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The effect of menu design on consumer behavior: A meta-analysis

Michael Man Him IP, Robin Chark *

Faculty of Business Administration and Centre for Cognitive and Brain Sciences, University of Macau Avenida da Universidade, Taipa, Macau Special Administrative Region of China

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ABSTRACT

A meta-analysis of 53 papers with 16,522 participants is conducted in the menu-design literature. To conceptualize different design elements, we extend a four-dimensional model by including two new dimensions—menu card label and menu item characteristics. We find that effect sizes vary among these six dimensions. Specifically, menu card characteristics that concern non-descriptive design elements have the largest effect size. The six dimensions are divided into two broad categories that relate to the entire menu or individual menu items. Our meta-analytical results show that the former category yields larger effect than the latter. Concerning the dependent variables, menu design has a large effect on physiological measures, a moderate effect on intention and attitude, and a marginal effect on actual purchase. Furthermore, laboratory studies yield larger effects than field studies do, and mock menus have stronger effect than real menus. Lastly, publication bias seems to be moderate.

When you do a menu at a restaurant, you have to be the engineer of that menu. It has to be a crowd-pleaser.

—Jean-Georges Vongerichten

1. Introduction

The restaurant industry's share of the food dollar in the United States in 2020 was 51%—up from around 40% in 2012. Despite the pandemic, the restaurant industry contributed $659 billion to the US economy in 2020 (National Restaurant Association 2021), with more than one million restaurants in the US together employing 12.5 million people, or one-tenth of the workforce. This trend is likely to continue given that younger generations spent the largest portion (National Restaurant Association 2021). As suggested by the French chef Jean-Georges Vongerichten in the epigraph, the menu has become a marketing tool that restaurateurs can use to please the crowd. Given the size of the industry, the originally humble and practical menu now attracts attention from academic research. One line of study seeks ways to optimize revenue by engineering the menu (e.g., Kwong, 2005; Noone and Cachia, 2020). Other studies examine the potential of a menu to serve larger social goals. For example, Wei and Miao (2013) studied mandatory calorie information disclosure on menus. The goal of this new menu labeling is to help promote healthier food choices.

While the extant literature is replete with several studies on how various design elements may influence consumer behavior, the evidence is mixed. For example, some designs received only mixed support (Hou et al., 2017). These inconsistent findings could hinder theory development and confuse practitioners (Ozdemir, 2012). A review of the literature may help clarify these issues. The most recent review on the menu-design literature was published seven years ago in 2015 (Ozdemir and Caliskan, 2015). Since then, 29 new papers (or 55% of all papers we surveyed) have been published. While there is no such thing as a minimum size of the literature for a meta-analysis (Lynn and Mullen, 1997), the current size of the menu-design literature makes a meta-analysis on this topic both timely and useful. Further, we examine a six-dimensional framework of design elements and test whether effect sizes vary among these dimensions. We also test a set of hypotheses derived from theories on attitude–behavior relationship and the Implicit Attitude Theory. Differences among experimental methodologies and settings are explored as well. The consolidated results offer promising directions to future researchers and a valuable summary of guidelines and recommendations for practitioners who design menus.

* Corresponding author.
E-mail addresses: michael.ipmh@gmail.com (M.M.H. IP), robinchark@gmail.com (R. Chark).

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2. Literature review and hypotheses development

2.1. Menu research

"Menu" is defined as the product range of the offering of a food and beverage operation, and it is acknowledged as a significant selling and display tool to communicate with consumers (Jones and Mifll, 2000). The function of the menu in a restaurant has broadened. Today it serves as a core aspect of restaurant marketing strategy and perhaps identity, a multifunctional instrument (McCall and Lynn, 2008) and key component of business strategies (Markovic et al., 2010). Hence, the menu is a specific communication tool with potential to influence how consumers behave. Multiple studies indicate that the function of a menu extends beyond simply showing food and beverage items. For instance, a menu can influence consumers' expectations, impression and spending (e.g., Antun and Gustafson, 2005), attitudes (e.g., Wang and Lynn, 2017), sales of the restaurant (e.g., Kwong, 2005), purchase intention (e.g., Jeong and Jang, 2016) and actual choices (e.g., Dodd, 1997).

Atkinson and Jones (1994) conceptualized menu analysis as a broad term encompassing menu research, which refers to a range of methods, techniques and procedures to develop an effective menu. Jones and Mifll (2000) reported that most studies focused on menu engineering, which aims to identify and evaluate the value of different items on a menu by applying different matrixes (Taylor and Brown, 2007). This focus on financial performance of menu items overlooks an important function of the menu as a marketing tool. More recently, there is a shift of focus to study the design elements in order to optimize the menu's communication with consumers. Menu design has the potential to influence consumer attitudes and behaviors (Ozdemir, 2012).

2.2. Dimensions of menu design

Menus come in a variety of styles and can be used to reflect a restaurant's characteristics and influence consumer behaviors (Seaberg, 1983). The concept of menu design refers to the approach by which a menu card or display is created. Menu design can be defined as visible and design-related elements on the menu, which are targeted to influence consumer opinion and behaviors. Components of menu design include color, paper, typeface, layout and other design-related elements that can attract attention and affect consumer behaviors (Bowen and Morris, 1995). Moreover, menu design comprises many techniques and consequential choices such as the location of items on the menu, style of typography, interplay of language, color variation and the use of illustrations and graphics (Kwong, 2005).

Ozdemir and Caliskan (2015) developed a framework to categorize elements of menu design into four dimensions: menu item position, menu item description, menu item label and menu card characteristics. Specifically, *menu item position* refers to the location of the menu items. It is the element that determines the placement and distribution of menu items such as order and bundling of items, and horizontal and vertical layout. Examples include placing the primary information about the targeted menu item such as its name in a specific location of the menu, putting the primary information about menu items in a particular pattern, and grouping a targeted menu item with other control menu items.

Menu item description refers to the elements that provide additional or corresponding information for supplementing or describing the menu item. Examples include a variety of descriptive and visual information, grading labels, price, and nutritional information such as calories and quantities of saturated fat, trans fat and other elements. This dimension also concerns the placement, format, and delivery approach of the mentioned information.

Menu item label refers to the elements used to identify menu items, such as the name of a dish or drink in different wordings and languages. These labels can be unique, fancy or meaningful names instead of common ones. For example, the use of original language for labeling a menu item, rather than translated names, may enhance the sense of authenticity.

Menu card characteristics refers to the non-descriptive design elements of the menu such as size, typeface, background color, background theme, delivery medium, font, layout, menu distribution and weight. These elements are peripheral to the menu's main information. They are usually applied to the entire menu. Examples are paper or electronic menu, large or small font size, a variety of typefaces and using a themed watermark or certain colors in the background.

The elements explored in some studies do not fit neatly into Ozdemir and Caliskan's (2015) four dimensions (e.g., Bacig and Young, 2019). We categorize these studies of the descriptive elements such as concept statement, description of the restaurant, format of surcharge, healthy claims and healthy information about the entire menu into a new dimension of *menu card label*. In addition, we identify another group of studies featuring elements that we classify as *menu item characteristics* (e.g., Bernstein et al., 2008). These elements directly or indirectly deliver an anchoring effect on familiarity, flexibility and other perceptions of the targeted menu item. One of the practical applications for these elements is arranging a menu item with positive or negative, healthy or less healthy, and varying or fixed nature near a targeted menu item in order to motivate a different reaction. Accordingly, Ozdemir and Caliskan's (2015) model has been extended to six dimensions in the present work (Fig. 1). Since these design elements are diverse in nature, it is predicted that their effect sizes vary. This leads to our first hypothesis:

H1. : Different menu design elements have different effect sizes on consumer behavior.

