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RUNNING HEAD: PACKAGING COLOUR

On the multiple effects of packaging colour on consumer behaviour and product experience in the 'food and beverage' and 'home and personal care' categories

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ABSTRACT

Colour is perhaps the single most important element as far as the design of multisensory product packaging is concerned. It plays a key role in capturing the attention of the shopper in-store. A distinctive colour, or colour scheme, can also act as a valuable brand attribute (think here only of the signature colour schemes of Cadbury's Dairy Milk chocolate). In many categories, though, colour is used to convey information to the consumer about a product's sensory properties (e.g., taste or flavour, say), or else to prime other more abstract brand attributes (such as, for example, premium, natural, or healthy). However, packaging colour can also affects the customer's product experience as well: Indeed, a growing body of empirical research now shows that packaging colour affects everything from the expected and perceived taste and flavour of food and beverage products through to the fragrance of home and personal care items. Packaging colour, then, plays a dominant role at several stages of the product experience.

KEYWORDS: COLOUR; PACKAGING; EXPECTATIONS, PERCEPTION, SIGNATURE COLOUR; CROSS-CULTURAL DIFFERENCES.

1. Introduction

In the Food & Beverage (F&B) and Home and Personal Care (HPC) categories, packaging plays a crucial role at all stages of the consumer's interaction with a given product (e.g., Ampuero & Vila, 2006). In fact, it plays a more important role for the products in these categories as they are normally displayed in their packaging in a way that is simply not the case for, say, home electronics or white goods.

As visually-dominant beings, it is vision that plays the key role in capturing the customers' attention and setting their product-related expectations (e.g., Kauppinen-Räisänen, 2014; Schifferstein, 2006; Spence, 2016). And, of all the visual packaging cues that are available to the customer, it is colour that is perhaps most important (Lynn, 1981). Just how important is brought home by Singh's (2006, p. 783) claim that colour drives 62-90% of all consumer purchasing decisions. Whilst the exact percentage might be difficult to ascertain scientifically, it is nevertheless widely accepted that colour plays a critical role in the customer's decisions concerning what to buy are concerned.[1]

According to Swientek (2001), colour, relative to other packaging cues, triggers the fastest response, hence perhaps explaining why it is so often used strategically in packaging in order to capture the attention of consumers in store (e.g., Danger, 1987; Garber, Burke, & Jones, 2000; Marshall, Stuart, & Bell, 2006; Orquin & Loose, 2013; Sacharow, 1970).[2] This is especially relevant given the suggestion that those fast-moving consumer goods (FMCGs) that are commonly and repeatedly purchased are normally chosen in a matter of seconds (Hoyer, 1984). In fact, according to Sacharow (1970), 75% of all such purchases are made on impulse,

[1] Keller (2013, p. 166) refers to packaging as the "last five seconds of marketing", "permanent media", and "the last salesman".

[2] Remember here that according to Treisman, colour is one of the features that is processed pre-attentively, hence perhaps explaining why unique colour singleton captures attention so successfully (e.g., see Wolfe & Horowitz, 2004).

with the average shopper (of the time) picking up 14 out of 6300 products in a store visit lasting an average of 27 minutes. Meanwhile, Nancarrow, Wright, and Brace (1998) suggested that (by the turn of the century) the average shopper was being exposed to as many as 1,000 different products per minute as they walked down the aisles of the average supermarket.

According to Hine (1995), colour affects the customer in three different and, in practice, interrelated ways: the physiological, the associational, and the cultural (see also Kaiser, 1984; Kido, 2000; Moller, Elliot, & Maier, 2009; Sacharow, 1970; Wheatley, 1973). At the physiological level, humans exhibit a small number of well-documented and seemingly hard-wired responses to specific colours. One example being the alerting effect associated with exposure to the blue light of dawn (e.g., Lehrl, Gerstmeyer, Jacob, Frieling, Henkel, Meyrer, et al., 2007). Another example here relates to the pinkish-red skin tones (e.g., bubble-gum pink) that inform us about the emotional state of our conspecifics (Changizi, Zhang, & Shimojo, 2006). Once again, it has been suggested that exposure to hues in this colour range (such as, for example, the infamous shade known as Baker-Miller pink) can affect us at a more physiological level (e.g., see Alter, 2013). However, while a small number of such physiological effects undoubtedly do exist, their relevance to the field of packaging design (where colour is nearly always seen in, and hence constrained by, context, be it the context of the packaging shape, or image mold, the context of the aisle in which one happens to be standing, etc.) is unclear. As such, they can, for present purposes at least, be safely ignored.

The associational level, meanwhile, refers to those packaging colours that have become linked with a brand image or even a specific product category through consumers having interacted with it in the marketplace over some extended period of time (see Amsteus, Al-Shaaban, Wallin, & Sjöqvist, 2015; Ares & Deliza, 2010; Cheskin & Ward, 1948; Dell'era & Verganti, 2007; Garber, Hyatt, & Boya, 2008; Grossman & Wisenblit, 1999; Sacharow, 1970; Kauppinen-Räisänen & Luomala, 2010). Of course, specific cultural associations are also

learned, but this time from the embedded regularities and signifiers maintained within a given culture over time, rather than necessarily from what one finds on the supermarket shelf (Aslam, 2006). Cultural associations constitute the third of the ways in which colour affects us according to Hine. For example, purple is associated with mourning in Japan and red is associated with good luck in China. The focus in the present article will therefore primarily be on the associational and cultural meaning(s) of packaging colour.

Packaging colour can be analysed in terms of three distinct components, hue, brightness, and saturation: *Hue* refers to the broad colour category (like red, yellow, black,[3] etc.); *Brightness* refers the amount of black/white added to the hue; And *saturation* is related to the intensity of the hue. Importantly, all three components convey meaning to the consumer (Gimba, 1998; Moller, Elliot, & Maier, 2009; Wright & Rainwater, 1962) and can influence their behaviour through incorporation in various marketing stimuli (Labrecque & Milne, 2012; Labrecque, Patrick, & Milne, 2013; Tijssen, Zandstra, de Graaf, & Jager, 2017).[4] That said, it is important to note that single colours are rarely seen in isolation when it comes to product packaging (Orth & Malkewitz, 2008). In fact, the background colour in/against which a particular example of product packaging is seen, and/or the interaction between the colour and shape (or image mold) of the packaging also influence the way in which a given colour is perceived/interpreted (e.g., Becker, van Rompay, Schifferstein, & Galetzka, 2011; Garber et al., 2008; Spence, 2016).

The challenge facing many companies (and the design agencies who normally deliver their product packaging) concerns how to use packaging colour to convey the right impression at the various different moments of interaction with a product (what are sometimes referred to as

[3] Though note that black and white are, strictly-speaking, achromatic colours.

