

*Article***Bottled vs. Canned Beer: Do They Really Taste Different?****Andrew Barnett**¹, **Carlos Velasco**^{2,3} and **Charles Spence**^{3,*}

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Abstract: People often say that beer tastes better from a bottle than from a can. However, one can ask whether this perceived difference is reliable across consumers; And, if so, whether it is purely a psychological phenomenon (associated with the influence of packaging on taste perception), or whether instead it reflects some more mundane physico-chemical interaction between the packaging material (or packing procedure/process) and the contents. We conducted two experiments in order to address these important questions. In the main experiment, 151 participants at the 2016 Edinburgh Science Festival were served a beer in a plastic cup. The beer was either poured from a bottle or can (i.e., a between-participants experimental design was used) and the participants were encouraged to pick up the packaging in order to inspect the label before tasting the beer. The participants rated the perceived taste, quality, and freshness of the beer, as well as their likelihood of purchase, and their estimate of the price. All of the beer came from the same batch (from Barney's Brewery in Edinburgh). Nevertheless, those who evaluated the bottled beer rated it as tasting better than those who rated the beer that had been served from a can. Having demonstrated such a perceptual difference in terms of taste, we then went on to investigate whether people would prefer one packaging format over the other when the beer from bottle and can was served to a new group of participants blind (i.e., when the participants did not know the packaging material). The participants in this control study (N = 29) were asked which beer they preferred or else could state that the two samples tasted the same. No sign of preference was obtained under such conditions. Explanations for the psychological impact of the packaging format, in terms of differences in packaging weight (between tin and glass), and/or prior associations of quality with specific packaging materials/formats (what some have chosen to call 'image molds') are discussed.

Keywords: packaging; beer; image mold; packaging weight; taste

Introduction

In casual conversation, people often say that beer from a bottle tastes better than from a can. Such anecdotal reports seem to be initially reliable as they are consistent with the results of a preliminary table (see **Table 1**). But then the question is: what could explain such a difference? One possibility here is that the packaging conveys some sort of taint on the contents (e.g., as was famously the case for tinned tomatoes; see Rosenbaum, 1979). Alternatively, however, one might hypothesize some difference (e.g., in oxygen) introduced by bottling/canning. More interestingly, though, is the possibility that the packaging may be exerting some sort of psychological impact over people's perception of the product itself (see Hine, 1995; Spence, 2016; Spence & Piqueras-Fiszman, 2012; Velasco et al., 2016, for reviews of the influence of packaging on product perception).

Table 1. Here, we present the results of a preliminary study designed to assess people's preferred beer format. 62 participants (30 females, M age = 29.40 years, SD = 9.32) were asked about their beer drinking frequency and preferred beer format on Prolific Academic (<http://prolific.ac/>) in exchange for £0.33. 61.29% believe that a beer tastes better from a bottle, 27.42% that a beer tastes the same from a bottle or a can, and 11.29% that it tastes better from a can.

Gender	Beer drinking frequency	A beer tastes better from		
		Bottle	Can	It all tastes the same
Female	Never	1	1	4
	Once a year	2	-	3
	Once a month	6	-	2
	Once a week	7	1	1
	Every few days	1	1	-
	Every day	-	-	-
Male	Never	2	-	3
	Once a year	4	-	-
	Once a month	5	1	3
	Once a week	4	2	-
	Every few days	5	1	1
	Every day	1	-	-
Total frequency		38	7	17
Total percentage		61.29%	11.29%	27.42%

In terms of the psychological impact of packaging on product perception, this could have a number of explanations. On the one hand, one might consider any differences in the visual appearance, sound, or feel of the packaging. There is, after all, an emerging literature showing that very often our feelings about the packaging appear to be transferred to our perception of the contents of that packaging (e.g., Krishna & Morrin, 2008). This is known as 'sensation transference' (see Spence & Piqueras-Fiszman, 2012, for a review). Alternatively, however, certain packaging formats take on an iconic status and become what are referred to as 'image molds' (see Spence, 2016a, for a review). Think only of the Coca-Cola bottle as one iconic packaging format (see Gates et al., 2007; Prince, 1994; Velasco et al., 2016), the Kikkoman dispenser bottle, or even the Campari Soda bottle developed by the Italian Futurist Fortunato DePero back in 1932 (and still on the shelves today). These are all examples of image molds. The suggestion here is that presenting a product in such a distinctive packaging format, will cue the consumer to the likely product attributes, much as revealing the brand name of a beer has been shown to do (e.g., Allison & Uhl, 1964; Anon. 1962).

