



## Touching tastes: The haptic perception transfer of liquid food packaging materials



Yangjun Tu<sup>a,b</sup>, Zhi Yang<sup>b,c,\*</sup>, Chaoqun Ma<sup>b</sup>

<sup>a</sup> Research Institute of Educational Science, Hunan University, China

<sup>b</sup> School of Business, Hunan University, China

<sup>c</sup> Department of Business Administration, College of Business, University of Illinois at Urbana-Champaign, USA

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### ABSTRACT

Based on the theory of crossmodal correspondence, which addresses transfer effects from one sense to another, and research that has explored the impact of touch on taste, the present study examined how the packaging materials of traditional Chinese cold tea drinks generated touch–taste associations. Blindfolded participants used a set of tasting attribute items to evaluate the taste of a liquid food product that differed only by the materials used to contain it, although they were led to believe that the products could differ. The results of Experiment 1 suggest that consumers' haptic perception of packing materials significantly impacted their sense of the product's SWEET dimension, but not the product's SOUR or BITTER dimensions. Consumers rated a liquid food product's sense of cold and ice (sub-dimensions of SWEET) higher when it was presented in a glass container rather than in paper or organic plastic containers. However, with the cups' weight controlled, the results of Experiment 2 revealed that consumers' haptic perception of packing materials only significantly impacted their sense of ice, but not their sense of cold. Consumers rated a liquid food product's sense of ice higher when it was presented in a glass container rather than in an organic plastic container. The preliminary findings of both experiments indicate a crossmodal correspondence between the touch of food packaging materials and the taste of the food contained within them. Sensation transference provides the most likely explanation for the results. Affective ventriloquism effects provide another, but less likely, explanation. The study's implications for choosing between packaging materials for liquid food products are discussed.

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### Introduction

When wandering in the supermarket to shop for everyday food and beverages, consumers will find that liquid food packaging material is diverse. This diversity makes liquid food packaging an ideal medium for testing the haptic effects of food packaging, providing us with a convenient site for conducting multi-comparisons and controlling independent variables (i.e., packaging materials). However, among all liquid food products, tea most clearly manifests Eastern cultural traditions and characteristics. Specifically, in China, the history of using herbal tea may as long as the history of using traditional Chinese medicines (TCMs), many of which are consumed in the form of tea (Zhao, Deng, Chen, & Li, 2013). According to the statistical report of the China National Food Industry Association, herbal tea has a 20% share of the Chinese beverage consumption market, and its market share is increasing at the

surprising rate of 30% per year (cited by Zhong & Wu, 2013). Due to its cultural significance and popularity, we selected Chinese cold tea to represent the liquid food stimulus for the present study.

At its most fundamental, packaging contains, protects, and preserves products; however, at its most sophisticated, it influences selling operations (Paine & Paine, 1992). In the highly competitive environment of retail stores, where the typical shopper passes by some 300 items per minute and makes 40–70% of all purchase decisions, packaging performs many sales functions and acts as an important promotional medium (Armstrong & Kotler, 2013). It is also a key strategic marketing tool for a product's overall success, especially in the food industry, with its rapid structural changes (Rundh, 2005). Food packaging, which is often intertwined with food, is a broad term, including form, structure, materials, color, imagery, typography, and regulatory information with a few ancillary elements (Xu, Li, & Wei, 2009). Successful food packaging not only creates desire and establishes brand loyalty, but it also often provides the sole reason for buying a product (Klimchuk & Krasovec, 2013, pp. 39–40). A substantial amount of research has exclusively examined how the shape and color of packaging affect

\* Corresponding author. Address: School of Business, Hunan University, LuShan South Road, Changsha, China. Tel.: +86 13974835477.

E-mail address: [yangmkt@126.com](mailto:yangmkt@126.com) (Z. Yang).

taste experiences. In studying the impact of shape, Spence and Gallace (2011a), for example, found an association between presenting sparkling water, cranberry juice, and Maltesers chocolate with angular shapes. In studying packaging color, Piqueras-Fiszman, Alcaide, Roura, & Spence (2012) found consumers rated the flavor intensity and sweetness of strawberry mousse higher when it was presented on a white plate rather than on a black one. Further, to a great extent, the physical features of food packaging have been shown to affect consumers' product attitude and price expectations (Becker, Van Rompay, Schifferstein, & Galetzka, 2011), perceived quality of a product (Borland, Savvas, Sharkie, & Moore, 2013), and perceived brand attributes (Parise & Spence, 2012). Even the cutlery with which a food sample is served has been shown to affect the response of consumers. Harrar and Spence (2013) found, for instance, that consumers perceived yoghurt as denser and more expensive when tasted from a lighter plastic spoon as compared to an artificially weighted spoon. Studies focusing on the color and shape of food packaging have contributed to a better understanding of how packaging can impact consumers' food taste and brand perception, yet the majority of the published research on food texture, or touch, has focused primarily on what occurs inside the mouth during consumption (Piqueras-Fiszman & Spence, 2012b). Less attention has typically been given to the possible influence of food packaging materials on consumers' taste experiences (Krishna & Morrin, 2008; Piqueras-Fiszman et al., 2012; Piqueras-Fiszman & Spence, 2012a, 2012b; Schifferstein, 2009).