These six dimensions can be grouped into two categories, depending on whether the dimension is applied to the entire menu or a menu item. Menu card characteristics and menu card label, which are applicable to the whole menu, are grouped as entire-menu elements. Meanwhile, menu item description, menu item label, menu item characteristics and menu item position constitute individual-item elements. Generally, these elements are applied to a relevant individual item or multiple items on the menu but not the content that is beyond an individual item, such as the restaurant name or theme of the menu. Entire-menu elements are often more visible than individual-item elements since the former apply to the whole menu whereas the latter involve details of specific items. The greater visibility likely translates into larger effect sizes. Thus we have:

H2. : Entire-menu elements have larger effect sizes than individual-item elements do.

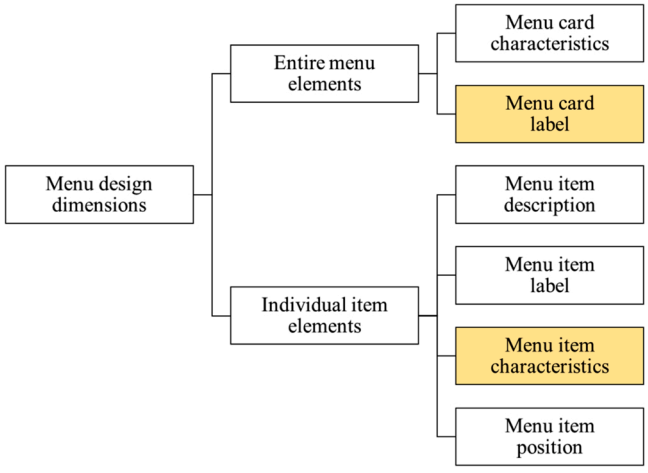

Fig. 1. Extended dimensions of menu design. The two new dimensions are highlighted.

2.3. Dependent variables in menu design

The aim of the menu-design literature is to identify its consequences on various consumer behaviors. Different types of dependent variables capture the behavioral changes induced by menu design. They represent distinct aspects that can be measured to gauge the effectiveness of menu design. For instance, these studies examine consumer attitude toward the menu (e.g., Yepes, 2015), attitude toward the food and the restaurant (e.g., Hou et al., 2017), purchase intention (e.g., Gi, Behnke and Almanza, 2014), consumer choices (e.g., Park and Oh, 2009), willingness to pay (e.g., Hou et al., 2017) and eye movements when reading the menu (e.g., Kim et al., 2018).

The differences among these dependent variables have not yet been systematically studied. Thus, we categorize them based on several dimensions. Broadly speaking, the dependent variables studied in the menu-design literature fall into one of four types: attitudinal, intentional, behavioral, and physiological.

A large number of studies rely on attitudinal measures to assess the effectiveness of menu design. These measures help determine consumer attitudes toward the food items, menu, restaurant, and nutritional information. For example, these studies invite evaluative responses to food items on a menu based on the appearance, healthiness, mental imagery, quality and perceived calories. The attitude toward a menu includes its usability, presentation, layout and ease of reading. The attitude toward a restaurant includes its price, uniqueness, service quality, overall quality, overall preference, green attributes, corporate social responsibility and location.

Intentional measures refer to the potential and likelihood to select a specific item on the menu. Such a measure does not involve actual purchase behavior. For example, it may measure the desire to visit a restaurant and select the menu item, purchase intention of the menu item, sales probability of the menu item, the intention to choose a menu item, healthy menu item or nutrients, and the willingness to pay.

Behavioral measures in the current context refer to actual purchase and gauge how much the design element contributes to the spending on a target menu item, order size, selected nutrient and quantity of an item. These dependent variables directly relate to actual purchase results and behaviors such as total or average check amount (Reynolds et al., 2005), consumption of nutrients (Gi et al., 2014) and quantity or proportion of ordering (Slapø and Karevold, 2019).

Physiological measures include eye movements such as the duration of fixations, the number of fixations and pupil dilation. An eye tracker is usually applied in these studies to precisely capture the quantity or duration of different physiological reactions when consumers see the menu design elements (e.g., Kim et al., 2018).

2.3.1. Attitude, intention and behavior

It is of interest to psychologists to predict and understand behavior. Psychological theories aim to identify the antecedents of behavior. We test a couple of hypotheses derived from a class of theories on the attitude–behavior relationship and the Implicit Attitude Theory. The first class of theories concerns the relationships among the first three types of dependent variables. Three popular theories have been developed to explain how attitude leads to behavior. They are the Theory of Reasoned Action (Ajzen and Fishbein, 1980), Theory of Planned Behavior (Ajzen, 1985; Ajzen and Madden, 1986) and Theory of Self-Regulation (Bagozzi, 1992). All have shown success in predicting behaviors in different domains such as university class attendance (e.g., Ajzen and Madden, 1986).

Common among these three models is the conceptualization of intention as a function of attitude, which is an evaluative response that individuals form toward an act or object (Leone et al., 1999). Thus intention is a transition between attitude and behavior (Ajzen, 1998). Depending on the specificity of the theory, other factors may affect the relationships among these three variables, e.g., subjective norms, past behaviors and desire (Leone et al., 1999). Recently, Briñol and Petty (2022) proposed the *self-validation theory* that summarizes these influences within the psychological construct of validity. The perceived validity is a metacognition and affects how reliable a thought is (such as attitude and intention) and how likely it is to be translated into action, e.g., a purchase intention. Some validations are cognitive in nature. For instance, one's expertise in the consumption domain can enhance the perceived validity of an attitude and behavioral intention and thus lead to a stronger influence on downstream consequences such as purchase decisions (Wood et al., 1995). Other validations are affective-based. These incidental factors include a sense of ease in information processing or one's mood. For example, being happy rather than sad facilitates the perceived validity of a thought (Briñol et al., 2007). It is therefore argued that menu design has a more direct influence on attitude than on intention, which receives other validations. Likewise, the influence on intention should be stronger than the influence on behavior, which receives another layer of validation. This leads to our third hypothesis:

H3. : Menu design has a stronger effect on attitude over intention, and then on intention over behavior.

2.3.2. Implicit attitude

Under the dual-attitude framework (Petty et al., 2007), individuals can simultaneously hold two distinct attitudes—implicit and explicit—toward the same object. Self-report measures such as the attitudinal, intentional and behavioral measures discussed in the last section are examples of explicit attitudes. They are conscious, deliberative and effortful (Fazio and Olson, 2003). When respondents are predisposed to such thought processes, they go through the propositional processes such as logical, abstract reasoning (Petty et al., 2007). Thus these explicit measures can be influenced by many factors (e.g., acceptable norms; Paulhus, 2002). By contrast, implicit attitudes usually originate in simple associative processes and are thus activated automatically, under the radar of awareness (Fazio and Olson, 2003) and introspectively inaccessible (Greenwald and Banaji, 1995).

