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Review article

# The psychology of condiments: A review

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ABSTRACT

Condiments and sauces constitute a ubiquitous presence on dinner tables the world over. Yet, that said, they have received surprisingly little serious scientific attention from researchers interested in gastronomy and food science. Here, I take a closer look at the psychology behind our choice of condiments, both when selecting what to purchase on the supermarket shelf, and when deciding which condiment(s) will best compliment a particular dish. Not only do condiments enhance the taste/flavour of a dish (e.g., they often contain flavour-enhancing elements such as salt and umami), but they may also be used to add some colour/textural interest to whatever is being consumed. And, as argued in this review, the actual taste experience (of the condiment/sauce) is often determined as much by the packaging/branding as by the product itself. Indeed, condiments are amongst the strongest and best-loved brands in the marketplace. Hence studying what has allowed them to be so successful for so long likely holds some important lessons for the design of many other food and beverage categories as well. This review of the literature is targeted at those working in the manufacturing/marketing of condiments.

## Introduction

Pretty much wherever people go out to eat, excepting perhaps the high end restaurant,[1] there will be a selection of condiments, sauces, and seasonings on the table. This ever-present accompaniment to meal times has, though, been seemingly neglected by researchers interested in gastronomy and food science. To illustrate the point, condiments hardly get a mention in the near 900 pages of McGee's classic (1984/2004) volume, *McGee on food and cooking*. As far as I can tell, all the great man has to say regarding condiments is the following "...many of them foods preserved and transformed by fermentation: sour and aromatic vinegar, salty and savory soy sauce and fish sauce, salty and sour pickles, pungent and sour mustard, sweet and sour and fruity ketchup."[2] A similar point is made by Tom Nealon when he notes that: "In Reay Tannahill's pioneering study *Food in History*, the index shows exactly zero mentions of condiments."[3] Nevertheless, one can find out plenty about the psychology and marketing of food and drink from a cursory, or better still a careful, look at what is going on in the condiments aisle/shelf. In fact, it can be argued that there is much more competition in the condiment aisle currently than for many other categories of food/beverage product. As such, the multisensory design standards for condiment packaging etc. often tend to be much higher/better than elsewhere in the supermarket aisles.

This literature review is targeted at those involved in the manufacture/marketing of condiments. It starts by reviewing the literature, such as it is, on the condiments category as a whole, and the relevant individual differences in preference. The following sections then trace the consumer journey with branded condiments, starting with the selection of the product from the supermarket shelf (where visual cues are pretty much the only thing that is important), though getting the product home and using it, when all sensory aspects of the packaging (i.e., its feel, sound, visual appearance etc.) matter. Thereafter, those factors that may affect the taste/flavour of the condiment are considered, and a link is made to the results of blind taste tests. The review ends by taking a look into the near future, with a brief summary of augmented reality (AR) enhanced product design/innovation, and the connecting of condiments with the growing trend of personalization.

Cookbooks generally distinguish between seasonings and condiments. The former referring primarily to those herbs, spices, and herb/spice mixes that are used during the preparation of food, while the latter, by contrast, tends to consist of a combination of ingredients (often including spices) added by the consumer at the point of consumption.[4] According to one commentator, the term 'condiment' comes "from L. *condimentum* "spice, seasoning, sauce," from *condire*

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[1] Spence, C. (2017). *Gastrophysics: The new science of eating*. London, UK: Viking Penguin.

[2] McGee, H. (1984/2004, p. 581). McGee on food and cooking: The science and lore of the kitchen (rev. ed.). New York, NY: Scribner.

[3] Nealon, T. (2010). De condimentis (1). *HiloBrow*, **September 7th**. http://hilobrow.com/2010/09/07/de-condimentis-1/.

[4] Sherman, P. W., & Billing, J. (1999). Darwinian gastronomy: Why we use spices. Spices taste good because they are good for us. *BioScience*, **49**, 453–463. See also Smith, A. F. (May 1st, 2007). *The Oxford companion to American food and drink*. Oxford, UK: Oxford University Press..

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1878-450X/ 

"to preserve, pickle, season" (variant of *condere* "to put away, store"). As its etymology suggests, a condiment must have a shelf life — which, until recently, means it was vinegar-, salt-, or sugar-based. Also, it must be at least slightly more complicated, and moister, than a seasoning."[5] That said, definitions vary with some including salt, pepper, or even cheese as condiments. Some use the term interchangeably with 'seasoning', while others use a much more restrictive definition. Personally, I find myself in agreement with Farrell's definition of condiments as: "prepared food compound[*s*], containing one or more spices", which are added to food after it has been prepared, and includes mustards, ketchups, and mint sauce.[6]

Condiments have a long history in cuisine: Think here only of the garam and fish sauce of ancient Greece and Rome. According to Tom Nealon: "it turns out that *Apicius*, the cookbook compiled from 4th/5th-century Roman cuisine, boasts an entire section devoted to condiments (*De Condimentis*)."[7] Other very popular condiments include the Indian chutneys and the North American ketchup (once known as catsup) in the 20th Century.[8] Soy sauce also deserves a mention given how popular it is across parts of Asia. In recent years, spicy condiments have also grown in popularity in many western countries. So, for example, in the 1980s, spicy salsas apparently surpassed ketchup in the US in terms of their popularity, due to the major influence of Mexican cuisine.[9] Meanwhile, in the UK, spicy sauces have recently been growing in popularity with the rise of a range of exotic barbecue, *piri piri*, and chilli sauces.[10]

## Why do condiments exist?

More fundamentally, one might ask why condiments are such a common feature of dining tables around the world (both now and over recent centuries), and why there is still so much difference in the kinds of condiments that those from different countries/cultures reach for to spice-up/season their food. One answer here is that salt and umami, which are a common feature of many condiments, play an important role as flavour enhancers.[11] Some have even gone so far as to argue that tomato ketchup is an 'überfood', given that it typically touches, at least four of the basic tastes, salt, sweet, sour, and umami.[12] Of course, the bright colour shouldn't be neglected either in helping to add some visual interest to a dish. Branston pickle and piccalilli both add some crunch (providing both textural and sonic interest) due to the presence of preserved vegetables. Condiments like ketchup, being very familiar to so many of us, can also play an important role in helping children to eat their vegetables.[13] Returning to the second question posed at the start of this section, it perhaps makes sense to consider cultural differences in condiments as a natural consequence of the well-established cultural differences in taste/cuisine.