The importance of consumers' ability to touch products that they are considering for purchase cannot be overstated. Whether in store- or internet-based selling, products with primarily material properties are more likely to be preferred (Citrin, Stem, Spangenberg, & Clark, 2003; McCabe & Nowlis, 2003) and to be rated more highly in shopping environments that allow physical inspection rather than in those environments that do not (Peck & Childers, 2003b). Those pre-selected high-quality products for which tactile input is diagnostic obtain more positive and favorable product evaluations (Grohmann, Spangenberg, & Sprott, 2007). Physical touch, sensorial judgment, and affective response are often related to one another in a specific hierarchy; for example, "relaxing" is a combination of indulgent/sensual and warm, while "precious" is a combination of indulgent/sensual and not warm (Chen, Barnes, Childs, Henson, & Shao, 2009). Researchers have examined how expectancy-based effects impact crossmodal correspondence, and have found that people generate expectations about the taste of a food from contextual cues, such as the features of hot and cold (Spence, Levitan, Shankar, & Zampini, 2010). A consumer's sense of touch has been shown to play a very important role, especially in the first stage of buying, during which the consumer develops a "feel" for the package and the ingredients inside (Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013). Accordingly, we may reliably speculate that when consumers purchase food they come to expect the actual taste of that food by habitually or subconsciously touching the packaging, indirectly evoking memories of the purchased food's taste. At the same time, touch may arouse affective responses, independently moderating the effect of food tactility on consumers' buying decision-making process. The present study contributes to this field of research, which is now gradually receiving increased attention. Specifically, the field focuses on how haptic, or touch-related, properties of food packaging materials affect consumer food-taste experiences. Since haptic perception is complicated by the number of perceptual processing inputs that are generated from multiple subsystems—including those in skin, muscles, tendons, and joints (Goldstein, 2013)—we address key issues in studying haptic perception before presenting the formal study.

Consumers experience a wide range of haptic sensations from the many different kinds of liquid food packaging materials to

which they are exposed in the market, and they may associate these materials and sensations with qualities derived from cultural semantics. For example, Tu, Yang, and Ma (2013) noted that consumers perceived organic glass as bright; wood packaging material as natural and comfortable, signifying something pure and sweet; and plastic as compact and smooth, suggesting something exquisite and elegant. Haptic perception may be divided into at least two systems of haptic classification. Lederman and Klatzky's (1990) initial classification of haptic sensation distinguished between eight diagnostic attributes: shape and size; texture and hardness; weight; temperature; part; and motion of a part. Littel and Orth (2013) narrowed haptic perception to four factors: size, hardness, contour, and texture. Researchers have observed that certain stereotypical hand-movement patterns were directed at extracting particular object properties; for example, static contact with temperature and unsupported holding with weight (Klatzky & Lederman, 1992; Lederman & Klatzky, 1987). Furthermore, Klatzky, Lederman, and Reed (1989) found that redundancy gains (shortened response time) were observed only for two substance factors at any given time (in their case, texture and hardness with planar contour). Lederman and Klatzky's (1990) also observed that when neither hand was favored by the initial mode of contact, the subject tended to use both hands throughout, which implies that holding a drink container in both hands may be a habit in everyday life. They also found that participants came to associate the most diagnostic (haptic) attributes (MDA) with specific exploratory procedures (EPs); for example, Texture MDA with Lateral Motion EP, Hardness MDA with Pressure EP, Temperature MDA with Static Contact EP, and Weight MDA with Unsupported Holding EP.

The present study is especially concerned with the crossmodal correspondence of haptic temperature, weight, and texture perceptions with taste. Crossmodal correspondence occurs when polarized stimulus dimensions between different, basic physical stimulus attributes—or features in different sensory modalities—seem to be associated, such as when a more-or-less extreme stimulus value on a given dimension is found to be compatible with a more-or-less extreme sensory value on a corresponding dimension (Spence, 2011). Crossmodality may occur at any level, depending on the stimulus meaning/valence, which could just as effectively associate low-level modal stimulus properties as high-level cognitive correspondence (Spence, 2011). Researchers have discussed crossmodal correspondence between many different pairs of stimuli (pitch and elevation, brightness and lightness, size and angularity of shape), but the majority of studies have matched auditory and visual stimuli (Spence & Deroy, 2013). Based on crossmodal correspondence theory, we have reason to believe that the haptic temperature, weight, and texture of food packaging materials may map onto food taste experiences. Krishna, Elder, and Caldara (2010) have shown that both smell and touch have semantic associations that can enhance haptic perception and product evaluation. Research has also established that the physical properties (e.g., weight) of food packaging containers can exert significant influence on consumers' expected satiety and perception of density (Piqueras-Fiszman & Spence, 2012a), sensory and hedonic responses (Piqueras-Fiszman, Harrar, Alcaide, & Spence, 2011), and even impressions and decisions (Ackerman, Nocera, & Bargh, 2010). Piqueras-Fiszman and Spence (2012b) found, for example, that a biscuit (i.e., cookie) contained in a rougher, yoghurt-like pot (i.e., cup) was perceived as being significantly crunchier and harder than those contained in a smoother, yoghurt-like pot.

Schifferstein (2009) has explored in particular how the experience of cups made of different materials affects the experience of drinking a liquid food product. That study revealed that different cup materials evoked different experiences. Schifferstein suggested that if the meaning of the test items could be derived directly from the perceived sensory characteristics of the liquid food product,

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