differences emerged among the various smells, with lemon and Teddy Grays being rated as significantly more pleasant than the majority of other smells, and canal water, paint and burnt rubber being rated as particularly unpleasant. Indeed, canal water and burnt rubber were scored as significantly less pleasant than all other smells (except paint). The smell of paint was rated as less pleasant than lemon, Teddy Grays and faggots.

In addition, there were significant correlations ($p < .01$) between the three dimensions of familiarity, intensity and pleasantness (see Table 6). Thus, a smell rated as high in familiarity was also likely to be rated as high in intensity and pleasantness.

Table 6

Pearson's Correlations Between Total Intensity, Familiarity and Pleasantness Ratings

	Pleasantness	Familiarity
Intensity	0.42	0.69
Familiarity	0.47	-

Next, these data were assessed using a 2 (smell: Black Country vs. general) x 2 (childhood location: Black Country vs. other) mixed ANOVA. For familiarity ratings, there was a significant effect of smell, $F(1, 39) = 4.22$, $p = .047$, $\eta_p^2 = 0.10$, caused by lower ratings of familiarity for Black Country ($M = 5.01$) than general ($M = 5.33$) smells. There was also a main effect of childhood location, $F(1, 39) = 9.52$, $p = .004$, $\eta_p^2 = 0.20$, with those who grew up in the Black Country rating the smells as more familiar ($M = 5.58$) than those who grew up elsewhere ($M = 4.41$). However, there was no significant interaction, $F(1, 39) = 2.02$, $p = .164$, $\eta_p^2 = 0.05$.

The same type of ANOVA was used to assess intensity and pleasantness ratings. For intensity, the only effect was of smell type, $F(1, 37) = 10.18$, $p = .003$, $\eta_p^2 = 0.22$, with Black Country smells being rated as less intense ($M = 5.12$) than general smells ($M = 5.57$). The main effect of childhood location ($p > .20$) and the interaction ($p > .75$) were both non-significant. Similarly, for pleasantness, the only effect was of smell type, $F(1, 35) = 6.57$, $p = .015$, $\eta_p^2 = 0.16$, with Black Country smells being rated as less pleasant ($M = 4.05$) than other smells ($M = 4.45$).

Recall of memories

For each smell, participants were asked to recall a memory and write a description of the event. Using this data, it was possible to determine whether a memory was recalled or not, and the mean proportion of memories recalled was 0.61 ($SD = 0.31$). However, variability was high: some participants did not recall any memories, whereas others recalled memories in response to every smell. As expected, the ability to correctly identify a smell, and the familiarity with that smell, correlated with the total proportion of memories recalled (identification: $r[52] = .33, p = .017$; familiarity: $r[41] = .36, p = .023$). Thus, the ability of a smell to evoke a memory is highest when that smell is familiar.

A 2 (smell: Black Country vs. general) x 2 (childhood location: Black Country vs. other) mixed ANOVA was then used to examine the number of memories recalled, but this did not yield any reliable effects ($F_s < 1$). However, examination of the individual smells revealed that some were particularly effective at prompting memories. This was determined using a chi-square test, corrected using the Bonferroni adjustment to control for Type I errors.

Paint ($\chi^2[1] = 11.08, p = .008$) and Teddy Grays ($\chi^2[1] = 7.69, p = .047$) were particularly effective at evoking memories. As shown in Figure 1, almost three quarters of participants recalled a memory in response to the smell of paint, and approximately 70% could recall a memory in response to the Teddy Grays smell.

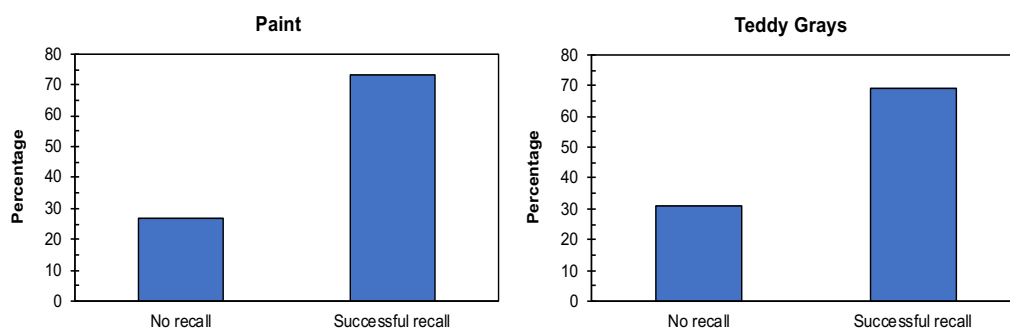


Figure 1. Percentage of participants recalling or failing to recall a memory in response to the smell of paint and Teddy Grays. These two smells were most effective at eliciting memories.