[4] While ideally objective measures of the colour appearance of product packaging would be provided on a regular basis, the expense of the measurement devices required to achieve this has limited the frequency with which such values are provided by researchers. Online studies of packaging colour also provide only limited control over the exact appearance properties of the packaging stimuli presented.

the ‘moments of truth’; see Louw & Kimber, 2011; Salgado-Montejo, Velasco, Ariza, Salgado, & Moreno, 2017.) Oftentimes, in fact, companies may well succeed at ‘the first moment of truth’ by changing their packaging colour in order to increase/optimize shelf stand-out, only to fail at the second ‘moment of truth’, when their consumers report that their experience/perception of the product has also changed (and not, it has to be said, for the better; see also Garber et al., 2000; Gutjar, de Graaf, Palascha, & Jager, 2014). At first glance, this can seem nonsensical, especially if the formulation, or design of the product itself has not changed. However, from a cognitive neuroscience perspective, it does make sense, given that consumers are visually-dominant, and what they see typically automatically (and near-instantaneously) sets expectations about a product’s likely sensory and hedonic properties. In turn, these expectations, anchor the consumer’s experience of the product’s sensory and higher-level attributes (see Piqueras-Fiszman & Spence, 2015; Spence, 2016, for reviews).

In this article, the focus is on the role of packaging colour as a key brand element, one that plays a crucial role in both building and maintaining brand equity (e.g., Caivano & López, 2007; Deliza & MacFie, 2001; Keller, 2013; Labrecque et al., 2013). First, we summarize the literature on the use of colour to capture the consumer’s attention on the shelf. Next, we assess the meaning of colour in the abstract and how that may be affected by culture and brand associations, and how it may have changed over the years. We then look at how packaging colour is used currently to set specific sensory, higher-order, and hedonic expectations, as well as to trigger/prime certain desirable brand associations. We then review the evidence demonstrating how packaging colour can actually modify the consumers’ product experience, at least under certain conditions. Finally, we look at the use of colour combinations to more effectively convey meaning. This point is especially important, given that most packages are not limited to a single colour.

2. Using colour to optimize shelf stand-out

The use of an unusual colour (or colour scheme) can undoubtedly help a product or brand to stand out on the store shelf (Caivano & López, 2007). Garber et al. (2008) summarized the results of a number of laboratory-based visual search studies showing how packaging colour needs to be considered in terms of the scene statistics of the shelf display in which a given product is likely to be placed (see also Jansson, Marlow, & Bristow, 2004). So, for example, they note how the use of black packaging in the predominantly white flour category ensures that a brand will stand out, and so be found more rapidly (at least by the participants in their laboratory visual search studies; see **Figure 1** for the kind of display that is often used). This, of course, is reminiscent of Nabisco's strategy with Alpen breakfast muesli. The distinctive black packaging for Alpen was introduced back in 1971 to help the brand to stand out in the cereal aisle (e.g., against the predominantly 'bright early morning sunshine colours' then used in the category; Wheatley, 1973, p. 26). More recently, Hendrick's Gin have similarly attempted to stand out in the drinks category through their use of a distinctive, and unusual, squat black bottle.

Figure 1. The virtual reality grocery store developed by Burke (1996; Burke, Harlam, Kahn, & Lodish, 1992; see also Needel, 1998).

2.1. Congruency, processing fluency, and packaging colour

The use of an unusual packaging colour (where the colour is not what is expected for a given product), though, may result in sensory incongruency. Such incongruency does not necessarily afford processing fluency (defined as the ease with which a stimulus is processed; e.g., Brakus, Schmitt, & Zhang, 2014; Reber & Schwarz, 2001; Reber, Schwarz, & Winkielman, 2004; Reber, Winkielman, & Schwartz, 1998). Indeed, it may well lead to a negatively-valenced 'disconfirmation of expectation' response instead (see Piqueras-Fiszman & Spence, 2015, for a review).[5]

The basic idea here is that people typically prefer those stimuli that they find it easier to process. In particular, stimulus configurations that conform to the crossmodal correspondences that customers have internalized[6] (see Spence, 2012) are likely to be processed more fluently, and hence to be liked more by consumers. The various sensory cues will likely be perceived as congruent, and hence will be easier to process (Loken & Ward, 1990). At the same time, however, it should be remembered that it may be harder for congruently-coloured packaging to stand out on the shelf so there is a trade-off to deal with.

That said, Schifferstein and Howell (2015) reported that people's willingness to purchase perfume was determined more by its fragrance than by the degree of congruency between the fragrance and the colour of the packaging. However, the use of a congruent packaging colour,

[5] Indeed, Garber et al. (2008) are careful to point out how the product/packaging colour must be congruent with the product at some level in order for a product to stand a chance of succeeding in the marketplace.

[6] Crossmodal correspondences are defined as the often surprising associations that people experience between features, attributes, or dimensions, either physically present, or merely imagined, in different sensory modalities (see Spence, 2011).

while easy/fluent for the consumer to interpret may be in danger of not standing out, at least in the very first seconds of the search process, in amongst all of the other congruently-coloured packages in the category (cf. Wolfe & Horowitz, 2017). Product attribute–packaging colour congruency, then, can be seen a key variable in the context of product identification and search in the marketplace.

In terms of empirical research concerning how product attribute–packaging colour congruency modulates the search for a particular product, Velasco, Wan, Knoeferle, Zhou, Salgado-Montejo, and Spence (2015) demonstrated that packaging colour/product flavour congruence facilitated the visual search for a particular flavour of crisps. Specifically, participants found it significantly easier to locate a predetermined flavour variety (e.g., cucumber) when the colour of the packaging was congruent with the customer's expectations (e.g., green, with their colour-flavour correspondences). That said, it should be noted that in this study the distractors and their corresponding colours were selected at random. Obviously, in such a search context it may be somewhat easier for congruently-coloured packaging to stand out. In future research, varying target-distractor similarity (i.e., moving the visual displays closer to the context of a real shelf) might say more about actual standout, etc.

Another intriguing finding to have emerged recently comes from the work of Sunaga, Park, and Spence (2016). The participants in a series of online studies were shown to find target products more rapidly when the items on the shelf were organized in terms of the lightness-elevation correspondence (i.e., with brighter items placed higher, and darker items placed lower on the shelf). Moreover, the Japanese participants who took part in these studies reported being willing to pay significantly more for the products (household cleaning products, books, and

crisps) when they were arranged as part of a corresponding array of products, rather than when the same products had been arranged in a non-corresponding configuration instead.[7]

It is, however, important to note that congruency in terms of packaging colour operates at multiple levels. So, for example, congruency may be defined in relation to a product's sensory attributes (e.g., its taste, flavour, or aroma) and its brand attributes (premium, natural, organic, cheap, etc.; see Huang & Lu, 2013). Imagine, for instance, catching sight of a bright orange package on the supermarket shelf. The colour might have been chosen to signify a cheap product (Wheatley, 1973), but should the product be a cola-flavoured drink then the colour would clearly be incongruent (at least if the consumer were to take the colour as signifying cue to the drink's flavour). To the best of our knowledge there is as yet no good research on how holding a specific product attribute (or series of attributes) in mind may modulate the role of the different colour cues that are present on a product's packaging, when it comes to the process of searching for it and determining product expectations (cf. Wolfe, 2012).