### *Individual differences*

Ultimately, though, the existence of condiments is probably also an acknowledgement of the very different worlds of taste in which we all live.[14] It is, for instance, well-known that some people have more of a sweet tooth than others.[15] There is also the oft-discussed difference between super-tasters and non-tasters (the former often argued to have more taste-buds on their tongue and enhanced taste perception, especially of bitter-tasting foods).[16] Condiments allow the consumer/diner to personalize the taste/flavour of their food (at least to a certain extent). In fact, one could turn this around and wonder why it is that condiments aren't even more ubiquitous than they are given the very different taste worlds in which we all live. Of course, these individual differences not only affect people's food preferences, they also affect people's preferences for condiments and sauces. For instance, Harold Moskowitz has conducted some very successful (and much publicized) commercial research for the food industry, segmenting consumers in terms of their preference for different sensory profiles in food (e.g., segmenting different groups of likers of smooth vs. chunky textured pasta sauces).[17] I return to a consideration of personalization and the condiment category toward the end of this piece. Having briefly considered the context of the condiment category, I want now, in the sections that follow, to trace the consumer journey with respect to condiments, looking at the various factors, both product intrinsic (such as the colour of the product) and product extrinsic (such as the colour, weight, feel, and even sound of the packaging) that can meaningfully affect the consumer's experience.

## Capturing customer attention in-store & conveying meaning

### *On the colour of condiments (and their packaging)*

Like any other food or beverage product, condiments are experienced through all of the consumer's/customer's senses – e.g., taste obviously, but also smell, sight, sound, and touch. For a start, just think about the bright and distinctive colour of the product itself, not to mention its packaging. What one sees being played out are the twin battles of, on the one hand, trying to capture the shopper's attention on the store shelf while, at the same time, making sure to correctly signal the type, or flavour, of product to the customer. No one, after all, wants to get home to find that they accidentally picked-up a jar of mustard when what they were really after was ketchup! Relevant here is the suggestion that 90% of the food and beverage brands that one finds in the supermarket use colour to convey relevant product information.[18]

[5] Nealon (2010).

[6] Farrell, K. T. (1990, p. 291). *Spices, condiments and seasonings* (2nd Ed.). MA, USA: Aspen Publishers.

[7] Apicius (1936). *Cooking and dining in Imperial Rome* (c. 1st Century; translated by J. D. Vehling). University of Chicago Press, Chicago.

[8] Soniak, M. (2012). What's the difference between ketchup and catsup? *Mental Floss*, **January 5th**. http://mentalfloss.com/article/29649/whats-difference-between-ketchup-and-catsup**;** Jurafsky, D. (2014). *The language of food: A linguist reads the menu*. New York, NY: Norton.

[9] McGee, H. (1984/2004, p. 418).

[10] Naylor, T. (2015). Tomato ketchup: The best and worst-taste test. *The Guardian*, **November 25th**. https://www.theguardian.com/lifeandstyle/2015/nov/25/tomato-ketchup-the-best-and-worst-taste-text.

[11] Breslin, P. A. S., & Beauchamp, G. K. (1997). Salt enhances flavour by suppressing bitterness. *Nature*, **387**, 563; See also Suwankanit, C., Dermiki, M., Kennedy, O. B., & Methven, L. (2013). *Umami: Suppressed by all other tastes but itself an enhancer of salty and sweet perception*. Poster presented at 10th Pangborn Sensory Science Symposium (11–15th August 2013, Rio de Janeiro, Brazil).

[12] Rozin, E. (1988). Ketchup and the collective unconscious. *Journal of Gastonomy*, **4(2)**, 45–56; Vilgis, T. (2012). Ketchup as tasty soft matter: The case of xantham gum. In C. Vega, J. Ubbink, & E. van der Linden (Eds.), *The kitchen as laboratory: Reflections on the science of food and cooking* (pp. 143–147). New York, NY: Columbia University Press.

[13] Cf. Pliner, P., & Stallberg-White, C. (2000). "Pass the ketchup, please": Familiar flavors increase children's willingness to taste novel foods. *Appetite,* **34**, 95–103; Rozin, E. & Rozin, P. (1981). Culinary themes and variations. *Natural History*, **90**, 6–14.

[14] Bartoshuk, L. (1980). Separate worlds of taste. *Psychology Today*, **14**, 48–49, 51, 54–56, 63; Blakeslee, A. F., & Fox, A. L. (1932). Our different taste worlds: P. T. C. as a demonstration of genetic differences in taste. *Journal of Heredity*, **23**, 97–107.

[15] Reed, D. R., & McDaniel, A. H. (2006). The human sweet tooth. *BMC Oral Health*, **6(Suppl 1)**: S17. doi: 10.1186/1472–6831-6-S1-S17.

[16] Miller, I. J., & Reedy, D. P. (1990). Variations in human taste bud density and taste intensity perception. *Physiology and Behaviour*, **47**, 1213–1219; Though see Garneau, N. L., Nuessle, T. M., Sloan, M. M., Santorico, S. A., Coughlin, B. C., & Hayes, J. E. (2014). Crowdsourcing taste research: Genetic and phenotypic predictors of bitter taste perception as a model. *Frontiers of Integrative Neuroscience*, **8**:33. doi:10.3389/fnint.2014. 00033.

[17] Gladwell, M. (2009). The ketchup conundrum: Mustard now comes in dozens of varieties. Why has ketchup stayed the same? In *What the dog saw and other conundrums* (pp. 32–50). USA: Little, Brown, & Company. Also published in the **September 6th**, 2004, issue of *The New Yorker*. http://www.newyorker.com/magazine/2004/09/06/the-ketchup-conundrum.

[18] Garber, L. L., Jr., Hyatt, E. M., & Starr, R. G., Jr. (2001). Placing food colour experimentation into a valid consumer context. *Journal of Food Products Marketing*, **7(3)**, 3–24.