Dating the memory

When a memory was recalled, participants were asked to write down their approximate age when the event happened. Some participants were unable to specify a precise age, and consequently these responses were grouped into five categories: childhood memory (up to the age of 12), adolescent memory (13-19), adult memory (20+), general memory (where a precise memory could not be recalled and participants may have remembered a general lifetime theme) or no recall. Figure 2 shows the total number of memories recalled by all participants and collapsed across all eight smells, separated into the four different age categories. As is clearly evident, the vast majority of memories did come from childhood.

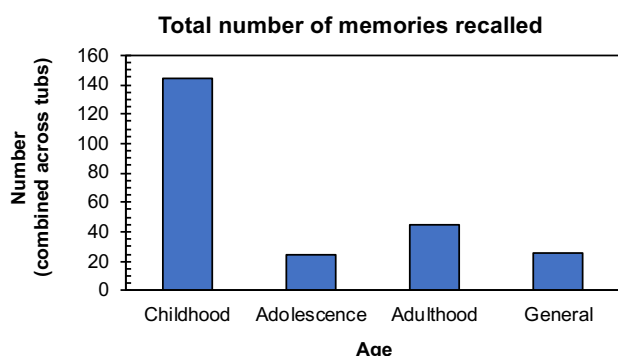


Figure 2. Total number of memories recalled across all smells and participants, according to the age at which the memory was formed.

The analysis of these data focussed only on cases where a memory was recalled. Using a chi-square analysis, the number of childhood, adolescent, adult and general memories was assessed for each smell. For seven of the eight smells, the chi-square test was significant (all p s < .05), and participants were much more likely to recall a memory from childhood than a memory at another time in their life. The only exception to this was the smell of paint, which yielded a similar number of childhood and adulthood memories.

Qualities of recalled memories

When memories were recalled, they were rated on their significance, detail and pleasantness. As participants could only rate a memory if they recalled one, the sample size was smaller here, so to assess these data each smell was compared using a Mann-Whitney U test, comparing the two childhood locations. The Bonferroni correction was applied to control for Type I errors.

The majority of comparisons were non-significant, but some differences emerged. For paint, the significance and pleasantness of the evoked memories were rated as higher in those who grew up in the Black Country than those who grew up elsewhere (significance: $U = 105$, $p = .047$; pleasantness: $U = 100$, $p = .039$). This is shown in Figure 3.

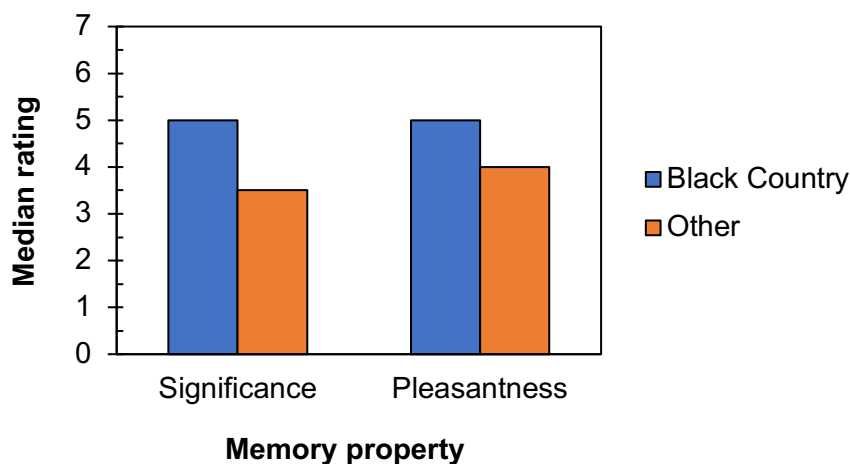


Figure 3. Ratings of the significance and pleasantness of memories recalled in response to the smell of paint according to whether participants spent their childhood in the Black Country (blue columns) or another location (orange columns).