The two attitudes, despite their common associations with the same object, can diverge (Rydell and McConnell, 2006). Whereas implicit attitude reflects the association between the object and the evaluation that is formed implicitly and is more resistant to change, explicit attitude is more susceptible to change upon receipt of new information and processing goals. Physiological measures such as eye tracking and pupil dilation (Hess and Polt, 1960) have been used as implicit measures of attitude (Petty et al., 2009). These measures tap into the automatic evaluative response that is activated spontaneously upon the mere presentation of the object (Fazio et al., 1986). Such responses bypass any opportunity for strategic responding (Wittenbrink and Schwarz, 2007). We hypothesize that these physiological measures, which are relatively free from conscious awareness, may more directly reflect the influence of menu design. Thus we have:

H4. : Menu design has stronger effects on physiological measures than on self-reported ones. Together, H3 and 4 predict a descending order of effect sizes among the four dependent variables of physiological, attitudinal, intentional, and behavioral.

2.3.3. Experimental setups

The surveyed studies can be broadly classified into field and laboratory. The laboratory studies were often conducted in classrooms, meeting rooms, universities and, more recently, using online platforms. The field experiments were often conducted in commercial restaurants and different types of campus restaurants or cafés. There are doubts that these experimental findings can be applied to commercial settings (Magnini and Kim, 2016). For instance, Yang (2012) and Reynolds et al. (2005) cannot find any effect of item positioning in field settings. These phenomena pertain to the debate over external and internal validity (Viglia and Dolnicar, 2020). Specifically, while field experiments provide realistic testing environments that can be easily generalized, highly controlled laboratory experiments minimize noise in the testing

environment and often result in higher statistical power. Thus, we hypothesize that:

H5. : Laboratory studies have larger effect sizes than field studies.

Both real and mock menus have been utilized in these experimental studies. There are two major types of real menus: restaurant menus and menu boards. These real menus mostly include the elements of price and a series or full set of menu items based on the cuisine and service type of the restaurant. A mock restaurant menu and mock food-item menu board are the two major types in other experiments that simulate a menu. Mock menus are mostly built according to real restaurant menus, but they are simplified or control for some elements such as not presenting price, blinding the cover page, and including or excluding selected items. A mock food-item menu is not a complete restaurant menu and only contains or presents the essential manipulations and targeted items to be tested. There are calls for greater realism in experimental stimuli (Mattila et al., 2020; Morales et al., 2017). However, the realism may come at a cost. Realistic manipulations may be more readily generalizable, but they may not be as strong as the unrealistic ones. In particular, mock menus with simplified features may be better able to highlight the essential features of the design elements under examination. This leads to our final hypothesis:

H6. : Mock menus yield larger effect sizes than real menus.

3. Methods

3.1. Literature search procedures

The literature search was conducted in March 2021 and involved a Google Scholar search to locate as many relevant studies as possible. The search procedures employed PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses; Fig. 2) according to Moher et al. (2009)/PRISMA Group. This method is widely accepted for conducting systematic reviews and meta-analyses (Tawfik et al., 2019). Four stages—of identification, screening, eligibility, and inclusion—were used in the search procedures to ensure that included studies match the inclusion criteria.

The initial stage of the search procedures was identification. All keywords were searched under the functions of "with the exact phrase" and "return articles published in" in the advanced search of Google Scholar to obtain more accurate search results in the specific publishing field. The first search was conducted by keyword "menu design" under the field of "hospitality". After review of the first search, more keywords and publishing fields were identified and employed for further searching. The identified keywords are "menu design", "menu format", "menu labeling", "menu labelling", "menu psychology", "restaurant menu", and "menu engineering"; and publishing fields are "hospitality", "tourism", "restaurant", "food service", "food & beverage", "food and beverage", and "foodservice". Searches on the seven keywords were

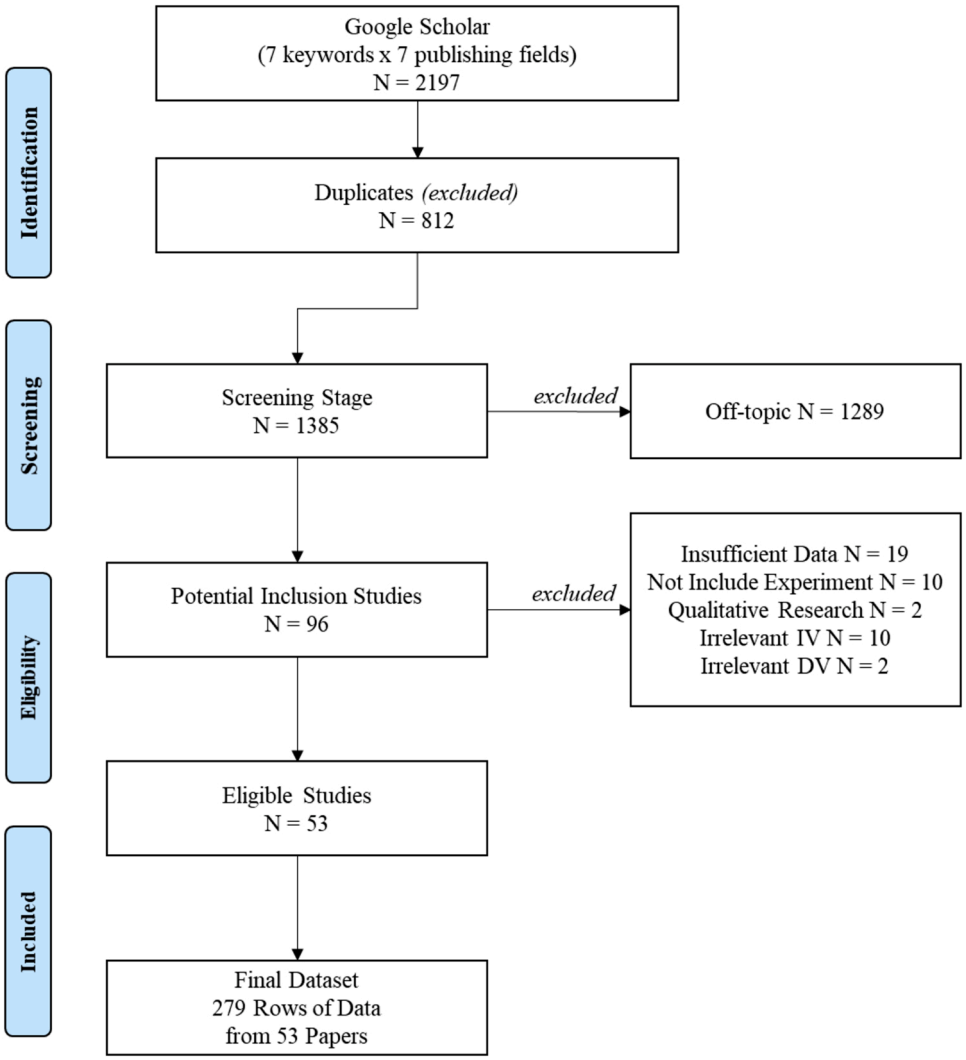

Fig. 2. Search procedure – PRISMA Flow Diagram. (*Note.* IV = independent variable, DV = dependent variable).

conducted recursively within the seven publishing fields, resulting in 49 searches.