Colour is undoubtedly very important as far as correctly signalling the product and/or brand is concerned: Both the colour of the packaging and that of the product itself when presented in transparent packaging play a role here (i.e., in capturing the attention of the shopper on the supermarket shelf). Indeed, one thing that is immediately noticeable about many popular condiments is just how bright and distinctively-coloured they are. Just think about it: All the way from the vivid reds of the ketchups through the golden sunshine yellows of English mustards and piccalillis, and from the livid green of mint sauces through to the rich dark browns of soy sauce, Branston Pickle, Worcester sauce, and the appropriately-named Brown sauce (note here, confusingly, that many sauces are actually condiments). (No wonder, then, that condiments are sometimes added to a dish simply to provide a dash of colour.)

According to one recent store audit, transparency is becoming an increasingly common feature of product packaging across a wide range of food and beverage categories. Currently in the marketplace, such transparency signals both quality and desirability to the customer,[19] and the condiment category is are likely no exception in this regard. However, it is important to note that this growing trend doesn't work for everyone: As a condiment manufacturer, one needs to make sure that the colour contrast between the packaging/brand colour shows-off the product inside to best effect. Think here only of the classic contrasts between the greenish-blue of the Heinz can and the orangey-red beans inside, or Cadbury's distinctive purple colour and the brown of their Dairy Milk Chocolate bar.[20] It is a relevant question therefore to consider whether there are any especially effective colour combinations currently in the condiment aisle.

## *Choosing condiments in the store*

Marketers have long argued that what consumers really want is choice, and lots of it. The more choice the better, or so the marketing mantra goes. However, one might ask whether things have gone too far in the condiment aisle.[21] After all, the number of offerings that one now finds is such that in certain high-end stores in The States (especially in the New York metropolitan area), a new breed of 'condiment sommelier' has emerged; Their job, to help the perplexed consumer navigate between the 10s, if not 100s, of different condiment offerings, that may be available for purchase.[22] Indeed, the shear visual search challenge that the shopper faces is emphasized by the oft-mentioned suggestion that they will be exposed to something like 1000 products/brands per minute while walking down the aisles of a typical supermarket.[23] For those of us who aren't fortunate enough to shop in an establishment with a condiment sommelier on hand, colour is typically used to guide our product search. As such, those products that are unusual, or unexpected, in terms of their colour scheme will likely stand out on the shelf and capture our visual attention.[24] This is why changing the colour of a product, or its packaging (so that it stands out from the crowd, say), may well help to increase the likelihood that it will be noticed. Indeed, it was just such a distinctive and unusual use of product colour that helped to make Heinz EZ Squirt green, blue, and purple ketchup such a success back in 2000.[25] Hard though it is to believe, the company was able to increase sales by c. 10% in what is a very slow moving category simply by adding 0.1% food colouring to their traditional ketchup recipe.

However, while upsetting the colour code for the category will likely guarantee a condiment manufacturer shelf stand-out at the so-called 'First-Moment-of-Truth',[26] the real challenge often comes later: How exactly does one go about avoiding the generally negatively-valenced disconfirmation of expectation response that normally follows when something does not taste as its looks (i.e., based on the product and/or packaging colour) make you think that it should?[27] Much of our work with the food industry over the years has revolved around trying to help those companies who have managed to capture their customer's attention on the shelf but have then had to deal with the latter's complaints that their unusually-coloured products don't taste as they expected that they should. While modernist chefs can get away with surprising their guests with unusual, or unexpected, colour-taste/flavour combinations – think only of the beetroot and orange jelly dish (orange and purple, respectively, given the use of golden beetroot and blood orange) that was served a few years ago by Heston Blumenthal at his world-famous The Fat Duck restaurant in Bray, UK[28] – high street condiment brands need to be much more careful when playing in this space.

As far as I am aware, Walkers crisps (in the UK) are one of the only food companies in the marketplace who have managed to reverse the established colour code for the category successfully with their Salt and Vinegar and Cheese flavoured crisps varieties.[29] While the majority of crisp manufacturers use blue packaging to indicate Salt and Vinegar and green to indicate Cheese and Onion, Walkers use the opposite colour-flavour convention. The suggestion in the literature is that this switch in the colour-flavour matching was introduced more than 30 years ago to get consumers to try a new flavour of crisp (the idea being that they would reach for their favorite colour in-store, only to realize that they had got the wrong flavour when they got home). This is

[19] Simmonds, G., & Spence, C. (2017). Thinking inside the box: Can seeing products on or through the packaging influence consumer purchase behaviour? *Food Quality & Preference,* **62**, 340–351; Simmonds, G., Woods, A., & Spence, C. (2018). 'Show me the goods': Assessing the effectiveness of transparent packaging vs. product imagery. *Food Quality and Preference*, **63**, 18–27.

[20] Though, unfortunately, Cadbury's long-running attempts to protect the distinctive shade of purple (specifically, Pantone 2685C) failed recently. See Neiburg, O. (2016). Cadbury left black & blue in latest Nestlé battle over the colour purple. *Confectionary News*, April **20th**. http://www.confectionerynews.com/Manufacturers/Cadbury-suffers-blow-in-latest-Nestle-battle-over-the-colour-purple.

[21] Iyengar, S. S. (2010). *The art of choosing: The decisions we make everyday - What they say about us and how we can improve them*. USA: Little, Brown; Iyengar, S. S., & Lepper, M. R. (2000). When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology*, **79**, 995–1006; Osnos, E. (1997). Too many choices? Firms cut back on new products. *Philadelphia Inquirer*, **September 27th**, D1, D7; Schwartz, B. (2005). *The paradox of choice: Why more is less*. London, UK: Harper Collins. It is interesting to ask just how much of the choice that the consumer is faced with on the condiment shelves is merely marketing-led, and how much of that variety caters to the genuine individual differences in people's preferences for different flavour profiles.

[22] Bellomo, R. O. (2015). Condiment sommeliers are taking over New York City. *Time Out (New York)*, **February 26th**. https://www.timeout.com/newyork/blog/condiment-sommeliers-are-taking-over-new-york-city; Kis, E. (2014). Maille mustard boutique's sommelier classes up our condiment game. *Metro (US)*, **December 17th**. http://www.metro.us/lifestyle/maille-mustard-boutique-s-sommelier-classes-up-our-condiment-game/zsJnlr—IBboIYw4kUTgY/.