In the present study, we first conducted a between-participants experiment at the 2016 Edinburgh Science Festival in order to determine what impact, if any, the type of receptacle (i.e., the packaging) had on the perceived taste of beer. One group of participants was given a plastic cup of

beer to taste that they saw being poured from a bottle. Another group of participants also rated beer from a plastic cup, but in this case they saw the beer being poured from a can instead (see **Figure 1**). Importantly, the beer was from the same batch (donated by Barney's Beer in Edinburgh, a small micro-brewery; see <http://barneysbeer.co.uk/>) so that all that varied was the receptacle in which the drink was served and consumed. That said, the participants were encouraged to pick up the bottle or can in order to inspect the label before rating the beer.



Figure 1. The bottle and can of beer used in the present study.

Methods

Participants: A total of 151 participants (80 females, Mean age = 31.83, SD = 8.70, age range 20-68, information based on 144 people who provided their age) took part in the study. The study followed a between-participants experimental design. 69 of the participants were served a bottled beer (35 females, M age = 33.27, SD = 10.12, ranging from 20-68 years), while a further 82 were served beer from a can (45 females, mean age = 30.61, SD = 7.13, ranging from 20-57 years).

Apparatus and materials: Two different presentations of the same beer were used in the experiment. The bottled and canned beers had a weight of 560g and 365 g, respectively. Both had a content of 330ml.

Procedure: Most of the testing was conducted at the opening night of the Edinburgh Science Festival on the 24th March 2016 (<http://www.sciencefestival.co.uk/>). Specifically, the respondents were invited to participate in the test and given a sample of beer in a plastic cup. They were shown the bottle or can and were invited to pick up a full bottle or can and to read the label prior to rating the beer that they had been given to taste. Bottle tasting was conducted for roughly an hour, followed by can tasting for the next hour, and so on throughout the evening. Each participant was given a pencil-and-paper questionnaire to complete, which included questions concerning their demographic details as well as their evaluation about the beer (e.g., their perceived taste, quality, freshness, price, and likelihood of re-purchase, see Appendix 1). A few additional samples (bottle only) were gathered at an event the following evening using exactly the same methodology.

Results

The data from eight participants who reported that they took part in a similar experiment before, were excluded from the analyses. In addition, data from six additional participants who failed to respond to all the questions associated with the beer samples, were also excluded from the analyses. The analyses were conducted in the remaining 137 participants (66 females, Mean age = 31.96, SD = 8.80, age range 20-68, see also **Table 2**, for a summary of the demographic variables as a function of group). No significant differences were observed in terms of how often the participants in the two groups drank beer (Mann-Whitney $U = 2200.50$, $p = .534$, $r = 0.053$). On average, the participants reported drinking beer about once a month ($M = 5.89$, $SD = 1.60$).

Table 2. Descriptive statistics for the demographic variables of the participants in the groups that drank the beer from bottles and cans, respectively.

Demographic variables		Bottle	Can
Age	Mean	33.23	30.84
	SD	10.14	7.31
Gender	Female	30	36
	Male	35	36
Do you know Barney's Beer	Yes	33	29
	No	32	43
Drinking frequency	Mean	5.79	5.97
	SD	1.63	1.57

Kolmogorov-Smirnov tests revealed that none of the variables were normally distributed ($ps \leq .001$). For that reason, Mann-Whitney tests were performed on the taste, quality, freshness, likely, and price ratings. The results are summarized in **Table 3**.

Table 3. Mann-Whitney tests. Significant terms highlighted in bold.

Variable	Bottle		Can		Mann-Whitney U	p	Effect size (r)
	Mean	SD	Mean	SD			
Taste	7.03	1.09	6.62	1.29	1886.50	.039	0.176
Quality	7.38	1.13	7.10	1.13	1938.00	.067	0.157
Freshness	7.62	1.22	7.49	1.29	2223.00	.600	0.045
Purchase likelihood	6.72	1.55	6.63	1.92	2285.50	.811	0.020
Price	3.70	0.85	3.71	0.65	2338.50	.658	0.038

The results demonstrate that participants rated the beer as tasting significantly better when consumed from the bottle than from the can. There was a borderline-significant effect on the perceived quality ratings as well. Once again, people's perception of the quality of the drink was slightly higher for the beer served from the bottle than from the can (see **Figure 2**).

