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ORIGINAL ARTICLE

How associations between products and numbers in brand names affect consumer attitudes: introducing multi-context numbers

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Abstract Drawing on numerical cognition research, we identify a set of multi-context numbers (MCN) that originate from the decimal (10), duodecimal (12) and sexagesimal (60) numeral systems frequently used in numerous domains (e.g., 10, 12, 20, 24, 60, 360, 100). We propose and show that inclusion of MCN in alphanumeric brand names (ABN) generates more favorable consumer attitudes and higher preferences for product extensions in different domains. We examine three types of fit, between (1) parent brands and numbers, (2) product categories and numbers and (3) parent brands and product categories. We find that the effects of ABN numbers are mainly mediated by product–number associations. Accordingly, while some numbers that are strongly associated with the product category (e.g., 401 and retirement services) or the parent brand (e.g., Heinz and 57; Levi's and 501) or that are familiar to consumers (e.g., 18, 21) generate favorable consumer responses in specific contexts, the same numbers fail in other product domains (e.g., 401/57/18/21 taxi service). In four empirical studies, we demonstrate that MCN in ABN can achieve and maintain favorable consumer responses and receive higher preferences than other very familiar numbers in various product extension contexts, regardless of parent brand names or product categories. Our findings suggest that it is ideal to use MCN in new extensions.

Keywords Numerical processing · Numerical cognition · Brand extensions · Product extensions · Product category fit · Brand names · Alphanumeric

Introduction

Inclusion of numbers in brand names (i.e., alphanumeric brand names [ABN]) is pervasive in many product categories (e.g., Audi A8, 3M; Pavia and Costa 1993). Recent research shows that the numbers in brand names can affect consumer attitudes, attribute inferences and product preferences (Gunasti and Ross 2010; Auh and Shih 2009; King and Janiszewski 2011; Yan and Duclos 2013). Because meaningful brand names are more likely to be successful in the marketplace (Kashmiri and Mahajan 2010; Lee and Ang 2003), the choice of numbers to include in brand names becomes a crucial one. A recent investigation of this issue by Kara, Gunasti and Ross (2015) sheds some light on how consumers process the numerical components of ABN. The authors showed that line extensions are evaluated more favorably when they are formed by changing a number in an existing brand (e.g., from A70 to A80) as opposed to a letter (e.g., A70 vs. B70). Gunasti and Ross (2010) investigated how companies might align ABN numbers with attribute values (e.g., AMD32 computer chips refer to 32-bit processing). Importantly, the authors observed that consumers' detection of associations between the numbers in ABN and attribute values depends on specific contexts.

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A number might be favored in a product category (e.g., 32 in computers) only when consumers have the extra knowledge and product familiarity, need for cognition or external primes that facilitate comprehension of the numbers (Yan and Duclos 2013; Gunasti and Ross 2010; King and Janiszewski 2011). Technological advances might also change the favorability of associations between parent brands and ABN numbers or product categories and ABN numbers (i.e., brand–number and product–number associations). For example, development of 64-bit processing diminished the favorability of the number 32 for Creative®, AMD® and Windows® brands and for related product categories (e.g., sound cards, CPUs, software).

It is important to note that ABN are assigned at the discretion of companies (Boyd 1985). Overall, the associations between products and numbers in ABN can be arbitrary, and the same number is often used in very different contexts (e.g., Mercedes S550, Canon Powershot SD550, Bobcat S550, Asus Vivobook S550, Mustang S550, Nikon Coolpix S550, Yamaha DVD-S550, Sony Bluray BDP-S550, JVC KD-S550). Thus, inferences about the meanings of numbers in ABN can easily change based on the product category. Sometimes a number might be strongly associated with only a specific product. For example, 1080 is not a special number in many domains (e.g., retirement services, taxis, energy bars, vacuum cleaners, lamps, automobiles), yet it can be specifically favored in HDTVs because of its association with picture resolution. At other times, a number may not be inherently associated with any products or contexts, but its repeated inclusion in brand names can help it gain a special meaning and lead to favorable associations (e.g., Levi's 501, in which the number 501 had no associations with jeans until Levi's used it). Thus, the favorability of a number included in an ABN likely depends on its associations with the product category and parent brand name, making it difficult for brand managers to identify the best numbers for brand extensions. Finally, the fit of product and brand name when extending to very different (or far) categories will likely affect the effectiveness of the numbers used (e.g., Levi's 501 phone services).