[23] Hine, T. (1995). *The total package: The secret history and hidden meanings of boxes, bottles, cans, and other persuasive containers*. New York, NY: Little Brown; Nancarrow, C., Wright, L. T., & Brace, I. (1998). Gaining competitive advantage from packaging and labeling in marketing communications. *British Food Journal*, **100**, 110–118.

[24] Garber, L. L. Jr., Hyatt, E. M., & Boya, Ü. Ö. (2008). The mediating effects of the appearance of nondurable consumer goods and their packaging on consumer behaviour. In H. N. J. Schifferstein & P. Hekkert (Eds.), *Product experience* (pp. 581–602). London, UK: Elsevier.

[25] Farrell, G. (2000). What's green. Easy to squirt? Ketchup! *USA Today*, **Monday July 10th**, 2b.

[26] Louw, A., & Kimber, M. (2011). *The power of packaging*. Downloaded from http://www.tnsglobal.com/_assets/files/The_power_of_packaging.pdf on 6/2/2011.

[27] Piqueras-Fiszman, B., & Spence, C. (2012). Sensory incongruity in the food and beverage sector: Art, science, and commercialization. *Petits Propos Culinaires,* **95**, 74–118; See also Spence, C., & Piqueras-Fiszman, B. (2014). *The perfect meal: The multi-sensory science of food and dining*. Oxford, UK: Wiley-Blackwell.

[28] Blumenthal, H. (2008). *The big Fat Duck cookbook*. London, UK: Bloomsbury; Velasco, C., Michel, C., Youssef, J., Gamez, X., Cheok, A. D., & Spence, C. (2016). Colour-taste correspondences: Designing food experiences to meet expectations or to surprise. *International Journal of Food Design*, **1**, 83–102.

[29] Piqueras-Fiszman, B., Velasco, C., & Spence, C. (2012). Exploring implicit and explicit crossmodal colour-flavour correspondences in product packaging. *Food Quality & Preference,* **25**, 148–155.

undoubtedly a risky strategy, and one that would not generally be recommended for the condiment category. That said, Heinz's unusually-coloured EZ Squirt ketchups should probably also be counted as a success in this space given that, as we have just seen, they were able to increase their market share, at least in the short-term.[30] Heinz may well have succeeded precisely because tomatoes can be green (so the colour is, in some sense, 'natural'). Perhaps more importantly, the unusual colour may have been successful precisely because there was nothing with such a vivid colour already in the marketplace for the consumer to confuse it with. Hence, while both Walkers and Heinz have been innovative in their use of colour in the supermarket aisle, the underpinning rationale, and consequences for consumer perception/behaviour are likely somewhat different. It is also worth bearing in mind here that EZ Squirt was more successful amongst kids, who generally like bright and unusually-coloured foods, than amongst their parents.[31]


**Fig. 1.** The distinctive shape of the Wishbone salad dressing bottle. This image mold is recognizable to many North Americans by its silhouette alone.

*Powerful 'image molds' in the condiment aisle*

Beyond the colour of the product and its packaging, what is also really important is the shape/form of the packaging itself.[32] Indeed, many of the most successful brands in the marketplace have managed to establish the distinctive shape of their product packaging as an 'image mold': The latter, the name given to an arbitrary packaging form that consumers have come to internalize as the shape of a particular product/brand. Think here only of the sloping shoulders of the Wishbone bottle that successfully established the image mold for the entire salad dressing category.[33] If a product has a particularly strong image mold, the consumer should probably be able to identify it immediately, even if they see nothing more than a silhouette (see Fig. 1).[34]

And while some marketers talk of image molds as if they constitute a form of tactile marketing,[35] they are obviously as much a visual phenomenon as anything else. That is why, after all, those with a strong image mold often end-up putting a silhouette of their recognizable packaging shape on the side of their sachets (think Heinz tomato ketchup) or cans (think of the instantly-recognizable black silhouette of the Coke bottle that one often sees printed on the side of their cans), when they change their packaging format for whatever reason.[36]

Other classic image molds include the distinctive Kikkoman sauce dispenser bottle, designed by Kenji Ekuan, through his company GK Industrial Design Group.[37] This flask-shaped and leak-resistant bottle with its red cap was first introduced back in 1961. The glass Heinz Ketchup bottle surely stands alongside as another iconic example, coming in 3rd place a 2014CBS top-10 list of packaging design icons.[38] Interestingly, Heinz ketchup was initially sold in a keystone-shaped glass bottle when first launched back in 1876. The iconic design that we all know today was launched in 1890, and has stayed around ever since. (The round neck designed to make the ketchup flow more easily while the narrow neck exposed less of the product to the air and so reduced any unwanted browning of the contents.) Subsequently, many other manufacturers have adopted a similar packaging form for their ketchups. In fact, it can be argued that the condiment category actually has more than its fair share of distinctive packaging shapes.

In the best-case scenario, the image mold does it all: First-off, it captures the shopper's attention on the store shelf; At the same time, it should be processed fluently,[39] and hopefully also convey a sense of product quality, thus justifying the likely higher price point.[40] The prediction has to be that condiments tasted from packaging forms that have taken on the status of a valued image mold will be rated more highly than the same condiment if unknowingly dispensed from a less iconic (i.e., anonymous) container instead, or if assessed in a blind taste test (see below).[41]

*Crossmodal correspondences in condiment packaging design:* A growing body of research published over the last decade highlights the fact that people naturally associate shapes with tastes. To the extent that a condiment expresses a dominant taste, one might therefore

[30] The fact that the product had been discontinued by 2006 does not, as many have wanted to argue, necessarily mean that this product launch should necessarily be considered a failure; See Spector, D. (2011). The 11 biggest food flops of all time. *Business Insider*, **February 5th**. http://www.businessinsider.com/major-food-flops-2011-1?op=1/#inz-ez-squirt-ketchup-1. Note here only the fact that the very same article points to the fact that Heinz sold 25 million bottles in the 3 years from launch.

[31] Spence, C. (2012). The development and decline of multisensory flavour perception. In A. J. Bremner, D. Lewkowicz, & C. Spence (Eds.), *Multisensory development* (pp. 63–87). Oxford: Oxford University Press.

[32] Spence, C. (2016). Multisensory packaging design: Colour, shape, texture, sound, and smell. In M. Chen & P. Burgess (Eds.), *Integrating the packaging and product experience: A road-map to consumer satisfaction* (pp. 1–22). Oxford, UK: Elsevier.