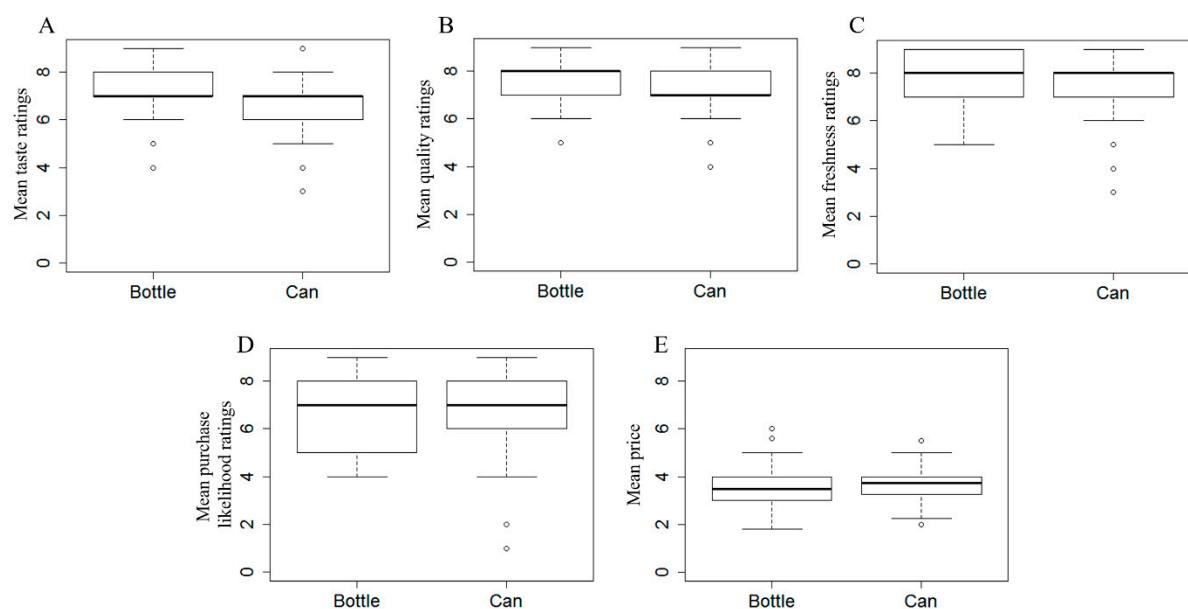


Figure 2. Boxplots for the different ratings as a function of group. Boxplots visualize the distribution of the data based on the minimum value, first quartile, median, third quartile, and maximum value. The points that are shown individually are those which fall in the lower or upper percentiles. Boxplots allow one to get a better picture of the distribution of the data (Weissgerberg, Milic, Winham, & Garovic, 2015).

An important concern here is whether some taint or physico-chemical difference might have been introduced as a function of the packaging materials used. In the past, it is certainly true that tin cans used to give a detectable taint to certain food and beverage products (e.g., tinned tomatoes; see Rosenbaum, 1979). Alternatively, it could be hypothesized that there might be better oxygen-control in the case of bottling vs. canning, or vice versa.¹ Although we thought these possibilities unlikely in the present case, we nevertheless thought it prudent to conduct a blind tasting control study in which 29 participants were served two glasses of beer blind (one from bottle the other from can) and had to indicate whether they preferred one of the samples or both equal (see Appendix 2 for the questionnaire used). The blind taste test was conducted at the SciMart event in Edinburgh on 3rd April 2016. In this case, the participants were not told anything about the beers that they were tasting.

The results revealed no differences between the bottled or canned beer when served blind – specifically 13 said that they preferred the canned beer, 12 preferred the bottled beer and 4 said the two samples tasted the same. Hence, in this case at least, the impact of packaging format on the preference for the beer would appear to be entirely psychological in nature (though admitting the small sample size).

Discussion

The results of the present study support the folk notion that beer tastes better from a bottle than from a can (see Spence, 2016a; Spence & Piqueras-Fiszman, 2012, for reviews). The packaging in which the beer was served in the present study was shown to exert a significant influence over the perceived taste of the beer, even though the beer itself was tasted from the same plastic cup in all cases. (One can only imagine how much more pronounced the effects of packaging may have been had participants tasted the beer direct from the packaging. Be aware though, that this kind of design would likely also introduce additional variability in terms of aroma perception given the differing opening formats of bottles versus cans; see Spence, 2016b.) Intriguingly, consistent trends for the bottled beer to be preferred were also demonstrated on perceived quality (though they just failed to reach statistical significance with the convenience sample collected here, thus, potentially deserving follow-up in future research). Here, it is important to consider whether differences in packaging material (e.g., glass vs. tin, therefore potentially their texture) or weight were doing the work in terms of driving the perceived differences in taste, or rather if it was the 'image mold' that was critical (Hine, 1995; Spence, 2016a). It is, of course, possible that both factors may have contributed to the effects we see here.