There were also differences between the groups in response to the smell of Teddy Grays. The significance of the memories evoked by Teddy Grays was higher for those who grew up in the Black Country than those who grew up elsewhere ($U = 75$, $p = .016$), as was the detail of the evoked memories ($U = 84$, $p = .024$). See Figure 4 (next page).

Additional analyses

The results reported above formed the major set of analyses. However, of additional interest were potential gender and age differences. Gender differences were rare and did not influence memory recall performance, but women rated the smells as more intense than males, on average (women: $Mdn = 5.69$; men: $Mdn = 4.75$; $t[37] = -2.99$, $p = .005$).

To assess age differences, participants were arranged into four groups (ages 18-44: $N = 12$; ages 45-54: $N = 14$; 55-64: $N = 10$; 65+: $N = 16$). The 18-44 group was formed due to the smaller number of participants aged under 44. As some groups were quite small, these data were assessed using the non-parametric Kruskal-Wallis test, but age differences were found in ratings of intensity ($\chi^2[3] = 9.28$, $p = .026$), familiarity ($\chi^2[6] = 16.23$, $p = .001$) and pleasantness ($\chi^2[6] = 10.56$, $p = .014$). There were also differences in the total number of memories recalled ($\chi^2[6] = 10.30$, $p = .016$), and more specifically differences in the number of memories recalled in response to the Black Country smells ($\chi^2[6] = 10.91$, $p = .012$).

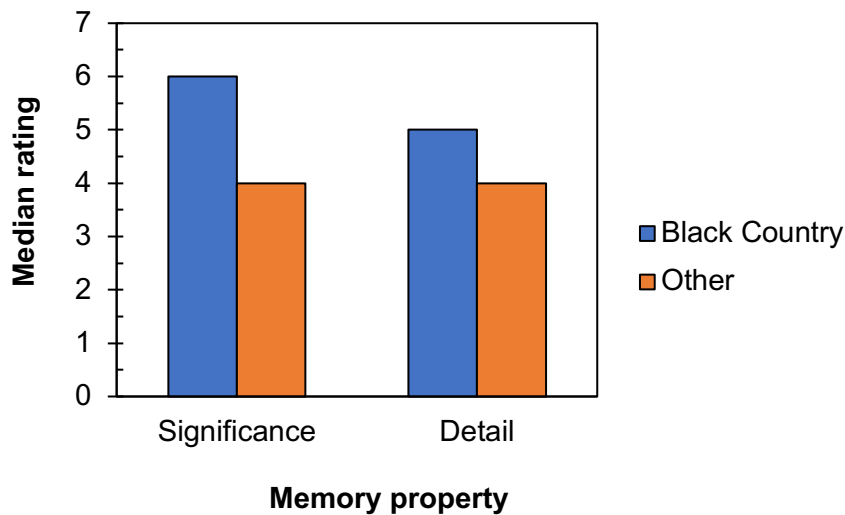


Figure 4. Ratings of the significance and detail of memories recalled in response to the smell of Teddy Grays according to whether participants spent their childhood in the Black Country (blue columns) or another location (orange columns).

The differences emerging from the Kruskal-Wallis analysis were further explored using pairwise comparisons (Mann-Whitney U tests), corrected with the Bonferroni adjustment.

The age differences in intensity and pleasantness ratings were primarily driven by lower intensity ratings in those aged 18-44 than those aged 45-54 (intensity: $U = 18.50$, $p = .012$; pleasantness: $U = 17.50$, $p = .012$). For familiarity ratings, participants aged 45-54 had significantly higher familiarity ratings than all other age groups (all $ps < .05$).

The age differences in the recall of memories was caused by lower recall scores in those aged 65+ than those aged 45-54. This applied to both the total number of memories recalled ($U = 48.50$, $p = .024$) and the number of memories recalled in response to Black Country smells ($U = 47.50$, $p = .032$).