[33] See Hine (1995).

[34] See Parise, C. V., & Spence, C. (2012). Assessing the associations between brand packaging and brand attributes using an indirect performance measure. *Food Quality and Preference*, **24**, 17–23; See also Arboleda, A. M., & Arce-Lopera, C. (2015). Quantitative analysis of product categorization in soft drinks using bottle silhouettes. *Food Quality & Preference*, **45**, 1–10; Wagemans, J., Winter, J., de Beeck, H. O., Ploegerô, A., Beckers, T., & Vanroose, P. (2008). Identification of everyday objects on the basis of silhouette and outline versions. *Perception*, **37**, 207–244.

[35] Lindstrom, M. (2005). *Brand sense: How to build brands through touch, taste, smell, sight and sound*. London, UK: Kogan Page. In this best-selling book, Lindstrom argues that Coca-Cola has strong tactile marketing because the brand is recognizable even if one is reaching into the bottom of the ice-filled drinks cooler (i.e., when all visual cues have been removed). While this is likely true, what is much more important, at least as far as I can tell, is that it is instantly visually-recognizable on the shelf.

[36] Prince, G. W. (1994). The contour: A packaging vision seen through Coke-bottle lenses. *Beverage World*, **113**, **(Periscope Edition; May 31)**, 1–6.

[37] McLaughlin, K. (2015). Famed Japanese designer of bullet train, Kikkoman soy sauce bottle and Yamaha motorcycles died, aged 85. *Daily Mail Online*, **February 9th**. http://www.npr.org/sections/thetwo-way/2015/02/09/384924292/from-soy-sauce-to-bullet-trains-famed-japanese-designer-dies-at-85.

[38] Peterson, K. (2014). 10 of the world's most iconic packages. *CBS Moneywatch*, **October 9th**. http://www.cbsnews.com/media/10-of-the-worlds-most-iconic-packages/3/; See also Verhaaf, M. (2011). *The Heinz Ketchup bottle*. BIS Publishers.

[39] Labroo, A. A., Dhar, R., & Schwartz, N. (2008). Of frog wines and frowning watches: Semantic priming, perceptual fluency, and brand evaluation. *Journal of Consumer Research*, **34**, 819–831.

[40] Such image molds are often strengthened by a process of copycat marketing; See Scott Morton, F., & Zettelmeyer, F. (2000). *The strategic positioning of store brands in retailer-manufacturer bargaining* (working paper). National Bureau of Economic Research. Cambridge, MA, W7712; and Peterson (2014). In other words, the shape that Wishbone happened to choose for their salad dressing has now become the standard for the category.

[41] Gates, P. W., Copeland, J., Stevenson, R. J., & Dillon, P. (2007). The influence of product packaging on young people's palatability ratings for RTDs and other alcoholic beverages. *Alcohol and Alcoholism*, **42**, 138–142. Working with food companies around the world, I am often surprised at how many national players have singularly failed to establish any kind of distinctive 'image mold' for their condiment brands. This definitely constitutes a lost marketing opportunity (as far as I can tell).

expect the label to signal this through the shape/angularity of the label, typeface used on the packaging.[42] So the next time you find yourself wondering down the condiment aisle in the supermarket why not check-out whether you can spot any crossmodal correspondence between the shapes of the labels of condiment bottles/containers and the dominant taste quality of the contents should there be one. Given that sweet goes with round, whereas sour, bitter, and spicy are associated with angular shapes instead, it would certainly make sense for sweet-tasting products like ketchup to have a rounder labels whereas a spicy condiment would be much better paired with an angular label instead (since that would likely enhance perceptual fluency). Just think of the strong angular diamond-shaped label of Tabasco sauce as a good example. In other words, it makes sense for a company/brand to try and maximize the 'perceptual fluency' of 'the total package'.[43]

## Multisensory product packaging: factors affecting the product in use

Having highlighted the crucial role of visual cues relating to colour and image mold/shape symbolism in everything from capturing the consumer's attention in-store, through to conveying meaning about the likely product attributes, and ultimately potentially influencing the experience of the taste/flavour of the product itself, I now turn to the other sensory aspects of packaging design that come into play when the consumer actually picks-up (and uses) the product. It is at this stage that the tactile and auditory attributes of the packaging suddenly become much more relevant.

### *Just how important is the feel of the condiment packaging?*

Perhaps unsurprisingly, if one can get the shopper to notice and, better still, pick-up your product, then you (as a condiment manufacturer) are well on the way to the sale. It is at that point that the sense of touch (in product packaging) really starts to kick-in. The texture, compressibility/firmness, and weight of the product (plus) packaging have all been shown to play a role in influencing the consumer's overall experience of the contents.[44] In fact, a quick walk through any well-stocked supermarket will soon highlight just how much innovation has taken place in recent years in terms of novel packaging forms and distinctive new surface feels.[45] As shoppers, we are all exposed to a range of variation that one would never have expected to see even a decade or two ago (as costs for packaging innovation have come tumbling down). In fact, research was published recently showing that giving packaging/plateware a gritty feel, surface say, can bring out the spicy/gingery notes in a food.[46] There are likely some marketing opportunities here around textured product packaging designed to deliver a signature packaging feel and at the same time help to up the perceived spiciness of a pickle or salsa, say.

Intriguingly, across a wide range of product categories, people have been shown to rate products as being of higher quality, as being more satiating, and as having a better/more intense smell/flavour when presented in heavy, rather than light packaging.[47] Traditionally, condiments were predominantly packaged in glass containers. While the shift to squeezable plastic bottles in recent decades undoubtedly helps reduce costs and increase functionality (in terms of easily extracting the contents), it is important to note that the overall multisensory product experience may suffer as a result of the shift to what may be perceived as 'flimsy' lightweight packaging.[48] It is an interesting empirical question, though, as to whether the fact that condiments are rarely consumed directly from the packaging reduces the impact of the feel of the packaging material on product perception. My gut feel is that is probably doesn't much matter.