An important question is what types of numbers are best suited for use in ABN for new extensions. Are any numbers inherently more advantageous when extending to different product categories? Drawing on the literature on numerical processing and numeral systems, we conduct a set of number usage frequency analyses and identify a set of numbers that can be favored in numerous contexts and transfer their favorability to different product categories. We refer to these numbers as *multi-context numbers (MCN)*. We propose that MCN that consist of decimals (10), duodecimals (12) and sexagesimals (60) will be liked and preferred more greatly regardless of context due to their frequent use in various domains. Accordingly, MCN will be ideal for use in ABN for numerous product extensions and will be superior to numbers that are familiar to consumers (e.g., 18) and numbers that have favorable associations in just a single context (e.g., 401 and retirement).

The paper proceeds as follows: We start with an examination of the Google Books database to establish that MCN are used more frequently than non-MCN in numerous domains. Then, we follow up with a set of experiments to illustrate that the inclusion of MCN in brand names leads to positive perceptions of product quality and overall product preferences in multiple contexts and product extensions in numerous categories—both in comparative and individual product evaluations. We find that the effects of MCN are mediated by product–number associations.

Overall, our results demonstrate that MCN are as effective as those numbers that have the greatest contextual associations with specific product categories (e.g., 1080 for HDTVs) and the numbers most familiar to consumers (e.g., 21 in the context of age). Importantly, MCN are more effective than all these numbers in different contexts and product categories. Our research contributes to the growing literature on numerical processing in marketing as well as the wide literature on fit of brand extensions by introducing the important role that numbers in ABN play in consumer judgments.

Conceptual background

Numeral Systems and the associability of numbers with multiple contexts

As suggested by research in numerical cognition (Dehaene 1997), frequent use of numbers increases their familiarity, likability and associability with more contexts (Zajonc 1968). The question is which numbers are used most often and are highly associable with multiple contexts. To examine this issue, we reviewed the most commonly adopted numeral systems in history and the mathematical formulas that have been developed in the numerical processing literature. As a result, we identified a set of numbers that we term MCN due to their high associability with multiple contexts and frequent use in many languages, as discussed next.

Decimal (10) Numerals: 2ness, 2.5ness, 5ness, 10ness Properties

Certain numeral systems have been associated with specific domains (e.g., the binary numeral system in computing), whereas others have been associated with counting,

measurements and calculations in general. The most commonly used system is the decimal (10) system (Schindler and Kirby 1997). Most numerals (notations of quantities), including Roman (I, V, X, L, M), Greek (α, β, γ), Chinese, Egyptian and the Hindu-Arabic numerals (1, 2, 3), are based on the decimal system, which use separate symbols for tenths and sometimes for fifths. Decimals are the basis of the metric measurements that are dominant in all domains (e.g., height/length, weight, volume, area, temperature). The decimal system is used in most evaluation types, unitization methods, percentages, ranking, monetary and financial instruments and referencing systems ranging from grades to military units (see "Appendix 1").

Comparisons of the use of numbers across various languages have shown that the numbers that follow Sigurd's (1988) and Jansen and Pollmann's (2001) formulas for 2-ness: $(2 * [x * 10^n])$; 5-ness: $(5 * [x * 10^n])$, 10-ness: $(1 * [x * 10^n])$ and 2.5-ness: $(2.5 * [x * 10^n])$, where $0 < x < 10$, $n >= 0$, are used more frequently than other zero- and five-ending numbers, which do not follow these formulas (Lotz 1955; Jansen and Pollmann 2001; Schimmel 1993). It is important to note that for example, 2-ness is not about divisibility with 2, but its divisibility by 20, 200 or 2000… depending on the size of the number. For example, 200 has 2-ness and 10-ness but 2200 has no 2-ness or 10-ness because it is not divisible by 2000 or 1000.

As Jansen and Pollmann (2001) describe: "Formulated somewhat less formally: a number has "10-ness" when the quotient of dividing it by 1, 10, 100, 1000, etc. is 1, 2, 3, 4, 5, 6, 7, 8, or 9; it has "2-ness," when dividing it by 2, 20, 200, 2000, etc. results in 1, 2, 3, 4, 5, 6, 7, 8, or 9; and it has "5-ness" when one of these outcomes is reached by dividing it by 5, 50, 500, 5000, etc. To give some examples: 40 has 10-ness, 2-ness and 5- ness, 8 has 10-ness and 2-ness but no 5-ness, 300 has 10-ness and 5-ness but no 2-ness, 70 has only 10-ness, and 61 has none of these properties." (p. 198).