It is an intriguing, interesting, and open question, therefore, as to how to ensure that the consumer interprets the meaning of colour in product packaging in the right way (i.e., in the way intended by the brand). It is here that other elements of packaging design often help constrain the possible meaning ascribed to a particular patch of colour (see also Garber et al., 2008). In terms of the use of packaging colour to enhance shelf stand-out, it would certainly be interesting to know whether a customer's goals influence their search behaviour – e.g., when looking for a premium or healthy/natural product, do different colours stand out (see Mai, Symmank, & Seeberg-Elverfeldt, 2016)? Does black packaging tend to stand-out more, for

[7] Though, of course, few brands have the luxury of controlling where they are placed on the shelf. Moreover, it is worth remembering that eye-level is widely considered to be the best place to be in terms of vertical positioning on the shelf (see Chandon, Hutchinson, Bradlow, & Young, 2009).

instance, when a customer is searching for a premium product offering, and orange packaging when they are looking for a bargain (cf. Yarbus, 1967)?

2.2. Interim summary

Ensuring shelf standout can be important for a brand, especially if the product concerned happens to be a new player in the marketplace. However, whether a particular colour scheme will 'stand-out' and grab the consumer's visual attention depends, ultimately, on the category in which the product happens to be displayed. As we will see in a moment, it may also depend on the brand loyalty of the consumer (see Piqueras-Fiszman & Spence, 2011). While some colours have become closely aligned with specific brands (think here only of the signature bluish-green colour of Heinz baked beans or the purple of Cadbury's Dairy Milk), packaging colour is used in the majority of cases to convey information about a product's sensory (e.g., Earl Grey flavoured tea) and/or brand properties (e.g., product premiumness, or naturalness, for example).

It is, however, important to bear in mind here that the colour code (that is, the meaning of colour) is not universal, nor even culture-specific (Rohit & Radhika, 2006). Rather, much of the meaning that consumers attach to particular colours (or colour schemes) tends to be fundamentally category-specific. So, for example, while bright red colour is used in packaging to signify 'full fat' (in the milk aisle, say; Rox, 2011), it is more likely to connote 'Ready Salted' in the crisps category, and perhaps beef in the meat fridge. That said, when the same red colour appears on a beverage can it may suddenly link to the Coca-Cola brand (see Garber et al., 2008). Additionally, the colour red is also associated with sweetness (e.g., in yoghurt drinks, Tijssen et al., 2017), with spiciness (Tu, Yang, & Ma, 2016), with low-fat (in the case of milk), etc. The meaning of colour, in other words, is nearly <u>always</u> determined (or

constrained, or primed) by the context in which it is seen (see also Madden, Hewett, & Roth,, 2000, p. 103). As such, there are few cross-category generalizations concerning the meaning of colour that are likely to apply across the board. One of the only exceptions here being that most consumers, regardless of background, expect more saturated packaging colours to correspond to more intensely flavoured/fragranced products (e.g., see Becker et al., 2011; Gatti, Spence, & Bordegoni, 2014; Kemp & Gilbert, 1997; Tijssen et al., 2017; see also Mai et al., 2016).

It is important to note that colours can sometimes take on a signature function. That is, some companies have succeeded in establishing their distinctive colour as a recognizable attribute of their brand identity. Think only of Tiffany aquamarine or Kodak yellow (see Garber et al., 2008). However, even those brands whose packaging colour is distinctive, and who understandably have wanted to protect it in order to stop others from using it, have not always succeeded. Cadburys, for example, have failed in their attempt to protect Pantone 2685C (Bowcott, 2014; Nieburg, 2016).

3. On the different meanings of colour

Thus far, the assumption has been that the meaning of colour is relatively fixed, both across consumers and over time (perhaps due to its common affective valence, see Adams & Osgood, 1973). However, such a generalization is unlikely to hold true, given the various cross-cultural differences and historical changes in the meaning of colour, as we will see below (see Labrecque et al., 2013; Madden, Hewett, & Roth, 2000). One idea here is that the more abstract the concept, the easier it may be for a colour to be associated with it, whilst the more concrete the concept, the less flexible it is, as the object in itself might have specific representation in

terms of colour. Additionally, in the case of abstract concepts, there might anyway be an underlying semantic meaning (Adams & Osgood, 1973).

3.1. Cross-cultural differences in the meaning of colour

Over the years, marketing researchers have highlighted a number of cross-cultural differences in the meaning of, and people's association with, specific colours (e.g., see Adams & Osgood, 1973; Cavallo & Piqueras-Fiszman, 2017; Jacobs, Keown, Worthley, & Ghymn, 1991; Madden, Hewett, & Roth, 2000; Meggos, 1995; Schmitt & Pan, 1994; Wan, Woods, Jacquot, Knoeferle, Kikutani, & Spence, 2016; Wheatley, 1973). Given such observations, one might therefore reasonably also expect to find differences in the customers' colour-brand concept associations, in their colour-flavour associations, and in any other associations that might be primed by colour (see Wheatley, 1973). **Table 1** highlights some of the cultural differences in the associations people have (or had) with abstract colour.

Table 1. An early attempt by the marketer Wheatley (1973) to summarize to a number of the cross-cultural differences in the meaning attributed to colour. If, however, as is claimed in this review, the meaning of packaging colour is mostly determined by the context in which it is seen (see Hine, 1995, p. 215) then one might legitimately question just how much value such observations really have for the packaging designer worried about what colour their product packaging should be.

	Austria	**Brazil**	**Denmark**	**Finland**	**France**
Black	Mourning	Mourning Death Mystery	Mourning Sorrow	Sorrow Jealousy	Sorrow Drunkenness Jealousy Pessimism
White	Innocence	Peace Cleanliness	Innocence Purity	Innocence Cleanliness	Purity Young

		Purity			
Red	Anger Love Passion Fire	Warmth, Passion Hatred Fire, Anger Violence	Love Danger Fire	Anger Love Passion Fire	Anger Heat Pleasure Timidity
Green	Hope	Hope Liberty Immature Sickness	Hope Annoyance Health	Hope Envy	Youthful Fear
Blue	Fidelity	Tranquility Cold Indifference	Quality	Cold Without money Indifference	Anger Fear
Yellow	Jealousy	Joy, Sun Fortune Envy Sickness	Danger Deceitfulness Envy	(No special expression)	Sickness

Anyone concerned with the design of packaging should probably be sensitive to such cultural differences. Anecdotally, for example, it has been suggested that Cadburys' Dairy Milk struggled to gain market share in Japan specifically because the distinctive purple of the brand was associated with death/mourning in the minds of Japanese consumers (see Ricks, 1983). However, even knowing this, it is still hard to know what else the company should/could have done in the circumstances.