Indeed, the feel is most probably a part of what makes ketchup served from the traditional heavy glass bottle taste better than exactly the same product when sampled from light plastic squeezable packaging instead.[49] One of the challenges here, of course, that many manufacturers are being encouraged (or, in some cases, even forced) to lightweight their packaging.[50] How can one cut down on waste while at the same time still give one's product packaging that substantial feel? That is the challenge facing many companies currently.

There was a time when 'difficult to open/use' was thought to convey a sense of quality.[51] Nowadays, though, it is all about ease of use. As we have seen already, the traditional ketchup bottle, which is both iconic and heavy has a lot going for it in terms of its ability to enhance the consumer's experience of the contents, however what it singularly doesn't afford is ease of use. This is where the switch to a squeezable plastic bottle that has been developed – so that the contents can be dispensed more easily – comes in. Inverting the bottle (and label) so that the contents collect near the entrance also helps in terms of accessing the contents of the packaging. A group of materials scientists from MIT had taken a somewhat different approach to this design problem. They developed a formula for a transparent non-stick coating (the company that subsequently spun out of this research going by the name of LiquiGlide) for the bottle that ensured that none of the contents ever stick to the side. This kind of innovative coating is currently being applied to the insides of some ketchup and mayonnaise bottles.[52]

### *Sonic branding: the sound of condiment packaging*

When the consumer finally gets to open and use the condiment,

[42] Spence, C. (2012). Managing sensory expectations concerning products and brands: Capitalizing on the potential of sound and shape symbolism. *Journal of Consumer Psychology*, **22**, 37–54; Velasco, C., Woods, A. T., Hyndman, S., & Spence, C. (2015). The taste of typeface. *i-Perception*, **6(4)**, 1–10.

[43] Hine (1995); Velasco, C., Salgado-Montejo, A., Marmolejo-Ramos, F., & Spence, C. (2014). Predictive packaging design: Tasting shapes, typographies, names, and sounds. *Food Quality & Preference*, **34**, 88–95; Velasco, C., Spence, C., & Cheok, A. D. (2016). Shaping taste. *Integrative Food, Nutrition and Metabolism*, **3**, 256–261.

[44] Gallace, A., & Spence, C. (2014). *In touch with the future: The sense of touch from cognitive neuroscience to virtual reality*. Oxford, UK: Oxford University Press; Spence, C., & Gallace, A. (2011). Multisensory design: Reaching out to touch the consumer. *Psychology & Marketing*, **28**, 267–308.

[45] Juravle, G., Velasco, C., Salgado-Montejo, A., & Spence, C. (2015). The hand grasps the centre, while the eyes saccade to the top of novel objects. *Frontiers in Psychology: Perception Science*, **6**:633. doi: 10.3389/fpsyg.2015.00633.

[46] Biggs, L., Juravle, G., & Spence, C. (2016). Haptic exploration of plateware alters the perceived texture and taste of food. *Food Quality & Preference*, **50**, 129–134; See also Piqueras-Fiszman, B., & Spence, C. (2012). The influence of the feel of product packaging on the perception of the oral-somatosensory texture of food. *Food Quality & Preference*, **26**, 67–73.

[47] Cf. Gatti, E., Spence, C., & Bordegoni, M. (2014). Investigating the influence of colour, weight, & fragrance intensity on the perception of liquid bath soap. *Food Quality & Preference*, **31**, 56–64; Kampfer, K., Leischnig, A., Ivens, B. S., & Spence, C. (2017). Touch-taste-transference: Assessing the effect of the weight of product packaging on flavour perception and taste evaluation. *PLoS ONE*, **12**(10).

[48] Krishna, A., & Morrin, M. (2008). Does touch affect taste? The perceptual transfer of product container haptic cues. *Journal of Consumer Research*, **34**, 807–818.

[49] The same goes for drinks consumed from bottles rather than cans. See Barnett, A., Velasco, C., & Spence, C. (2016). Bottled vs. canned beer: Do they really taste different? *Beverages*, **2**:25. Though note that Heinz discontinued their glass bottle some years ago.

[50] Bland, A. (2008). Fed up with too much packaging? Just leave it on the counter. *The Independent*, **June 1st**, 46; Finch, J., & Smithers, R. (2006). Too much packaging? Dump it at checkout, urges minister. *The Guardian*, **November 14th**. http://www.theguardian.com/business/2006/nov/14/supermarkets.ethicalliving/print.

[51] McDaniel, C., & Baker, R. C. (1977). Convenience food packaging and the perception of product quality: What does "hard-to-open" mean to consumers? *Journal of Marketing*, **41(4)**, 57–58.

[52] Plamer, K. T. (2015). The physics behind those no-stick ketchup and mayo bottles. *Wired*, **July 2nd**. https://www.wired.com/2015/07/physics-behind-no-stick-ketchup-mayo-bottles/; See also the viral ketchup pouring video from a couple of years ago: https://vimeo.com/89936188. Note that such implicit cues that a product hasn't been tampered with might be expected to be especially important in places like China where there is a real concern with authenticity and food safety.

there may be a distinctive sound on opening the product packaging. Indeed, given how much money many companies spend on their visual branding it is surprising to consider how difficult it can be to discriminate between brands solely on the basis of the sounds they make. We are currently working with a number of food and beverage companies in order to help them try and establish a signature sound of opening, one that conveys a functional benefit in terms of enhancing the consumer's expectations, and hence experience, of the product concerned.[53]

As an example of what can be achieved in this space, one need think here only of the distinctive sound of the Snapple 'pop.' Simply by sonically signalling that the product had not been tampered with, the company were able to reduce packaging costs by removing the plastic wrap around the opening that used to serve this purpose.[54] That said, achieving similar benefits for the condiment category isn't necessarily going to be quite so easy to address given that the latter, unlike beverages, tend to be kept in the fridge (or cupboard) for a while, and reopened on multiple occasions. But what makes a distinctive product opening/usage sound? Well, I think, one knows that one when people start to use the sounds made by your product packaging as instrumental sounds in musical compositions. Go online, for instance, and you'll find many examples of the Pringles pop being used in just this way. I have also come across online examples of tracks involving the pop of a freshly-opened ketchup bottle. Ultimately, then, there is lots of opportunity for enhanced sonic differentiation in the condiments aisle, both when it comes to the advertising of condiments and when it comes to consuming them.[55]

So having reviewed the literature on the impact of visual cues (e.g., at the point of purchase) and the impact of the other sensory cues (specifically tactile and auditory) when the consumer interacts with the product (e.g., when using it in the home) the next question to consider is the taste/flavour of the condiment itself. Here, it is natural to look to the results of blind taste tests in order to ascertain how different the taste/flavour space for condiments actually is. However, given that as we have just seen the multisensory attributes of the product packaging play such an important role in helping set our taste/flavour expectations,[56] some have started to question what exactly the results of blind taste tests really show.