¹ Regarding the effect of oxygen ingress on flavour - bottles have lower oxygen content at filling. However, note that the deterioration due to oxygen is a long-term effect. As both beers were presented relatively fresh after packaging (about a week), oxidation shouldn't be a factor here anyway.

'Image mold' is the term introduced by Louis Cheskin to describe the fact that certain arbitrary packaging formats/shapes come to be associated with specific brands/product categories (Cheskin, 1957). The classic example here is the Wishbone Salad dressing bottle shape. This has subsequently come to define the packaging shape for the category (see Velasco et al., 2016, for a review). In terms of the beer category, one can think of the distinctively-shaped steel Sapporo beer can as potentially representing such an image mold, as can the distinctively-shaped Brahma beer bottle (see Spence & Piqueras-Fiszman, 2012, for a review). Hence, when a product is packaged in packaging that has an identifiable image mold, it can sometimes act as a cue to the brand of the product. Hence, it may well be the brand awareness that is doing the work in terms of modulating people's perception of the taste/quality of the contents as much as the physical attributes of the packaging itself.

Consumers may well have different associations with bottled versus canned beer. In fact, one explanation for the significant difference obtained in the present study between bottled and canned beer relates to the fact that the volume manufacturers moved from bottles to cans as the principal beer packaging format during the 1980s and 1990s. This change in packaging format coincided with an increase in 'off-trade' sales at the expense of 'on-trade', not to mention the rise of the supermarkets as the biggest channel for sales. Relevant here, cans were used by volume brewers and multiple grocers as a source of discounting and the value of beer in this format declined in real terms over this period. It can be hypothesized that buyers increasingly came to associate cans as a value pack format. Consequently when 'craft beer' emerged as a category it was predominantly packaged in bottles (a more commercially accessible format for low volume production) and had a premium price and publicity. Thus bottles, which had all but disappeared in the preceding two decades returned with a premium or quality association. That said, things look too be changing once again. This is because cans are now being presented as the fresher, more convenient, packaging format by craft brewers (led by those working out of the US). That said, it would appear to be proving hard to get this message through to the consumer, except in exceptional cases such as with the Sapporo can or perhaps the Heineken can asymmetrically covered with tactile paint (see Anon., 2011; Spence & Piqueras-Fiszman, 2012).

While it has long been anecdotally asserted that the packaging material (or image mold) exerts a significant impact on what consumers have to say about the taste of the contents (Hine, 1995), rigorous empirical data in support of such a notion have, until now, been lacking. That said, the last few years have seen growing interest in the impact of the receptacles in which we drink on people's perception of the contents (see Spence & Wan, 2015, 2016). Furthermore, the results of the present study are especially interesting in the context of the recent drive toward cans being used as the preferred packaging material for craft beers these days in North America.

Alternatively, however, as was mentioned in the introduction, it could be something to do with the feel of the packaging in the hand. There are undoubtedly salient perceptual differences in compressibility/firmness, temperature (or rather thermal diffusivity; see Bergmann Tiest & Kappers, 2009), and texture (all of which have been shown to influence taste ratings, e.g., see Biggs et al., 2016; Krishna & Morrin, 2008; Piqueras-Fiszman & Spence, 2012). Though perhaps the most noticeable difference between bottle and can is in terms of the weight. The filled bottle used in the

present study weighed in at 560 grams, whereas the can weighed 365 grams (330 ml of beer in both cases). There is a growing body of research to show that adding weight to product packaging, typically results in an enhancement in people's perception of the product (e.g., see Gatti et al., 2014; Kampfer et al., submitted; Piqueras-Fiszman & Spence, 2012; Spence & Piqueras-Fiszman, 2011).

The one other thing to consider here is whether the bottle and can are perceived visually to have the same weight. There might, for instance, be illusions of different volume, despite the fact that both vessels actually contained the same volume of beer (cf. Attwood, Scott-Samuel, Stothart, & Munafò, 2012; Wansink & van Ittersum, 2003, 2005). Finally, here, one should perhaps also consider the sound associated with opening and pouring from bottles and cans (see Spence & Wang, 2015, for a review). Once again, this can provide useful information to help the trained consumer distinguish between different brands of beer (e.g., see Stummerer & Hablesreiter, 2010, p. 105, for one particularly impressive example).