Correspondingly, not all zero- and five-ending numbers are used as often. For instance, the number usage frequencies measured by Jansen and Pollman (2001, Fig. 2–4, pp. 192–194) and Coupland (2011) indicate that zero- or five-ending numbers (e.g., 35, 130, 190, 370, 410, etc.) which do not possess multiple properties of 2-ness, 5-ness, 2.5-ness and 10-ness are not used as often as numbers that possess more of these properties.

Duodecimal and sexagesimal systems

MCN also stem from two other numeral systems. The oldest counting method involves the use of a single hand and the 12 finger bones in one hand. The thumb of the hand touches the three bones in each of the four other fingers ($4 \times 3 = 12$). This method, still widely used in Asian countries, is believed to be the origin of the duodecimal/dozenal (12) numeral system (Macey 1989). Combining this method with the five fingers of the other hand to count dozens ($5 \times 12 = 60$) has led to the sexagesimal (60) numeral system, which dates back to the Babylonians and Sumerians (Ifrah 2000). The first known numerals introduced by the Babylonians around 3100 BC consist of notations for multiples and fractions of 60 (Sigurd 1988; Bietenholz 2013). This forms the basis for most time-related measures (hours, minutes), mathematics, geometry (angles, degrees), geography, finance and astronomy (see "Appendix 1"). Similarly, the duodecimal system is predominantly used in Anglo-Saxon cultures and is frequently employed in all non-metric measurements (e.g., 12 inches in 1 foot, dozenal packaging, older monetary units) as well as time-related measures (e.g., 12 months, 24 h) (Jansen and Pollmann 2001); see "Appendix 1" for interesting examples. Some mathematicians and organizations such as the Dozenal Society advocate adopting a duodecimal system in measurements due to the superior divisibility of 12 (by 2, 3, 4 and 6) compared to 10 (2 and 5) (Schiffman 1982).

Numerical cognition and number frequency studies have documented that multiples and divisors of 12 and 60 (e.g., 12, 24, 30, 60, 180, 360) also appear frequently in various languages (Dehaene and Mehler 1992). An important difference between these two systems and the decimal system (which forms the basis of the Arabic numerals we use) is that as we go up the number line, multiples of 12 (e.g., 288) and 60 (e.g., 780) will be more difficult to detect, less associable and thus less frequent. Similar to number properties formulated by Jansen and Pollmann (2001) that we discussed earlier, divisibility by 12, 60, 120, 600 and so on becomes differentially important depending on number size. For example, although 504 is divisible by 12, it is not divisible by 60 or 120, which is more important in determining its usage frequency and associability in multiple contexts given its size.

MCN in brand names: association with multiple contexts

Based on our examination of the three most prevalent numeral systems, we combined all dynamic formulations based on number size developed in the literature (2ness, 5ness, 2.5ness, 10ness, 12ness, 60ness) to identify MCN. Accordingly, we define MCN as the numbers up to 60 that are divisible by 5 or 12 (e.g., 10, 12, 15, 20, 24, 25); divisible by 60 up to 360 (i.e., 120, 180, 240, 360); and divisible by 50 up to 1000 (e.g., 100, 150, 200, 300). For the first set of MCN, we included each decimally and duodecimally round number until we reach the sexagesimal

base (i.e., 60). Because all three numeral systems are very commonly used in a variety of contexts, including these numbers would be reasonable. From the sexagesimal system, we limited the MCN inclusion to up to 360 due to the disproportional use of 60 and its multiples, especially up to that point. For the multiples of 50 and 100, we confined the scope of the MCN definition to ten times these divisors because 10 is the base for the decimal system. Although further research may incorporate some other numbers as MCN, limiting MCN within certain boundaries enabled us to combine all the formulated properties in the numerical processing literature (Sigurd 1988; Dehaene and Mehler 1992; Schimmel 1993; Jansen and Pollmann 2001).