All studies from the identification stage were reviewed in the screening stage after removing duplicates. The topic, abstract, descriptive information, methodology and variables in all identified studies were reviewed in this second stage. The screened studies that investigate the relationship between menu design elements and consumer behaviors were designated as candidates for a detailed review and selection at the next stage, that of eligibility, in which descriptive and statistical results of all variables in these potential inclusion studies were reviewed in detail. Qualified results and data at this stage were captured for the inclusion stage, the final stage of the search procedure, and systemically recorded for further analysis.

3.2. Criteria for inclusion of studies

We include all qualified English-language studies found under the identified keywords and publishing fields, and no limitation on the publishing time is applied. An included study must employ either a laboratory or field experiment that involves a menu design element placed in a menu for the purpose of measuring the difference in consumer behavior between a control condition and a treatment condition with the target element. The included study must examine the effect of a single or multiple design elements on consumer behavior. Studies are excluded when the experimental method is not employed (e.g., Peters and Remaud, 2020), the study is qualitative research (e.g., Jones, 2009), the independent variable is not about the menu design element (e.g., Medina-Molina and Pérez-González, 2021), the dependent variable is not about consumer behavior (e.g., Raucci et al., 2020) or statistical data are insufficient. Specifically, studies lacking means, standard deviations and sample sizes that can be used to calculate effect size or test statistics such as t-statistics or F-statistics that can be used to infer effect size are excluded. For example, one study only reported *p*-values (Bowen and Morris, 1995).

3.3. Variables code from each report

This study captures as much information on the following variables as possible from each included study for further analysis: (a) basic information of each study, (b) searching keyword and field, (c) research methodology, (d) type and design of the menu, (e) venue of the research, (f) sample size of the research, (g) type, nationality and source of the sample participants, (i) independent variable, (j) dependent variable, (k) test statistics, (l) summary of the finding of statistical data. When moderators are involved, we survey the main effects of the menu design.

3.4. Data analysis

According to variables coded from each report, effect sizes were calculated based on the available statistical data for each recorded variable. Cohen's *d* was employed as a standardized effect size to compare across studies. To convert and calculate the effect sizes, we utilized the effect size online calculator (https://campbellcollaboration.org/research-resources/effect-size-calculator.html), which is a companion to the book *Practical Meta-analysis* (Lipsey and Wilson, 2001). Means and standard deviation of variables were prioritized for use in calculating the effect size. Converting reported effect sizes was the second approach; and test statistics (e.g., F-statistics, t-statistics) were the last option to infer the effect sizes.

A meta-analysis is "a set of procedures for statistically summarizing, integrating and comparing the results of previous research" (Lynn and Mullen, 1997, p. 121). The output of the analysis is a summary statistic, i.e., effect size, of a group of studies. Effect size is an index of the strength of the effect that allows a statistical evaluation of the effectiveness of the experimental manipulation (menu design in our context). The meta-analysis is performed using MetaXL 5.3 (http://www.epigear.com). A random-effects model was employed. The fixed-effect model assumes that all studies share a true common effect (Borenstein et al., 2009). However, the surveyed studies explored a diversity of elements in menu design and a range of consumer behaviors through different experimental settings. Thus a random-effects model is more appropriate.

4. Results

4.1. Descriptive analysis

In the stage of identification, a total of 2197 studies was accrued. The number of studies significantly decreased to 1385 after duplicates were excluded (N = 812). In the stage of screening, studies unrelated to the menu design elements and consumer behaviors (N = 1289) were excluded. Thereafter, 96 studies were selected for potential inclusion in the stage of eligibility. We excluded 43 of these due to insufficient data (N = 19), not being experimental studies (N = 10), being qualitative research (N = 2), having irrelevant independent variables (N = 10) and having irrelevant dependent variables (N = 2). As a result, 53 studies were ultimately considered eligible (Fig. 2; see online supplementary material for a complete list).

Most of the eligible studies were conducted in the U.S. (N = 44), with the rest scattered in nine countries. In these surveyed studies, 61 interventions were employed in the experiments, with a total of 16,522 participants (see online supplementary materials for a complete list). The participants can mainly be categorized as representative samples of adult consumers from different countries (73.22%) and online panels (7.95%) or as university students, faculty members and visitors (18.83%). There are 12 field studies and 41 laboratory ones, with 40 adopting mock menus whereas the other 13 used real ones.

Among the surveyed studies' 61 interventions, various dependent variables result in 279 effect sizes. The dimension of menu item description represents more than half (156/279) of the effect sizes. Menu item label has 46 effect sizes. Both menu card label and menu item characteristics have 18 effect sizes. Menu card characteristics has 28 and menu item position has only 13. In terms of dependent variables, the most frequently used is attitude, representing 144 effect sizes. Intention adds another 73 effect sizes. Actual purchase (behavior) has 33. Physiological measures represent only 29.

4.2. Meta-analysis

Fig. 3 shows the overall effect of menu design on consumer behavior, with average effect sizes and 95% confidence intervals (CIs) reported for each dimension. Results indicate that the overall effect of menu design elements (ES = 0.39, 95% CI = [0.34, 0.45]) is significant. There is significant heterogeneity in the effect sizes (I^2 = 95%, $p < .001$). Since the hypothesis of homogeneity of the effect sizes is rejected, we test if the heterogeneity arises from the differences in effect sizes among different design dimensions and dependent variable types.

4.3. Subgroup analysis

Table 1 summarizes the subgroup analysis for the effect of each dimension of menu design on consumer behaviors. We find that all six dimensions have significant effects on consumer behavior. These results for each dimension align with the overall effects of menu design. We further compare the effect sizes among the six dimensions (Table 2). Supporting H1, nine of these 15 pairwise comparisons are significant. The size of effect follows sequentially menu card characteristics, menu item characteristics, menu item label, menu card label, menu item position and menu item description (Fig. 3).

We also divide the six dimensions into two categories and test whether the effect sizes differ (H2). While effect sizes of both categories are significant, entire-menu elements (ES = 0.66, CI = [0.46, 0.86]) yield a larger effect size than individual-item elements (ES = 0.34, CI =