In recent years, researchers have increasingly started to use computerized testing methods (with experiments frequently being conducted online) in order to assess the most appropriate colour code/scheme for product packaging within a specific category (e.g., Piqueras-Fiszman & Spence, 2011; Tijssen et al., 2017; Velasco et al., 2014, 2015).[8] Oftentimes, testing may take

[8] Note here, in contrast to **Table 1**, how Velasco et al. (2014) assessed the meaning of colour in the appropriate marketing context.

place in several continents simultaneously. So, for example, Velasco and his colleagues were able to demonstrate that different packaging colours were deemed most appropriate for a given flavour of crisps in the three markets they tested (namely, mainland China, Colombia, and the UK; see Velasco, Wan, Salgado-Montejo, Woods, Oñate, Mu, & Spence, 2014): So, for example, blue packets of crisps were associated with a 'Natural' flavour in Colombia, with the 'Cheese & Onion' variety in the UK (though see Piqueras-Fiszman & Spence, 2011), and with 'Cheese and Bacon' amongst Chinese consumers.

Interestingly, however, there appeared to be more cross-cultural agreement concerning the colours deemed most appropriate for those packets of crisps whose flavour consisted of a single unambiguously coloured ingredient (e.g., such as red packaging for tomato-flavoured crisps, and green for cucumber-flavoured crisps). The Colombian participants in Velasco et al.'s study picked green as the colour for lemon-flavoured crisps (see **Figure 2**), whereas both the Chinese and Brits picked yellow instead. Note that lemon-related products are associated with green in the Colombian marketplace. [9]

Figure 2. An example of the cross-cultural differences in the meaning of packaging colour that exist. While British and Chinese consumers associate

[9] The participants in the majority of these studies had to match colours with specific sensory stimuli and/or to pick the most appropriate colour based on specific attributes. Note how this approach helps specify the "consumer goal." It is, however, important to note that consumers might have different goals in the supermarket and perhaps the appropriate combinations of colour might be more suitable (than a single colour) to tackle segmentation based on different consumer goals?

lemon with yellow, Colombian consumers associate it with green packaging instead. This, then, helps to explain the packaging shown above which is congruent for those from one culture (Colombia) but incongruent to those from elsewhere (UK and China). [Picture from http://www.carulla.com/images/products/149/0002526852677149/0002526853365414_xl_a.jpg.]

3.2. Brand associations

Now, beyond any cultural differences, it is important to note that the meaning of packaging colour sometimes differs as a function of a person's specific brand affiliation too (Ludden, Schifferstein, & Hekkert, 2008; Piqueras-Fiszman & Spence, 2011). Here, it is interesting to consider a relevant industry initiative in the UK. The majority of crisp brands in the UK use the colour green to signify 'cheese and onion' flavour, and blue to signify 'salt and vinegar' flavour instead, while Walkers does the opposite (see **Figure 3**; see Piqueras-Fiszman & Spence, 2011). The company switched their colour scheme back in the 1980s (in order to drive initial consumer exposure to a then-new flavour). The fact that this inverted colour scheme is still in place in the marketplace stands as one of the few examples of a company successfully going against the packaging colour conventions of the category. The playful image of the brand, and Walkers dominant position in the category, may have both helped the company to succeed with this most unusual strategy.

Figure 3. One example of the arbitrary use of colour to convey flavour in the crisps category. [Arbitrary in the sense that none of the named ingredients – e.g., salt, vinegar, cheese, or onions are obviously strongly associated with either green or blue, in the way, say, that red colour and tomato flavour go together.] In this case, however, Walkers (in the UK) went against the norms of the category. Just one example of how the meaning of colour is very often contextually determined.

Piqueras-Fiszman and Spence (2011) conducted a laboratory study in which participants sampled crisps (potato chips) direct from the packaging while trying to identify the flavour. The crisps were presented in four packets, two of 'salt and vinegar' (green) and two of 'cheese and onion' (blue; commercial Walkers packaging was used in all cases; see **Figure 3**). Unbeknownst to the participants, however, the contents of two of the packets had been switched surreptitiously. No surprise, then, that the participants sometimes found it hard to identify the correct flavour for the crisps presented in the incongruently-coloured packaging. By contrast, no such problems were encountered in those trials in which the crisps were sampled from the congruently-coloured packaging instead.

3.3. Historical changes in the meaning of (packaging) colour

The meaning of, and associations with, colour are also likely to have changed over the years (e.g., House & Garden, 1970; Sharpe, 1975; cf. Downham & Collings, 2000; Walford, 1980). Any such changes obviously need to be taken into account by those deciding on the most appropriate colour scheme for a new product and/or its packaging. Here, it is interesting to ask, for instance, when exactly bright orange became associated with a bargain product/brand (see Geboy, 1996; Lane, 1991; Sacharow, 1970; Wheatley, 1973, p. 26, for early albeit anecdotal mentions of this association). Was it always so? Similarly, black has not always been associated

with a premium product either (e.g., Bottomly & Doyle, 2006; Wheatley, 1973; though see Amsteus et al., 2015, on the varied meanings associated with this achromatic colour).

We have reviewed the evidence showing how colour in packaging can be used to stand out on the shelf/online, and how researchers assess the various meanings that may be associated by the consumer with a particular abstract patch of colour/colour scheme using computerized testing techniques (often conducted online). In the next section, therefore, we move on to assess how the colour of the packaging affects the expectations/experience of the product itself when seen in context (i.e., in the context of product packaging; see Amsteus et al., 2015).

4. Does packaging colour influence the consumers' product expectations?

Over the years, a number of researchers have assessed the impact of packaging colour on people's expectations concerning a product's sensory and higher-level properties. To date, far fewer studies have either assessed, not to mention successfully demonstrated, a significant effect of packaging colour on the consumers' product experience. Below, in this and the next section, we critically review the research that has been conducted on each of these questions.

In one of the earliest studies in this area, Deliza (1996; as summarized in Deliza & MacFie, 2001) in her PhD research assessed the influence of varying the appearance of the packaging of a carton of passion fruit juice. Her participants (94 Brits) expected juice shown in packaging with an orange background-colour to taste sweeter than juice served in packaging with a white background instead. They also thought that the white packaging would contain a drink that was purer, sharper, fresher, more natural, and more refreshing. Furthermore, expected liking was also higher for the product displayed in the white packaging.