Multiplies of 10 have been shown to influence a number of consumer decisions, such as how consumers process prices (Schindler and Kirby 1997), stock buying behavior (Kandel et al. 2001), brand choice (Gunasti and Ozcan 2016; Gunasti and Devezer 2016) and impressions of product quality (Stiving and Winer 1997). For example, Gunasti and Ozcan (2016) found that when brand names include multiples of 10, consumer preferences increase due to products being perceived as more complete. Prices that end with zeros may affect the price–quality relationship positively and enhance product evaluations (Stiving and Winer 1997). Overall, zero-ending numbers may create a positive meaning if they are presented as reaching a new threshold.

In this study, we expand this general view of decimals to include duodecimal and sexagesimal numeral systems. We identify and name these numbers as MCN. Based on prior research on mere exposure effects (Zajonc 1968), we claim that familiarity is an important aspect of MCN. However, familiarity by itself is not adequate to define MCN. The effects of MCN are more readily associated with many contexts when compared to numbers that are associated with specific products or numbers that are culturally (biblical, folkloric) or personally (address, social security, birthday) familiar and favored over others (Ang 1997; Bornstein and D'Agostino 1994; Dehaene 1997; Whittlesea and Williams 2000).

MCN are also often used to identify quantities in multiple contexts, and such repeated exposure through use in multiple contexts has been shown to generate positive attitudes (Dehaene 2001). Accordingly, we posit that these favorable perceptions and conceptual associations will transfer to different stimuli (e.g., perfect 10, feeling 100%, 360° perspective). Product–number associations will occur naturally and will not be limited to the product context. For instance, despite differences in product categories, the Xbox 360 video game console, Norton 360 antivirus software, Anderson Cooper 360 TV show and 360 Federal Credit Union bank are all perceived favorably for different reasons and because of associations with the MCN, 360, in numerous contexts. Thus, we propose that MCN may be more usable and adaptable to different brands because they should be perceived as more versatile and applicable in multiple contexts.

MCN are different from numbers that are familiar because they have strong associations with specific contexts. For example, the number 69 is very familiar to Americans because it has strong sexual connotations (Coupland 2011). We expect that its use in a related domain (e.g., Trojan 69 condoms) will result in favorable consumer attitudes. However, the familiarity of this number will not help in other contexts, and thus we cannot define such numbers as MCN.

The role of number fit in brand extensions

There is a vast literature on "fit" as an important moderator of brand extensions (Aaker and Keller 1990; Mao and Krishnan 2006; Park et al. 1991). However, fit solely focuses on the match between the parent brand name and the extension's product category (e.g., Listerine expanding to the juice category would be a terrible fit). Inclusion of an appropriate number in a brand name is an equally important issue that has not been considered for brand extensions. Little is known about how the fit of numbers in ABN with the parent brand or the product category might affect extension evaluations.

Mandler's (1982) schema congruity theory suggests that moderate congruity for brand extensions seems to be superior to full congruity and extreme incongruity (Meyers-Levy et al.1994). Applying this to the current research, we expect that numbers that are perceived as moderately congruent with product category and brand name should lead to more favorable attitudes. For example, some numbers are associable with specific products (e.g., retirement 401 Ks, 1040 tax forms and 1080p resolution HDTVs). Other numbers have developed associations with specific brands due to prolonged customer exposure (e.g., Heinz 57 ketchup). Finally, other numbers are familiar to consumers simply due to their strong associations with certain domains (e.g., 21 is the legal drinking age, 18 is the voting age). We would expect such numbers to be favored in related categories, such as TurboTax 1040 or Smirnoff 21, as product–number–brand associations increase. However, we would not expect TurboTax 21 or Smirnoff 1040 to be favored due to the lack of such associations. Thus, unlike MCN, we do not expect non-MCN to induce positive attitudes in multiple contexts.