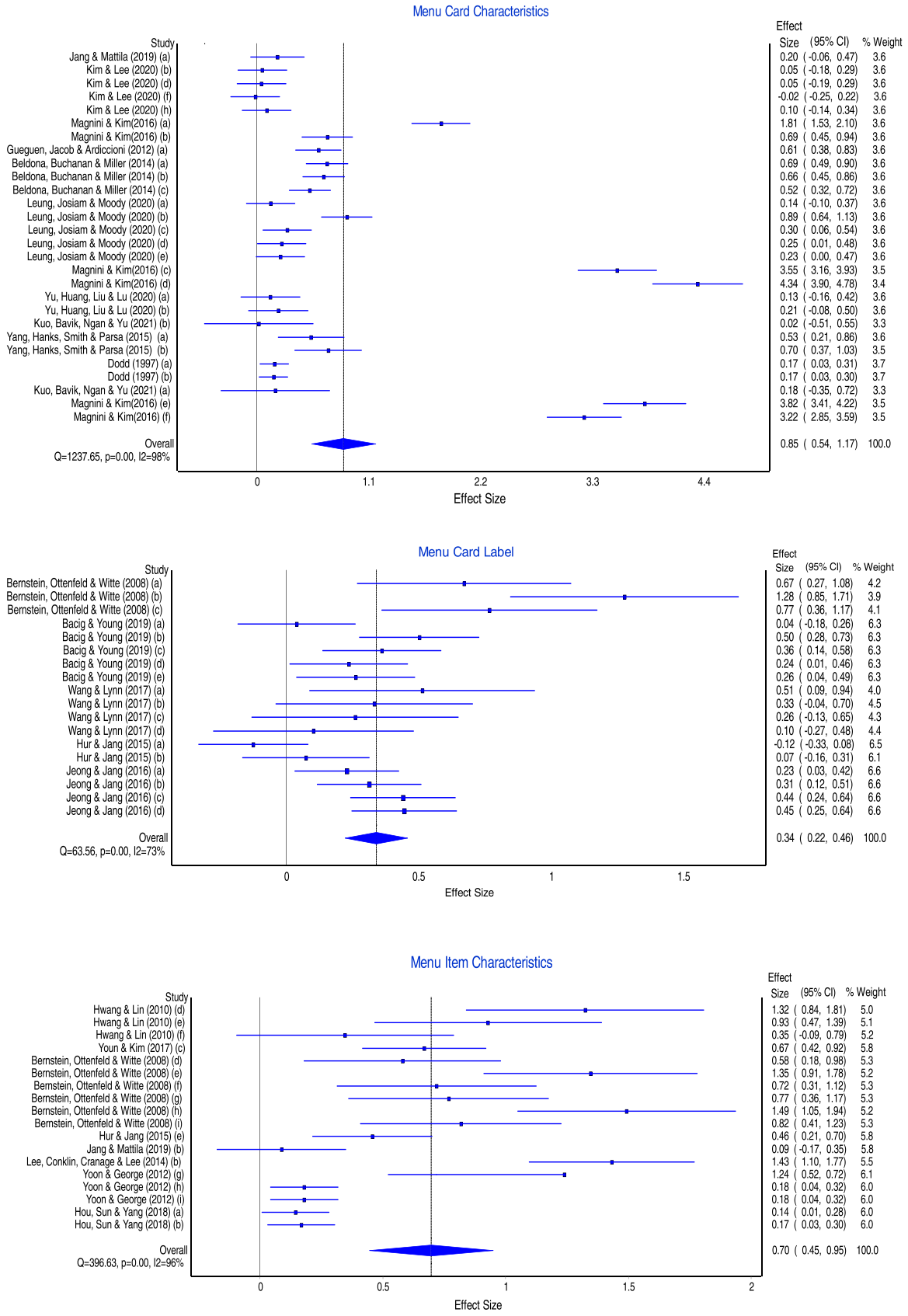

Fig. 3. Forest plots of menu design elements in relation to consumer behavior. (*Note.* Overall = overall effect of menu design on consumer behavior; the dot square and horizontal line represent the effect size and 95% CI of the study, respectively; the center of the diamond represents the pooled effect size, and its width represents the pooled 95% CI.).

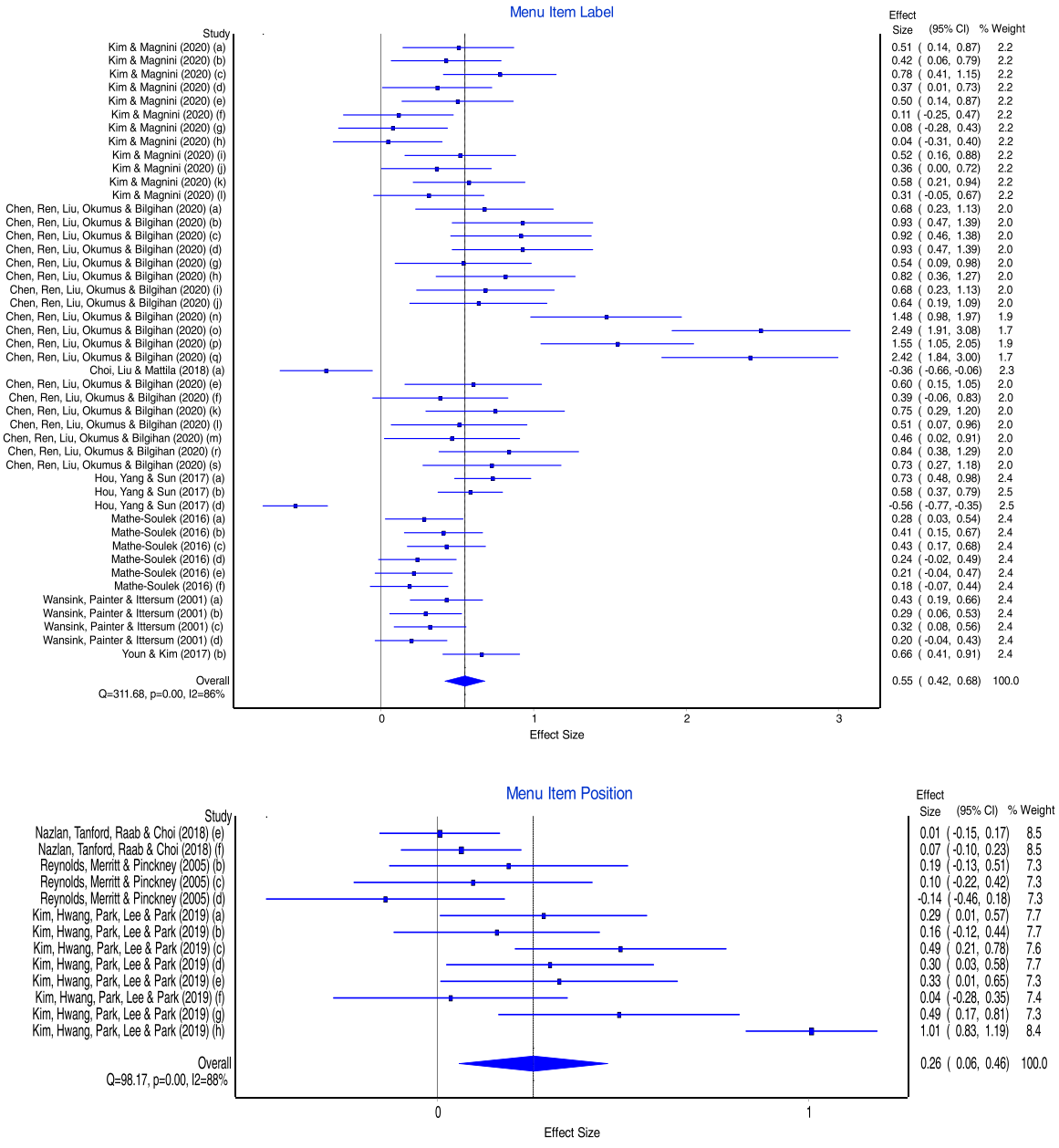

Fig. 3. (*continued*).

[0.28, 0.40]) do (0.32, CI = [0.11, 0.53], $p < .003$). H2 is supported.

4.4. Dependent variables

Another subgroup analysis is conducted to explore the effect of menu design on different types of dependent variables. The effect sizes are all significant (Table 3), and they follow the pattern predicted by H3–4: physiological, attitudinal measures, intentional and actual purchase (behavior). Supporting H3 and 4, all pairwise comparisons are significantly different (Table 4).

We further look into the individual effects of different dimensions of menu design on different dependent variables (Table 5). Following the suggestion from Valentine, Pigott and Rothstein (2010), we only include combinations that contain more than two studies in order to have a meaningful result. The effect sizes of all these design elements × dependent variables are statistically significant, except the effect of menu item description on actual purchase. When these effect sizes are further broken down, the dimension of menu card characteristics has the strongest effect on attitudes, whereas menu item description has only a marginal effect on actual purchase.