## What do the results of blind taste tests (of condiments) really tell us?

Well-known, premium brands often perform poorly in unbranded 'blind' taste tests. This is equally true of condiments as of any other category of product. Just take, for example, Heinz as one representative example. Their ketchup brand failed to score in the top-10 (being beaten by 8 own brand varieties) when 130 British shoppers rated 13 different brands of ketchup in a blind taste test with chips for the consumer watchdog *Which?*[57] So why should the consumer pay more for a premium product when it scores poorly in a blind taste test? I suspect that such arguments miss the point that we rarely do taste products totally blind, and that includes condiments. Just think about it, how often is the brand clearly visible on the packaging of the condiments one finds sitting there on the dinner table. Often, then, we taste condiments in the presence of their packaging, and the added value that a product attains when served branded (and that includes in its appropriate packaging) has, I believe, to be a core part of the total product proposition. Indeed, the branding of the condiments may well be the only brand information that is visible when a diner sits at the dinner table – hence making it potentially more relevant/salient than the branding of the ingredients or seasoning, say, that have gobe into creating the dish. What the customer should really want to know, then, is which condiment brand tastes best when presented in its own packaging. To say that packaging is nothing more than the fifth "P" in the marketing mix is really to miss the point here.[58] It is the total multisensory product experience, one that includes all aspects of branding and packaging (together with the iconic packaging shape), that presumably helps to explain why 60% of all ketchup sold is Heinz (often at a considerable price premium).[59] This despite the regular stream of blind taste tests reported in the media showing that the premium brands rarely come in top.

So, having assessed the current customer journey in relation to the multisensory experience of condiments, all that remains for me to do is to take a look at the future of the condiment category. Here, three emerging trends stand out, namely virtual prototyping, the emergence of personalization, and growing concerns about health in relation to the foods that we eat.

## Emerging trends in the condiment category

### Virtual prototyping of condiments

Moving forward, one of the trends that may become increasingly relevant concerns the enhanced opportunities for innovation in the category offered by virtual prototyping as, for instance, offered by the latest augmented reality (AR) techniques. So, for example, vision scientists over in Japan have shown how the visual appearance properties of tomato ketchup can be modified using AR.[60] It is now possible to change the visual appearance of a condiment (such as a ketchup) in real-time and without the need for any external markers (like meta-cookies) on the food itself. The AR solution allows one to see the product being squeezed onto a plate, say, and then to taste the product (see Fig. 2). Working together with Katsunori Okajima and his team, we have been able to demonstrate that people really do eat first with their eyes, inasmuch as changing nothing but the visual appearance properties of the ketchup results in a significant change the rated taste of the ketchup.[61] This sort of approach to virtual product innovation is likely to have use amongst the condiment companies' development/innovation kitchens in the years to come. After all, assessing people's responses to new products, or product innovations that have been created virtually tends to be a much more rapid process than if one has to actually develop a range of new formulations in advance in order to determine which, if any, the public (focus group, or

[53] Spence, C., & Wang, Q. (J.) (2015). Sensory expectations elicited by the sounds of opening the packaging and pouring a beverage. *Flavour*, **4**:35; Spence, C., & Wang, (Q.) J. (2017). Assessing the impact of closure type on wine ratings and mood. *Beverages,* **3**:52; doi:10.3390/beverages3040052.

[54] Byron, E. (2012). The search for sweet sounds that sell: Household products' clicks and hums are no accident; Light piano music when the dishwasher is done? *The Wall Street Journal*, **October 23rd**. http://online.wsj.com/article/SB10001424052970203406404578074671598804116.html?mod=googlenews_wsj#articleTabs%3Darticle.

[55] For a review, see Spence, C. (2014). Multisensory advertising & design. In B. Flath & E. Klein (Eds.), *Advertising and design. Interdisciplinary perspectives on a cultural field* (pp. 15–27). Bielefeld, Germany: Verlag.

[56] Piqueras-Fiszman, B., & Spence, C. (2015). Sensory expectations based on product-extrinsic food cues: An interdisciplinary review of the empirical evidence and theoretical accounts. *Food Quality & Preference*, **40**, 165–179.

[57] Daily Mail Reporter (2011). Red-faced: Heinz ketchup comes BOTTOM in taste tests after being beaten by cut price supermarkets. *Daily Mail Online*, **May 18th**. http://www.dailymail.co.uk/news/article-1387285/Red-faced-Heinz-ketchup-comes-BOTTOM-taste-tests.html; See also http://www.cbc.ca/news/canada/windsor/leamington-ketchup-french-s-taste-test-1.3496422.

(footnote continued)

[58] Nickels, W. G., & Jolson, M. A. (1976). Packaging – the fifth "p" in the marketing mix? *Advanced Management Journal*, **41(1)**, 13–21.

[59] Daily Mail reporter (2011).

[60] Okajima, K., & Spence, C. (2011). Effects of visual food texture on taste perception. *i-Perception*, **2**:8; Okajima, K., Ueda, J., & Spence, C. (2015). Effects of visual texture on food perception. *Journal of Vision*, **13**:1078; see http://www.okajima-lab.ynu.ac.jp/demos.html for a video.

[61] Spence, C., Okajima, K., Cheok, A. D., Petit, O., & Michel, C. (2016). Eating with our eyes: From visual hunger to digital satiation. *Brain & Cognition*, **110**, 53–63.