Taken together, then, the results of the present study demonstrate that the packaging in which a beer is served can influence the perceived taste of the product. Our results also provide support for those companies wanting to promote glass over other packaging materials.² Ultimately though, of course, the decision about which packaging material to use reflects a trade-off between the cost of different materials/formats, the cost of transporting them to market, not to mention questions of sustainability and recyclability (Bland, 2008), and the impact (psychological or otherwise) of packaging material on perceived taste and quality judgments. In premium categories, such as fine wine, the producers clearly feel it worthwhile to make their glass wine bottles significantly heavier in order to convey the perception of quality (see Piqueras-Fiszman & Spence, 2012a). Premium beer producers might be well advised to do the same. That said, there have been reports in the North American craft beer market suggesting that people's perception of canned beer has been rising in recent years (see also Elzinga et al., 2015).

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² E.g., See the *Vidrio es vida* campaign by Peldar, highlighting the sonic benefits of glass bottles over other beverage packaging materials; see <https://www.youtube.com/watch?v=pQAcY8oee5Y>.

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Appendix 1: Beer Taste Test

Thank you for taking part in our taste test! Firstly, please answer a few questions about yourself.

Age:	<input type="checkbox"/> Male <input type="checkbox"/> Female
Today's date:	The time:
Have you ever drunk Barney's Beer before?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Have you participated in this taste test already?	<input type="checkbox"/> Yes <input type="checkbox"/> No

On average, how often do you drink beer?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Several times a day	(Nearly) every day	A few times a week	Once a week	A few times a month	Once a month	Every few months	Once a year	Less often	Never

Now, please tell us what you thought of the beer.

On a scale of 1 to 9, how would you rate the taste of the beer?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8	9
Very poor				Average				Very good

And how would you rate the quality of the beer?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8	9
Very low				Average				Very high

And how would you rate the freshness of the beer?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8	9
Very low				Average				Very high

How likely would you be to buy the beer in future?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8	9
Very unlikely				Neither likely nor unlikely				Very likely

Imagine you are in the pub. A friend is going to the bar and you ask him/her to buy you a Barney's Beer, but you don't know how much it costs. You name a price and tell your friend to buy the beer if it costs this much or less, but not if it costs any more as it would be too expensive for this particular beer - and you will pay your friend back. What price do you name as the maximum you would be willing to pay?

£ _____

Finally, please briefly give your thoughts on the beer:

Appendix 2: Beer Taste Test

Thank you for taking part in our taste test! Firstly, please answer a few questions about yourself.

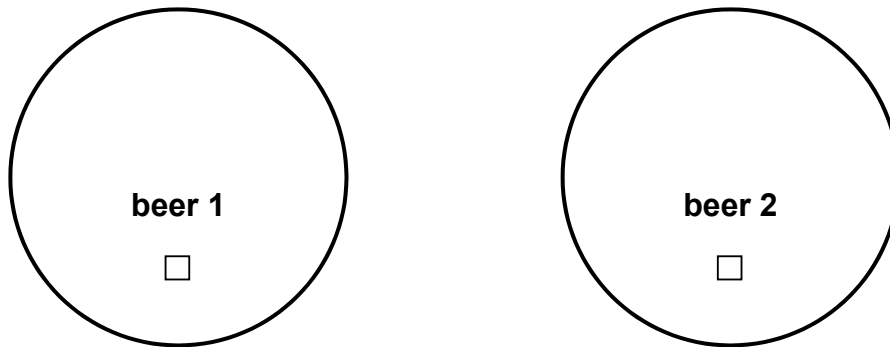
Age:	<input type="checkbox"/> Male <input type="checkbox"/> Female
Today's date:	The time:
Have you ever drunk Barney's Beer before?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Have you participated in this taste test already?	<input type="checkbox"/> Yes <input type="checkbox"/> No

On average, how often do you drink beer?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Several times a day	(Nearly) every day	A few times a week	Once a week	A few times a month	Once a month	Every few months	Once a year	Less often	Never

Now, we are going to give you two beer samples to try.

Could you tell us which you prefer, or if you like them equally?



Tick which beer you prefer or...

'I like both beers equally'



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