4.5. Experimental specifications

The effect sizes from laboratory experiments (ES = 0.45, CI = [0.38, 0.52]) are greater than those from field experiments (ES = 0.18, CI = [0.12, 0.24]), and the difference is statistically significant (ES = 0.27, CI = [0.18, 0.37], $p < .001$). H5 is supported.

Exploring the difference between results from studies using mock menus and those using real menus, we find that the effect size of the mock menu (ES = 0.48, CI = [0.47, 0.64]) is greater than that of the real menu (ES = 0.16, CI = [0.06, 0.26]), and the difference is statistically significant (ES = 0.32, CI = [0.20, 0.44], $p < .001$). H6 is supported.

4.6. Publication bias

Doi plot was used to visualize the publication bias or the file-drawer

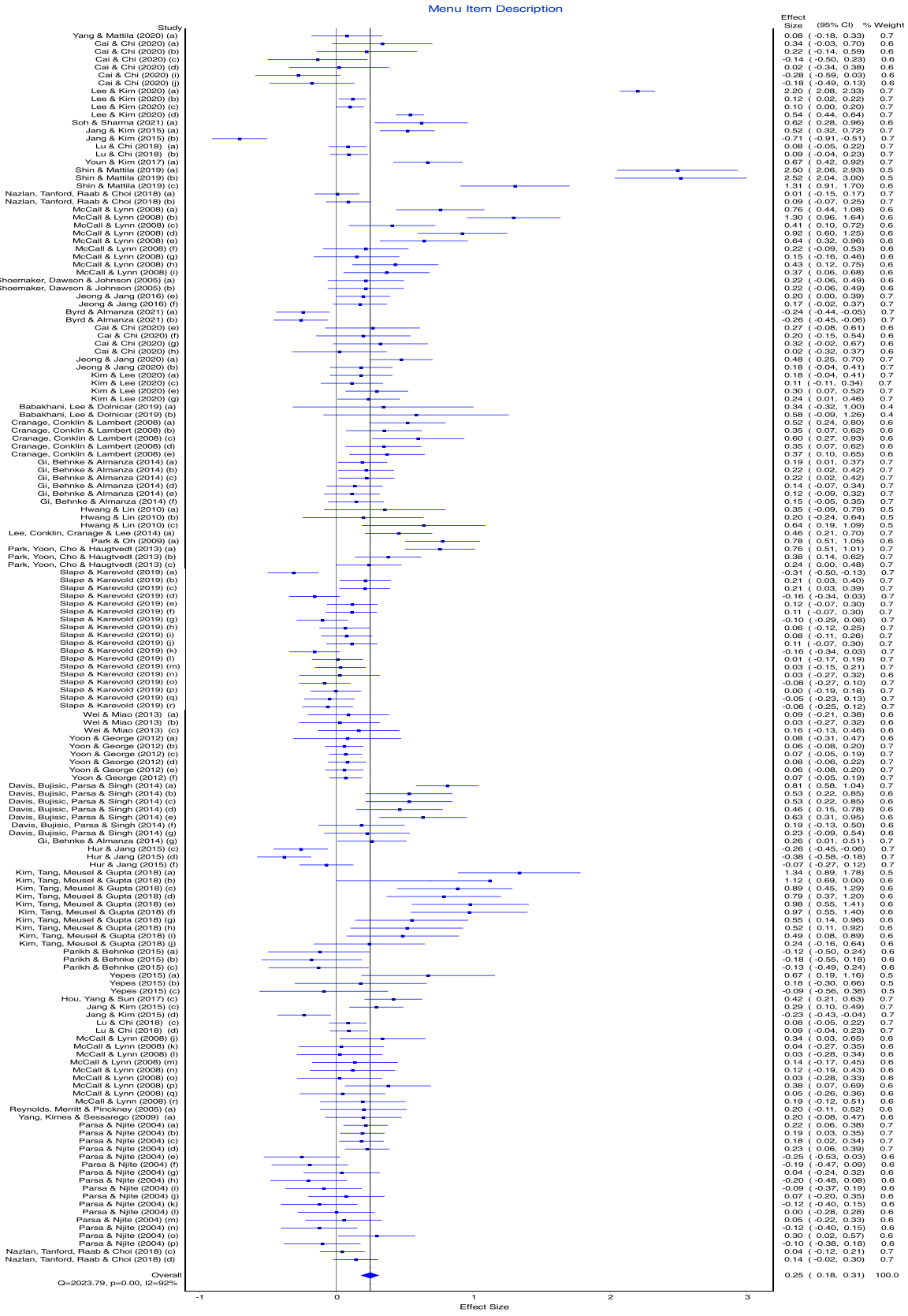

Fig. 3. (*continued*).

effect. The *Doi* plot (Fig. 4) suggests a minor asymmetry pattern. This is confirmed by the *LFK* index, which is 1.37. According to Furuya-Kanamori et al. (2018), an *LFK* index within ± 1 means no asymmetry, whereas one beyond ± 2 indicates major asymmetry. Since the value is within ± 2, the publication bias does not seem to be severe.

Table 1
Effect sizes of different menu design dimensions. (* $p < .05$, ** $p < .01$, *** $p < .001$).

Menu design element	ES	n	95% CI	Heterogeneity (I^2)
Entire-menu elements	0.66	46	0.46, 0.86	97%***
Menu card characteristics	0.85	28	0.54, 1.17	98%***
Menu card label	0.34	18	0.22, 0.46	73%***
Individual-item elements	0.34	233	0.28, 0.40	92%***
Menu item description	0.25	156	0.18, 0.31	92%***
Menu item label	0.55	46	0.42, 0.68	86%***
Menu item characteristics	0.70	18	0.45, 0.95	96%***
Menu item position	0.26	13	0.06, 0.46	88%***
Overall	0.39	279	0.34, 0.45	94%***

5. Discussion

We conduct a meta-analysis on menu design. Fifty-three papers with a total of 16,522 participants are surveyed. Our findings provide an overview of the research on menu design and suggest that menu design does influence consumer behavior effectively. As menu design studies involve a variety of interventions, measurements and experimental settings, the literature displays considerable heterogeneity. The effect sizes vary among dimensions of design elements, different ways of measuring the influence on consumer behavior, and assorted experimental settings, yet the ability of a menu to serve as an effective communication tool is a ubiquitous phenomenon.

There are a few notable trends in the literature. First, as predicted by H1, there are variations in effect sizes among the six dimensions of design elements. While the dimension of menu card characteristics has a very large effect, menu item characteristics and menu item label have moderate effect sizes. Menu card label, menu item position and menu item description have only marginal effect sizes. The support of H1 suggests that the six-dimensional framework manages to organize the heterogeneity in effect sizes across different menu design elements. Although there still exists significant heterogeneity within each dimension, which is arguably due to variations in experimental settings and dependent variables in capturing the effects, the framework is one step closer to explaining the heterogeneity by grouping the studies according to their elements of design and showing significant differences in their effect sizes.