Ares and Deliza (2010), meanwhile, reported a study in which they examined the combined influence of packaging shape and colour on consumer expectations concerning milk desserts using the word association and conjoint analysis techniques. 105 Uruguayan participants were shown six containers, varying in terms of their colour (black, white, and yellow) and shape (rounded vs. more angular). The results revealed that both expected liking and willingness-to-pay were influenced by the colour of the packaging. Yellow came out on top on both measures, being associated in the minds of the participants with sweet-tasting, delicious, vanilla and *dulce-de-leche*-type desserts. By contrast, the participants expected that they would like the desserts in the white packaging less and associated the packaging's contents with plain, sour, tasteless, and fruity milk desserts instead. At the same time, the black packaging was associated by some with bitter, dark-coloured, chocolate desserts. Others associated it with a 'disgusting taste', whilst another segment of those tested associated it with a 'premium' product instead. Bear in mind here also that the participants in this study only saw the colour of the packaging (that is, they did not see the product itself). Nevertheless, these results clearly do suggest that different packaging colours give rise to robustly-different expectations concerning the likely taste/flavour of the (in this case, unseen) contents.

Huang and Lu (2015) conducted a laboratory-based within-participants study in which 40 North American students were tasked with evaluating the apparent healthiness and sweetness of four different foods (breakfast cereal, ice-cream, iced tea, and yoghurt) presented in blue, green, and red packaging (see **Figure 4**). Each participant made a total of 12 ratings. The results revealed that the participants expected that products in red packaging to taste sweeter (and thus were inferred to be less healthy) than the same products when presented in green or blue packaging instead. That said, the impact of packaging colour on consumers' product-related expectations in this particular study was more apparent in those of the participants who were

classified as high external eaters than in those classified as low external eaters (Brignell, Griffiths, Bradley, & Mogg, 2009).

Figure 4. The four products tested in Huang and Lu's (2015) study of the impact of packaging colour on people's inferences concerning the likely attributes of the product contained within. One might worry that the colour manipulations introduced in these somewhat artificial-looking packaging prototypes are more 'obvious' than might be the case on a more realistic, ecologically-valid, example of packaging (that one might, for example, find, in the store). Hence, variations in packaging colour might have a more pronounced effect on people's product expectations than would be the case were more realistic examples of packaging to have been evaluated.

Finally, here, Tijssen et al. (2017) have just published an intriguing study in which they used very realistic and well-controlled variations in packaging colour (the hue, saturation, and brightness of the packaging colour were all varied orthogonally). In particular, these researchers found that for a healthy low-sugar yoghurt drink, red (rather than blue) packaging gave rise to expectations of a significantly sweeter, creamier-tasting, and more intensely-flavoured product. Meanwhile, for a less healthy low-fat processed sausage product, red packaging (see **Figure 5**) led to expectations of a fattier and more flavourful sausage product than did the blue packaging. Decreasing the colour brightness of the packaging increased

expected sweetness intensity. Curiously, variations in the brightness of the packaging colour had opposite effects on the expected flavour intensity of the two products.[10]

Figure 5. Four of the hyper-realistic examples of product packaging tested recently by Tijssen et al. (2017). The images show one of the products (sausage) tested in one of the hues (red) varying in terms of the saturation and brightness of the dominant colour.

Zellner, Greene, Jimenez, Calderon, Diaz, and Sheraton (in press) have recently assessed the flavour expectations set by a piece of metallic foil paper having one of four different colours (red, green, orange, and purple/pink). The participants (N=24) were first asked to report whether the colour of the paper made them think of a particular flavour or not. If they responded in the affirmative (which most participants apparently did), then they were then asked what the flavour was. Thereafter, they were asked what flavour they would expect a candy wrapped in foil paper of this colour to be. And, finally, they were asked what flavour they would expect a beverage in a container with this paper wrapped around it to be. Regardless of the condition (i.e., abstract, candy wrapper, or beverage packaging), the participants mostly reported that the orange wrapper as associated with an orange flavour, the red with cherry, and the pink/purple

[10] Like Piqueras-Fiszman and Spence (2011) before them, Tijssen and her colleagues also used the IAT to assess the strength of the association between packaging colour and specific brand attributes (e.g., healthfulness; cf. Parise & Spence, 2012; Piqueras-Fiszman & Spence, 2011).

with grape. The only case where the packaging context influenced the flavour associations reported was for green. In this case, the association was associated with mint in the abstract and candy wrapper conditions, and with lemon/lime in the context of a beverage.

Finally, in a conference presentation, Fenko, van Lith, and Galetzka (2015) reported that the specific packaging colours that were associated with healthy and unhealthy products depend on the category (see also Huang & Lu, 2013; Schuldt, 2013). For crisp bread, the packaging colour that set the healthiest product expectations amongst the 10 colours assessed was light brown, whilst the product in the bright yellow packaging was expected to be the least healthy. When it came to chocolate, the least healthy colour was bright yellow once again. Surprisingly, however, the packaging colour that was expected to be most healthy was bright red.[11] According to Fenko and her colleagues, this result can perhaps best be explained by the colour code typically used for different varieties of chocolate in the Netherlands, where the study was conducted. There, red packaging is commonly associated with dark chocolate, blue packaging with milk chocolate, and green with hazelnut chocolate variety. Therefore, the suggestion was that for Dutch consumers, red packaging is linked with dark chocolate (i.e., with a 'healthier' product).[12]

What is clear from the research that has been reviewed in this section is that when colour cues are embedded in product packaging they can indeed help set people's product-related sensory and hedonic expectations. In fact, the results of a number of studies now show that if the colour of the packaging is changed then the consumer's expectations concerning the sensory and higher-order product attributes, not to mention their expected hedonic response to it, will likely

[11] This is surprising in light of the research mentioned earlier showing the sweet-red association in product packaging.

[12] It is interesting here to note Saluja and Stevenson (in press) recent findings that when people try and articulate why it is that they associate a particular colour with a specific taste, those who say anything report bringing to mind exemplars of foods having that taste (e.g., Brussels sprouts and other cruciferous vegetables when thinking of what colour goes with a bitter taste, for example).

also change too (e.g., see Ares & Deliza, 2010; Fenko et al., 2015; Huang & Lu, 2015; Rebollar, Lidón, Serrano, Martín, & Fernández, 2012; Tijssen et al., 2017; Zellner et al., in press). While such results may come as little surprise given what we have seen already in the earlier sections of this review, the more important question to be addressed next is whether such expectations carry-over to influence the consumer's product experience on evaluating the sensory attributes of the product itself?