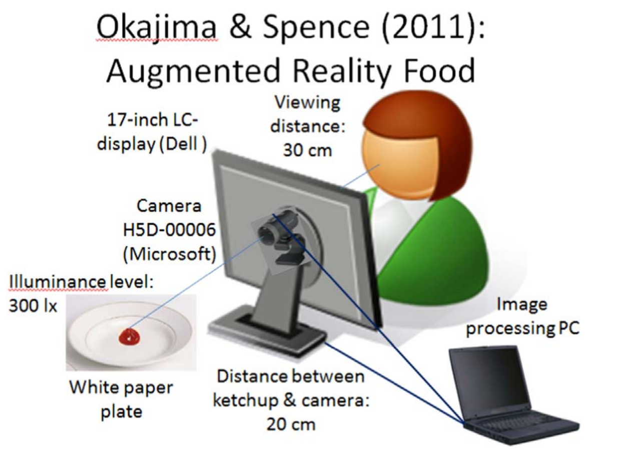


**Fig. 2.** Virtually modifying the appearance properties of ketchup. Is this the future of product innovation in the condiment category?.

consumer panel) actually like. Furthermore, the AR approach also means that a company can assess the impact of a change in the colour of the packaging, say, on the taste/flavour experiences of their consumers.

*Condiments, personalization, and healthy eating*

With the removal of salt and pepper from the table in a growing number of top restaurants,[62] it will be interesting to see whether in the years ahead condiments will also start to disappear (at least from the better class of dining establishment). More likely, the powerful trend toward personalization/customization of our cuisine will win out and hence the range and popularity of condiments on tables around the world will continue to grow. In fact, it may turn out that condiments end-up becoming a more popular means of seasoning dishes at the table in the years ahead, as a growing number of restaurants start declaring the salt/calorie content of their dishes on the menu.[63] One consequence of is likely to be that the presence of unhealthy (but tasty) ingredients, such as sugar, salt, and fat in the food itself will be reduced so as to ensure that the numbers that appear on the label/menu fall below some psychologically-meaningful criteria/level (e.g., 99 cal, or < 1% salt, sounds so much better that 101 cal, or 1–2% salt). Many food and beverage companies/restaurant chains have changed their food/beverage offerings for just this reason. I suspect that condiments (which necessarily constitute an optional addition to a dish) are not considered in most people's mental accounting of how healthy/unhealthy a particular dish is.[64] Hence, in the future, I can easily foresee diners/consumers ordering/buying a burger that contains less than 400 cal, say, but not having to sacrifice too much on taste by liberally adding the ketchup (which counts as silent, or at least unaccounted for, calories). However, as to whether this comes to pass, only time will tell.

The growing concern with health, and the role that diet plays is also likely to see the rise of 'healtheir' versions of condiments. Indeed, many condiments are not particularly healthy, containing large amounts of sugar (think ketchup) and/or salt (soy sauce). In fact, just a single tablespoon of mayonnaise contains around 11 g of fat, 100 cal, and 85 mg of sodium.[65] However, as just mentioned, it may be that condiments do not enter into people's mental calculations of the healthiness of a dish or meal. Nevertheless, in the years ahead we are likely to see a push toward reduced sugar/salt versions of many of our more popular condiments. It remains an interesting question as to whether the distinctive taste/flavour attributes of condiments can be maintained in the mind of the consumer by changes to the multisensory design of e.g., the packaging while at the same time reducing the concentration of some of the less healthy ingredients.[66]

## Conclusions

As I hope to have convinced you in this review, there really is a lot more to condiments than meets the eye, or the tongue, for that matter. While seemingly neglected by the majority of the academic research community, there is much to consider (and learn) from a closer analysis of the condiment aisle, and what has been happening there in recent years. On the one hand, the very existence and continued popularity of a wide range of condiments and sauces for different occasions hints, I think, at the very different taste worlds in which we all live, along with the growing importance of being able to personalize/customize one's food. However, the explanation for why particular condiments/sauces have come to be such powerful brands in the global marketplace over the last century does not reside solely in their chemical composition or ingredient list, nor in their ability to enhance/complement the taste/flavour/appearance/texture of that which they are combined with. Rather, it order to really understand what has made the best-selling condiment brands so successful for so long one really needs to consider the impact of the total product experience, including some very strong branding supported by strong packaging/image molds. The ultimate message, then, for the condiment manufacturer/marketer is never to forget the influence of the packaging to all stages of the consumer's interaction with the brand. Meanwhile, for the chef, one of the most interesting questions in the space concerns where s/he stands with respect to the rights of the diner to modify their product offering, with some chefs, especially in high-end restaurants going so far as to eliminate even the salt and pepper from the dining table.

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## Author information

*Charles Spence* is an experimental psychologist and gastrophysicist working out of Oxford University, who is fascinated by the design of multisensory dining experiences. In 2014, he published the prize-winning *The perfect meal: The multisensory science of food and dining* (Oxford, UK: Wiley-Blackwell) together with Dr. Betina Piqueras-Fiszman. In 2017, he published his latest book *Gastrophysics: The new science of eating* with Penguin Viking.

[62] See Spence (2017).

[63] Pavia, W. (2015). New York peppers menus with salt warnings. *The Times*, **December 1st**; Clarke, T., & Athavaley, A. (2014). Calorie counts on restaurant chain menus set to go nation-wide. *Scientific American*, **November 24th**. https://www.scientificamerican.com/article/calorie-counts-on-restaurant-chain-menus-set-to-go-nation-wide/.

[64] Of course, reducing the unhealthy ingredients in condiments and sauces tends to lead to consumer backlash too; See Tozer, J. (2011). The great HP Sauce revolt: Online fury over salt cut that 'ruins the taste'. *Daily Mail Online*, **September 12**th. http://www.dailymail.co.uk/news/article-2036349/HP-Sauce-revolt-Online-fury-salt-cut-ruins-taste.html.

[65] These figures reported by Patel, A. (2013). Bad condiments: 15 unhealthy condiments include ketchup, BBQ sauce and mayonnaise. *Huffington Post*, **February 21st**. http://www.huffingtonpost.ca/2013/02/21/bad-condiments_n_2733484.html; See also Ramsey, L. (2016). Not all condiments are created equal — here are the best and worst ones for you. *Business Insider*, **June 21st**. http://uk.businessinsider.com/what-is-the-healthiest-condiment-out-there-2016-6?r=US&IR=T.

[66] Spence (2016).

## List of abbreviations

Not applicable.

## Declarations

Ethics approval and consent to participate. As a review paper, no participants were tested in this paper.

## Consent for publication

Approval to publish has been given where required.

## Availability of data and material

There is no data or material to make available.

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