Second, supporting H2, entire-menu elements have larger effect sizes than individual-item elements. These two broad categories enable us to dissect the literature into those design elements that apply to the whole menu and the others that apply to individual items. Theoretically, this difference in effect size supports the intuition that menu design is primarily about visual information processing. Anything that is more visible or draws more visual attention is more likely to make a difference. The fact that entire-menu elements have a significantly larger effect size than individual-item elements holds practical significance. Restaurateurs are advised to first approach menu design with entire-menu elements that may yield the most promising results and seek further improvement later with individual-item elements.

Third, due to ease of administration, most studies use attitudinal and intentional measures, whereas physiological measures and those indicating actual purchases are relatively scarce. Supporting H3 and 4, we find that menu design has a large effect on physiological measures, with only marginal effects on attitudinal and intentional measures. It exerts a relatively marginal albeit statistically significant effect on actual purchases. This pattern is theoretically grounded and interesting. In particular, the prediction of the order of effect sizes is derived from two classes of psychological theories and has not been previously proposed and shown empirically, as far as we know. The four types of dependent variables follow an information-processing pathway that is assumed to receive increasing influences from factors other than the original input (menu design in our case) and thus display a decreasing effect downstream. Given the non-trivial size of the literature surveyed, the pattern seems to be robust and stable. A promising avenue for future research is to study the factors that enhance or hinder the relay of the effect of menu design down this pathway.

Fourth, in terms of experimental settings, two specifications are found to influence the effect sizes significantly—whether it is a laboratory or field experiment and whether the study utilizes a mock or real menu. We find that laboratory studies and mock menus have significantly larger effects, supporting H5 and 6, respectively. Given the ultimate goal to inform practices, these observations suggest that the reported effects of menu design may be overestimated. Fortunately, effects from field settings and with real menus are on average significant.

Table 3
Effect sizes of different dependent variables. (* $p < .05$, ** $p < .01$, *** $p < .001$).

Menu design element	ES	n	95% CI	Heterogeneity (I^2)
Physiological measures	0.88	29	0.70, 1.05	75%***
Attitude	0.45	144	0.35, 0.54	96%***
Intention	0.27	73	0.21, 0.34	84%***
Actual purchase	0.07	33	0.01, 0.14	74%***
Overall	0.39	279	0.34, 0.45	94%***

Table 4
Test of differences in effect sizes among the four dependent variables. (CI in square brackets; * $p < .05$, ** $p < .01$, *** $p < .001$).

	1	2	3
1. Physiological measures			
2. Attitude	-0.43*** [− 0.63, − 0.23]		
3. Intention	-0.60*** [− 0.79, − 0.41]	-0.17** [− 0.29, − 0.05]	
4. Actual purchase	-0.80*** [− 0.99, − 0.62]	-0.37*** [− 0.49, − 0.25]	-0.20*** [− 0.30, − 0.11]

Table 2
Test of differences in effect sizes among the six design elements. (CI in square brackets; * $p < .05$, ** $p < .01$, *** $p < .001$).

	1	2	3	4	5
1. Menu item description					
2. Menu item label	0.30*** [0.15, 0.45]				
3. Menu card label	0.09 [− 0.04, 0.23]	-0.21* [− 0.38, − 0.03]			
4. Menu item characteristics	0.45*** [0.19, 0.71]	0.15 [− 0.14, 0.43]	0.36* [0.08, 0.64]		
5. Menu card characteristics	0.60*** [0.28, 0.93]	0.30 [− 0.04, 0.65]	0.51** [0.18, 0.85]	0.16 [− 0.25, 0.56]	
6. Menu item position	0.01 [− 0.20, 0.22]	-0.29* [− 0.53, − 0.05]	-0.08 [− 0.31, 0.15]	-0.44** [− 0.76, − 0.12]	-0.59** [− 0.97, − 0.22]

Table 5
Effect sizes broken down by the dimensions of menu design element and dependent variables. (*Note:* CI in square brackets; cells with fewer than three studies are shaded.).

	Physiological	Attitudinal	Intentional	Actual Purchase
Menu Card Characteristics		1.25 [0.77, 1.73]	0.16 [-0.04, 0.35]	
Menu Card Label		0.32 [0.18, 0.46]	0.42 [0.26, 0.58]	
Menu Item Characteristics		0.62 [0.30, 0.94]	0.87 [0.38, 1.35]	
Menu Item Description	0.94 [0.76, 1.12]	0.28 [0.15, 0.41]	0.23 [0.16, 0.29]	0.06 [-0.01, 0.13]
Menu Item Label		0.34 [0.25, 0.42]		
Menu Item Position			0.26 [0.05, 0.48]	

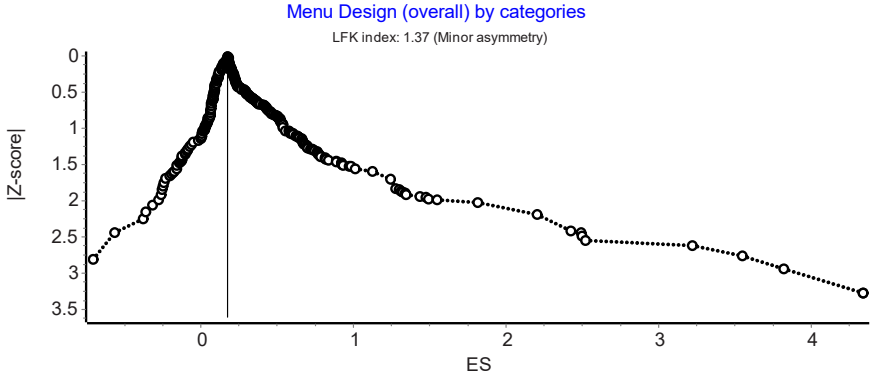

Fig. 4. Doi plot.

Our findings offer useful information to practitioners for understanding the different effect sizes stemming from various experimental settings by putting them into perspective.

5.1. Theoretical implications

As part of the process of theoretical development, we extend Ozdemir and Caliskan's (2015) framework of menu design to also include *menu card label* and *menu item characteristics*. Although the original four-dimensional framework features parsimony and provides a good summary of the menu-design literature, there is a need to update the framework to reflect the more recent growth of the literature. We find that these two new dimensions together represent 13% of the effect sizes we surveyed, and most studies on these two dimensions were conducted more recently (e.g., since 2008). Another important observation is that the effect sizes of the studies under these two dimensions are relatively marginal in comparison with the other four dimensions. This is likely because the low-hanging fruits were identified earlier in the literature.

Another observation is that menu item description remains the most studied dimension in the literature, accounting for more than half of the effect sizes surveyed. This phenomenon pertains to the original and main function of a good restaurant menu, which is to provide an overview of available items and the relevant information for consumers' decision-making (Baiomy et al., 2019; Lessel et al., 2012). For example, it was argued that the accuracy of menu description is one of the key contributors in facilitating customer satisfaction and expectations (Reynolds et al., 2005). More generally, there is a belief among marketers that "content is king", which manifests in many domains such as website design (White, 2006). As a result, the content—menu item description—naturally receives the most attention from researchers.

However, this intuition of "content is king" cannot be accepted without the scrutiny of a meta-analysis of this kind. Our findings suggest that menu design is visual by nature, at least with the traditional printed menus. Information relying on verbal processing may not pan out as well. Instead, dimensions that rely on visual information processing, such as menu card characteristics (ES =.85) and menu item characteristics (ES =.70), yield larger effects and may deserve more attention.