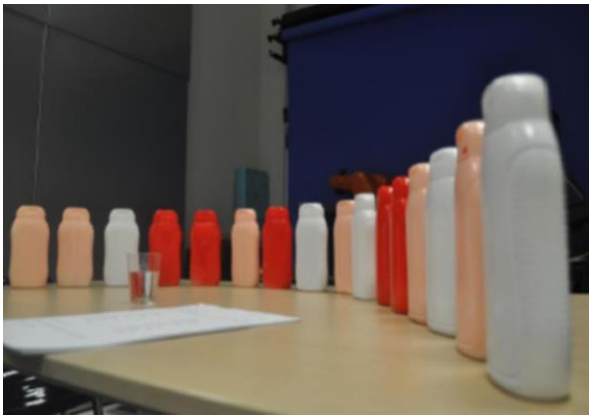
There are a few observations concerning these findings that are worth stressing before we move on. First, it is worth remembering that if packaging colour is the only thing that varies in an experiment or study then there is a danger that colour becomes more relevant to the participants' responses than might be the case under naturalistic conditions. Second, if colour is one of the only attributes on the packaging, there may be a danger that its importance as a diagnostic cue with regard to the product may be over-emphasized as compared to what would be seen in more naturalistic examples of product packaging. Third, there may be relevant individual differences in the strength of the associations that people have with packaging colour. And finally here, it should also be remembered, as we saw earlier, that the meaning of colour may well be category, brand, and even possibly culture dependent.

5. Does packaging colour influence the consumers' product experience?

Over the last 70 years or so, there have been a number of anecdotal reports from the marketplace suggesting that changing the colour of the packaging sometimes adversely affects the consumers' experience of a commercial product's sensory properties. So, for example, Louis Cheskin (1957), the émigré marketer (see Samuel, 2010), was perhaps the first commentator to note in print that changing the colour of the packaging influenced what consumers had to say about the taste/flavour of the contents. In his book, *How to predict what*

people will buy, Cheskin reports how when 15% more yellow colour was added to a can of 7-Up, people described the contents as tasting 'more lemony'. Something similar happened in 2011 when Coca-Cola launched a white Christmas can. It the latter case, however, it turned out that so many consumers complained about the taste of the drink that the company was forced to withdraw the cans from the shelves (Abad-Santos, 2011; Esterl, 2011).[13] But, one might ask, are such anecdotal reports from the marketplace also supported by the results of peer-reviewed academic research?

Well, Gatti et al. (2014) have reported that packaging colour influences people's judgments of fragrance intensity (see also Schifferstein & Howell, 2015). These researchers conducted a laboratory-based study in which their participants (N = 20) were presented with 12 plastic bottles of an unnamed hand-washing solution. The participants were instructed to pick up each bottle, unscrew the lid, and sniff the contents before rating the perceived intensity of the fragrance and how efficacious they thought the product would be. The bottles either contained a lower or a higher level of the fragrance. Half of the bottles were also slightly heavier than the others (450g vs. 350g, respectively). As can be seen from **Figure 6**, the colour of the bottles varied between white, pink, and a fully-saturated red.



[13] The excess stock was subsequently served to unsuspecting airline passengers (see Spence, 2017). Intriguingly, Guinness recently launched a white version of their erstwhile black can. Given the Coke example, it will be interesting to see how consumers respond to this innovative use of packaging colour.

Figure 6. The 12 bottles facing the participants in Gatti et al.'s (2014) study of the impact of packaging colour (white, pink, or red) on perceived fragrance intensity (and the inferred efficacy of a liquid hand-wash).

The results revealed that participants rated the fragrance of the unseen handwash as smelling significantly more intense when presented in the red bottle than in either of the other bottles. In particular, the fragrance sniffed from the red packaging was rated as 16% more intense than from the product in the pink packaging, and 44% more intense than from the white packaging. The handwash in the pink bottles was also rated as smelling significantly more intense than the product contained in the white bottles. (In passing, it is worth noting that the more intense the fragrance was rated as being, the more effective the participants thought that the product would be too.) Such results, then, provide clear evidence that the colour of the packaging can indeed bias a consumer's experience of the product itself. In this case, the crossmodal effect of packaging colour on judgments of fragrance intensity may well have been driven by the crossmodal correspondence between saturation and intensity (see Kemp & Gilbert, 1997; Spence, 2011): That is, consumers generally expect products in more saturated packaging to have more intense sensory properties than those products that happen to be packaged in colours that are less saturated.

While Gatti et al.'s (2014) results represent some of the clearest empirical evidence reported to date that packaging colour can indeed affect product experience, there are nevertheless a couple of points/caveats to note here concerning the interpretation of their findings. On the one hand, it is important to bear in mind that the participants never saw the colour of the hand-wash itself. That is, they only saw the packaging. It is currently an open question as to whether packaging colour may exert a more pronounced influence over product experience under those conditions in which the consumer can't see the product itself (think here also of the consumers drinking

direct from the can in Cheskin's earlier 7-Up example; Cheskin, 1957). On the other hand, it should also be stressed that when the colour of the packaging is the only visual attribute that is available, one might expect that it would tend to influence people's expectations more than when that colour is embedded in-amongst a host of other graphic design elements (such as label, logo, product imagery, etc.; see **Figure 5** for one such example the kind of thing we have in mind here).

Another recent example demonstrating that packaging colour can influence product experience, even when the product itself is visible comes from Tijssen et al. (2017) experiments. In a final experiment, these researchers demonstrated that the taste expectations elicited by the variations in packaging colour (as described earlier) sometimes influenced the rated taste of the products when assessed in the laboratory. Specifically, the low-sugar yoghurt product associated with the red packaging with low brightness and high saturation was perceived as tasting sweeter, creamier, and to have a more intense flavour. However, although similar trends were reported for the sausage product, these failed to reach statistical significance. While Tijssen et al. (2017) assessed colour in perhaps the most meaningful and realistic exemplars of product packaging to date, one might nevertheless still worry that if all that varies between one stimulus and the next is the colour of the product packaging (remember that participants were presented with 12 versions of the same packaging varying only in colour), then, as mentioned in the preceding section, participants might well have their attention drawn to this feature of the packaging in a way that it perhaps is not in everyday shopping/product encounters, say. What is more, it is also worth highlighting the fact that the influence of packaging colour on taste ratings were less pronounced than those documented solely on the basis of the visual expectations set by the packaging colour (see also Becker at al., 2011).

As a final example here, it is worth dwelling on Zellner et al.'s (in press) recent study of metallic foil candy wrappers. As we saw in the previous section, in an initial study, these researchers demonstrated that different wrapper colours did indeed set different expectations in the minds of participants concerning the likely flavour of the contents. Interestingly, however, when, in a second experiment, these researchers had a new group of participants (N = 60) actually taste a sugar spun candy wrapped in one of the four metallic foil colours (in a between-participants design), no effect of packaging colour on product experience was observed (this despite the authors one again showing that the majority of participants expected the wrapper to have a specific flavour). The colour of the wrapper had no effect on liking, flavour intensity, or sweetness intensity. Zellner et al.'s findings therefore currently stand as one of the few studies to report that packaging colour affected people's product expectations, without also affecting their product experience. That said, it is easy to imagine how there might be a file drawer problem/publication bias against publishing null results in this area (Rosenthal, 1979).