This trend has continued, with a focus on new content on the menu that reflects recent developments such as consumers' rising health consciousness. For instance, there are studies examining the effect of nutrition information of menu items (Byrd and Almanza, 2021; Gi et al., 2014). Whereas the 2021 study found a significant effect of the

information on calories ordered, the 2014 study yielded a null result. This difference may be attributed to the difference in research settings (i.e., laboratory vs. field study). Thus there is an ongoing effort to identify the effectiveness of these new contents. Another recent development that fuels the continuous focus on menu item description is the greater use of information technology in running restaurants. In particular, there is an increasing use of electronic menus (Lessel et al., 2012), which was further encouraged by online ordering of food delivery service during the pandemic. The interactivity and multimedia nature open up new possibilities of menu item description (Beldona et al., 2014). The interaction between the content and the new interface of content presentation attracts attention in the research community.

We also tested a couple of hypotheses based on theories on the attitude–behavior relationship and the Implicit Attitude Theory. In particular, physiological measures, proxying implicit attitudes, are more direct measures of the effect of menu design, with relatively less influence from cognitive intervention. Thus they show the strongest effect. Among the remaining three types of dependent variables, we observe that attitudinal measures show the second strongest effect, followed by measures of intention and actual purchases. Interestingly, this pattern follows the models that theorize about the relationships between attitude and behavior (e.g., Ajzen and Fishbein, 1975). Specifically, attitude is formed when individuals are exposed to the target object. It translates into actual behavior through its influence on intention. Along the path, there are other factors such as subjective norms and past experiences (Leone et al., 1999) that will affect the strength of the relationships among these variables. This pattern may explain why menu design has stronger effects on the *upstream*, compared with the *downstream*, variables during the process.

5.2. Practical implications

Results from the meta-analysis offer guidance to restaurateurs for the design of their menus. The dimension of menu item description is particularly well studied. Its effect on physiological, attitudinal, and intentional measures is significant, but insignificant on actual purchases. As there is only small number of studies on actual purchase, other design dimensions' effects are inconclusive in this respect. Unlike academics who are interested in theoretical development and the underlying processes, restaurateurs primarily care about the effect on actual purchase when evaluating menu design. They may approach it by trial-and-error, in a more systematic manner such as using A/B testing.

Given the limited attention customers pay to different aspects presented on a menu, it is crucial to identify the most effective dimension of menu design elements for specific effect on consumer behavior. In cases when restaurateurs have their own objectives to achieve, our findings may shed some light as well. For example, when trying to direct attention to particular menu components, such as the provision of descriptive and visual information, have been shown to yield large effects in physiological measures such as number of fixations and duration of fixations. When restaurateurs aim to change consumers' attitudes toward the food items, the menu and the restaurant overall, or behavioral intentions to select a specific item, the findings suggest that menu item characteristics such as varying or fixed nature near a targeted menu item may be more effective. This is especially the case when consumers are becoming more health-conscious in their food consumption (Perez-Cueto, 2021). It is essential to highlight the healthiness of food items. In this circumstance, menu item characteristics may be the best tool to change consumers' attitude and purchase intentions of the menu item.

Food delivery has become increasingly important, especially with COVID-19 seeming to have permanently changed consumers' dining habits. According to an industry report, "[o]ne-third of consumers are now using a restaurant or meal delivery service, and 7% of consumers get delivery once a week" (Labine-Romain et al., 2019). Food delivery is greatly enhanced by the recent popularization of the online-delivery platforms. In Asia, the market of food delivery grew by 14% in 2018 (Labine-Romain et al., 2019). There are opportunities for restaurants to capture this market. For instance, since consumers order food with their mobile apps, restaurateurs should pay more attention to their menus on these platforms. First, unlike printed menus, restaurants may change the design and content of their menus more frequently. They could have daily, weekly and seasonal themes in their designs to appeal to different segments of consumers. Second, based on consumers' past orders, restaurateurs may customize the design such that different customers get the "best format" for them. Third, the mobile apps provide an easy way to give more information on the menu items, e.g., calorie content. Restaurateurs can help consumers achieve their health or other goals. They may also attempt to replicate the app experience with the sit-in diners by providing electronic menus. According to Randy Garutti, the CEO of Shake Shack, touch-screen ordering results in higher spending (Hawley, 2018).

Even though the food industry underwent globalization over the last few decades, there is concern whether the findings of this meta-analysis can be generalized geographically. The majority of studies are from the U.S., and studies from other places represent only 25% of the total. This fact casts doubt on our knowledge of the effects and effectiveness of menu design elements in different countries or regions. As consumers in different places display different patterns of behavior, there may be variations in effectiveness based on restaurant locale. We explored differences in these effect sizes and found no statistically significant difference (ES $= -0.025$, CI $= [-0.15, 0.10]$, $p > .7$) between the U.S. studies (ES $= 0.39$, CI $= [0.32, 0.45]$) and those conducted outside the U.S. (ES $= 0.41$, CI $= [0.30, 0.52]$).

5.3. Limitations and future research

A restriction regarding meta-analysis is that its value is dependent on the range and quality of primary studies, and the results are only as good as the included studies in a meta-analysis (Lipsey and Wilson, 2001). In particular, while there is strong evidence that menu design is effective, there appears to be significant heterogeneity among the effect sizes of the surveyed studies. We thus classify them by a six-dimensional model and according to the dependent variables. Subgroup analyses reveal that there still exists heterogeneity among the six dimensions, given the diversity of the research setups and complexity of the interventions in menu design research (Ozdemir, 2012). Future studies could try to identify factors that explain the heterogeneity among the effect sizes.

Laboratory studies have larger effect sizes than field studies, and mock menus yield more significant results. There are tradeoffs between internal validity from laboratory settings and external validity provided by field studies (Viglia and Dolnicar, 2020). Also, the realism of experimental stimuli attracts attention from researchers (Mattila et al., 2020; Morales et al., 2017). More emphasis should be placed in future research on examining these experimental settings.

Last but not least, the new ways to order food such as the use of electronic menus and online menus, QR code ordering, and ordering from third-party delivery platforms are becoming more popular, especially since the pandemic's onset. Most studies in the current review investigated menu design from the perspectives of a traditional menu. Under the theoretical framework, the study of the delivery media, e.g., the use of electronic menus, has been categorized into the dimension of menu card characteristics, under which only two out of ten studies employed an intervention of electronic presentation. It was proposed that electronic and printed menus may complement each other (e.g., Lessel et al., 2012). Yet it is still not clear that the insights gained from studying offline menus may be applied to their digital peers. For instance, printed menus are limited physically in space for placing information, while electronic menus can be flexible and afford the interactivity that allows customers to browse and search (Beldona et al., 2014). These features break the assumption that customers read the menu linearly. Information delivery is also not limited to verbal and visual but can be audial. Graphics can be animated. This trend will

continue, and designers of menus will adapt to these new possibilities and become even more innovative. It is clear that the knowledge we have accumulated in the current literature is limited. The good news is there will be so many novel and interesting phenomena out there that we, as researchers, can pick up. A lot can be learned from neighboring fields such as human–computer interaction. We look forward to seeing Ozdemir and Caliskan's (2015) framework further extended to cover new design elements such as interactivity and intangibility.

Data Availability

Data will be made available on request.

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Declaration of Interest statement

The authors declare that there is no conflict of interest.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ijhm.2022.103353.

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