As to why wrapper colour had no impact in Zellner et al.'s (in press) study, one might wonder whether inner and outer packaging (Krishna, Cian, & Aydinoğlu, 2017) might have different effects of packaging colour (with candy wrappers more likely to be considered as inner than outer packaging, as studied so far in this review). However, in this case given that the wrapper set clear flavour expectations, the sugar spun candy was pretty much tasteless, and hence there is likely to have been a big disconnect, that may have led to participants to ignore the packaging colour. In fact, on tasting the candy, the participants reported vanilla (29% of participants) or butterscotch (14%) flavour. A third experiment conducted by Zellner et al. revealed that people expected the spun candy to taste of mint (38%), vanilla (15%) or coconut (15%).

The other question is whether the consumer believes the particular colour to be informative about a product's sensory (or higher-order) attributes or not. Should the consumer think that

colour has been added solely for aesthetic rather than for diagnostic reasons (i.e., simply to add colour variety, say; see Piqueras-Fiszman & Spence, 2014), it may not influence judgments (even though the consumer can infer the meaning of that colour were it to be treated as diagnostic; see Lewis, Pearson, & Khuu, 2013; Tanaka & Presnell, 1999, on the role of colour as a highly diagnostic cue in object perception/recognition).

Hence, in conclusion, the limited research that has been published to date on this topic reveals that while packaging colour can indeed influence people's product experience (Gatti et al., 2014; Tijssen et al., 2017), it is certainly by no means guaranteed to do so (see Tijssen et al., 2017; Zellner et al., in press). It thus becomes an important question for future research to try and determine the key factor(s) accounting for when exactly packaging colour influences the consumers' sensory and hedonic product experience. Beyond the factors identified in the preceding section, it may be relevant to note that packaging is presumably more likely to affect product experience when it is thought to be diagnostic (carrying meaning) rather than merely ornamental/aesthetic. It may also be more impactful when it taps into one of the more fundamental crossmodal correspondences involving colour (such as, the colour saturation-intensity mapping; Gatti et al., 2014).

6. Colour combinations

While much of the literature has focused on the meaning of individual colours, it is important to note that the majority of packages actually comprise several distinct colours. As such, one relevant question here concerns the meaning, or expectations, that are set in people's minds by particular combinations of colour. While there is certainly less research on this topic to date, what little there is suggests that certain combinations of colour may connote a particular product attribute more effectively that any single colour. Much of the research in this space has

tended to focus on colour schemes that are congruent with a particular taste, flavour, or fragrance. So, for instance, in their intriguing book, *Colour and Communication*, Favre and November (1979) presented a number of colour schemes that they argued were appropriate for a specific taste (see **Figure 7**). However, while these practitioners' suggestions do indeed seem intuitively plausible, they fail to say how, exactly, they came to their conclusions, nor whether any empirical evidence supports their suggestions.

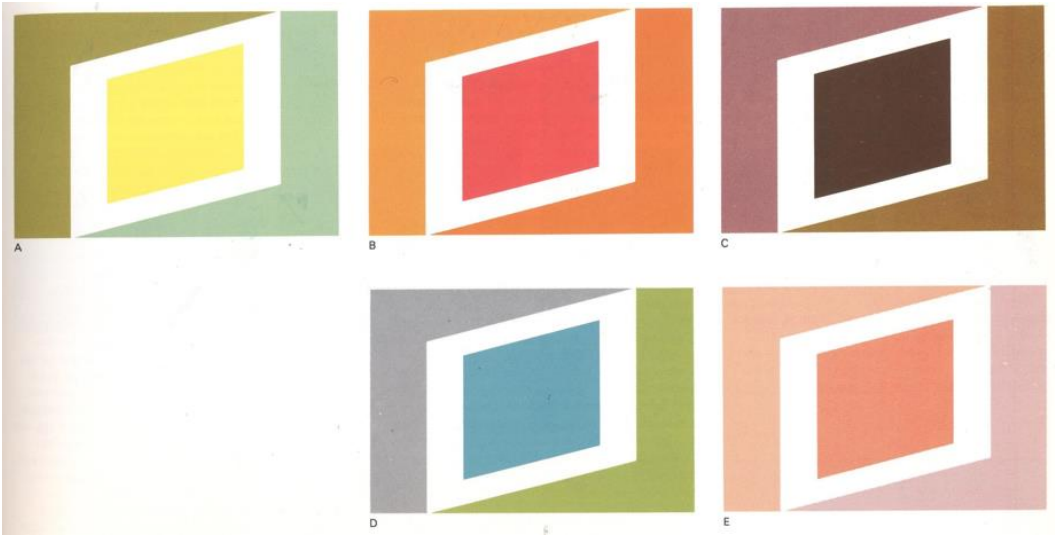


Figure 7. Colour schemes put forward by Favre and November (1979) to suggest specific tastes: A acid; B sweet; C bitter; D salted; and E liqueur-like, sweetish. Are such recommendations based merely on intuition or on robust empirical findings? However, given the possibility of historical changes in the meaning of colour, one might ask if these colour schemes still communicate the desired meaning almost 40 years after they were published?

The latest research from Woods and colleagues (Woods, Marmolejo-Ramos, Velasco, & Spence, 2016; Woods & Spence, 2016) has demonstrated that pairs of colours, at least if clearly organized into a foreground/background arrangement, can sometimes be used to convey a specific taste rather more effectively than the best individual colour.[14] Interestingly, however,

[14] Note that the latest online testing techniques were used to sample a large number of people and a relatively large number of different pairs of colour in order to arrive at these conclusions.

when pairs of colours were arranged side-by-side, people found it a little harder to associate them with a taste. In this regard, it is intriguing to note how the colour schemes put forward by Favre and November (1979) are clearly organized into foreground and background colours. Elsewhere, Jacquot, Velasco, Spence, and Maric (2016) have demonstrated that specific colour triplets can also be used to convey a fragrance effectively, even when marketing to consumers from somewhat different cultural backgrounds (see **Figure 8**). Ultimately, as well as using colour combinations to convey specific meanings, one also needs to make sure that the resulting combination is itself harmonious (Ou, 2015), and/or that it can be processed fluently by the target consumer (e.g., Reber & Schwarz, 2001). And, once again, there may be cross-cultural differences to take account of here too (Madden et al., 2000). That said, the suggestion is that the connotation of colour may be easier to ascertain in a cross-cultural section when a combination of colours is used rather than just a single colour patch.

Figure 8. Colour palettes chosen by Jacquot et al. (2016) in order to communicate the smell of lavender, peppermint, and cucumber, respectively, in a way that is meaningful to both French and British consumers.

7. Conclusions

Colour is perhaps the single most important element (or feature) as far as the design of multisensory product packaging is concerned. On the one hand, it plays a dominant role in terms of capturing the attention of the shopper in the aisle, or increasingly, online. On the other,

distinctive colours (and colour schemes) can also act as a valuable brand asset (see Geboy, 1996; Kanner, 1989). As Singh (2006, p. 787) put it: *"Indeed, color can be an important, controllable marketing variable for managing image standardization because a product's color can function not only as an immediate identifier of its brand but also its quality and price."* That said, in many categories, packaging colour is more commonly used to convey category-specific information instead. The evidence published to date clearly demonstrates that a consumer's sensory and hedonic product-related expectations are influenced, in part, by the colour of the packaging in which that product happens to be presented. At the same time, a more limited body of research suggests that packaging colour sometimes affects the consumers' experience of the product itself as well (e.g., its perceived taste, flavour, and/or fragrance).

7.1. Why does packaging colour influence product expectations and experience?"

The basic idea here is that packaging colour automatically sets sensory and higher-order expectations in the mind of the consumer (e.g., concerning the likely taste/flavour/fragrance properties of the contents of the packaging, Huang & Lu, 2015; see Piqueras-Fiszman & Spence, 2015, for a review). Colour, after all, is a highly-diagnostic cue as far as object recognition is concerned (e.g., Lewis et al., 2013; Tanaka & Presnell, 1999). These expectations are likely based on learnt associations between hue and specific sensory attributes (e.g., such as specific tastes and flavours); They may also reflect the crossmodal correspondence between saturation and intensity (Gatti et al., 2014; Kemp & Gilbert, 1997) – either innately determined or, once again, learnt from the regularities of the marketplace.

The product expectations that are evoked by the colour of the packaging then anchor, and possibly also influence, the subsequent product experience. However, it is important to note

that the product expectations associated with the colour of the packaging do not always carry-over to influence the consumer's product experience, of either sensory or higher-order product attributes (Tijssen et al., 2017; Zellner et al., in press).[15] One question that we are left with is why this should be so. One possibility is that it depends on, amongst other things, how far the actual sensory experience of the product itself (on tasting/smelling) is from the expectation (see Ares & Deliza, 2010; Deliza & MacFie, 2001; Piqueras-Fiszman & Spence, 2015; cf. Shankar, Simons, Shiv, Levitan, McClure, & Spence, 2010; Wang, Keller, & Spence, 2017).

Ultimately, packaging colour can play an important role at all stages of the consumer's interaction with many F&B, HPC, and FMCG goods. The challenge, therefore, is to determine which colour scheme will prove to be most beneficial across the various stages of the consumer's product experience. It would be interesting to know more about how the relative importance of packaging colour at the various stages of the customer's interaction with a given class of product. Furthermore, finding colour schemes that work cross-culturally can prove particularly challenging for global brands, especially given the well-documented differences in the meaning of colour. Importantly, however, the latest computerized testing techniques (often conducted online) are increasingly allowing F&B and FMCG companies (and the design agencies who work for them) to more effectively evaluate the efficacy (e.g., the shelf stand-out) and meaning of various different colour schemes in a variety of consumer markets (see Woods et al., 2015). Big data analysis may also start to provide useful information in the years ahead (Kaedi & Alinia, 2017).

[15] And, as mentioned earlier, one should also be aware that there may be a file drawer problem here (Rosenthal, 1979), with null results of packaging colour on product experience staying in the filing draw rather than making it into the public domain.

7.2. Directions for future research

In terms of potentially fruitful directions for future research, one question to which we do not yet have a clear answer concerns whether packaging colour has a more pronounced impact on product perception when the product itself is consumed/used direct from the packaging versus when it is removed prior to consumption/use.[16] It is also unclear, based on the evidence that has been published to date, whether packaging colour has a more pronounced effect when the consumer doesn't get to see the colour of the product itself (as when drinking direct from a can, say; see also Zellner et al., in press). Once again, it would be good to have an answer to this question.

Moving forward, one of the issues to keep in mind when interpreting the results of the published research concerns those studies where packaging colour is only seen on a prototype package displayed on a computer screen, say. Is there a danger that the results of such research may underestimate the true impact of packaging colour on the customer's product perception? At the same time, however, it is worth stressing that computer-based online testing is undoubtedly starting to help revolutionize the assessment of the most appropriate innovative product packaging colours to use (see Woods et al., 2015).

7.3. Limitations and conclusions

One of the challenges for packaging colour is what happens when a multitude of other packaging cues (such as typeface, branding, written descriptions, etc.; see Bottomley & Doyle, 2006; Lunardo & Livat, in press; Ngo, Piqueras-Fiszman, & Spence, 2012) also compete for

[16] According to some estimates, roughly a third of the food and drink we consume is, in fact, consumed direct from the packaging.

the customer's visual attentional resources. The key question therefore becomes one of whether those experimental settings in which packaging colour is the only thing that changes from one trial to the next may unintentionally serve to overemphasize the role (meaning) of colour relative to everyday situations. Another issue that demands further research will be to assess how long-lasting the impact of any particular change in packaging colour is for product expectations, and more importantly, the customer's perception of a given product. After all, most of the research conducted to date has only involved short-term exposure to the effects of innovative packaging colouring. It would also be interesting to more systematically assess whether the influence of packaging colour on product perception is mediated by the degree of discrepancy between what was expected based on packaging colour and what was experienced when using/consuming the product (Piqueras-Fiszman & Spence, 2015; cf. Shankar et al., 2010).

Another topic that there has not been time to discuss in detail here concerns the question of whether different segments of the consumer base (e.g., within a given culture and at a specific time) may respond differently to packaging colour (see Huang & Lu, 2015; Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013). What literature there is out there on this topic suggests that such differences do, in fact, exist (e.g., differences between different age groups; see Marshall et al., 2006; Piqueras-Fiszman, Ares, & Varela, 2011). Furthermore, the influence of colour blindness on the consumer's response to colour in product packaging also seems like something of a neglected area, given that it has been estimated that as many as one in every ten male consumers may suffer from some sort of deficit in their colour vision.[17]

[17] And while the majority of published studies in this area normally exclude anyone reporting a colour vision deficit, it might be argued that a more representative way in which to assess the likely consumer response to a given packaging design is, in fact, to include everyone. This makes sense insofar as the colour blind presumably do as much of the shopping as anyone else (hence what one really wants to know is how packaging affects the average consumer; Kaufman-Scarborough, 2002).

Ultimately, though, despite the various caveats that have been outlined here, we believe that research into the optimization of colour in product packaging (in order to convey the right expectation/optimize the customer's product experience) is now in a much better position than ever before, given the rise of computerized testing techniques (often conducted at scale online) that allow a company to rapidly and relatively inexpensively assess the product expectations and associations that are associated with packaging colour in multiple markets simultaneously.

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