To examine the role of MCN in evaluations of brand extensions, we conducted a set of empirical studies. First, we analyzed the Google Books database to demonstrate the high frequency of MCN in numerous domains. Next, we ran Study 1, which showed that MCN have a higher

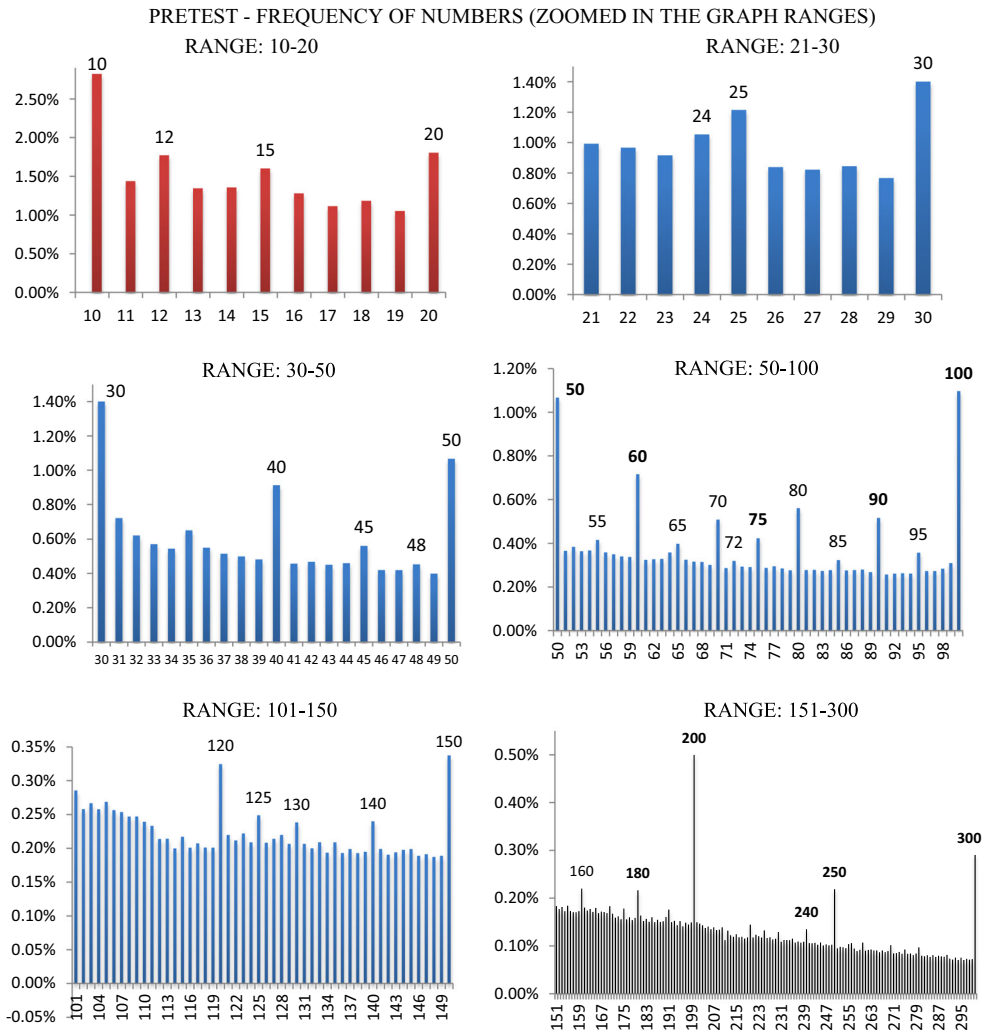

Fig. 1 Pretest: frequency of numbers (zoomed in the graph ranges)

relative choice share than non-MCN. Study 2 compared MCN with non-MCN that are highly favored in specific contexts (e.g., Smirnoff 21 brand vodka) and showed that MCN are always more versatile for use in brand extensions. Finally, Studies 3 and 4 further examined the mediating roles of product–number and brand name–number associations for the effects of MCN.

Pretest: frequency of MCN in multiple domains

The purpose of this pretest was to demonstrate the high frequency of MCN in various domains. As we discussed earlier, our categorization of MCN is dynamic and based on the decimal, duodecimal and sexagesimal numerical systems. Thus, we focused on the frequencies of MCN in specific intervals, as explained in the analysis section.

Methods

We conducted a frequency analysis of numbers 10 through 1000 to illustrate that MCN are used more frequently than other numbers. Our investigation focused on Google Books data compiled by Michel et al. (2011). We examined the relative percentage of numbers in all books published in English between 2007 and 2008, which was the latest available dataset in the Google database. Then, we examined the average relative frequencies of MCN and non-MCN among all words used in each book.

Results and discussion

We observed that MCN were used more often compared to other numbers (M = .56% vs. .08%; $F(1,989)$ = 215.1, $p < .001$). To put these percentage results in perspective,

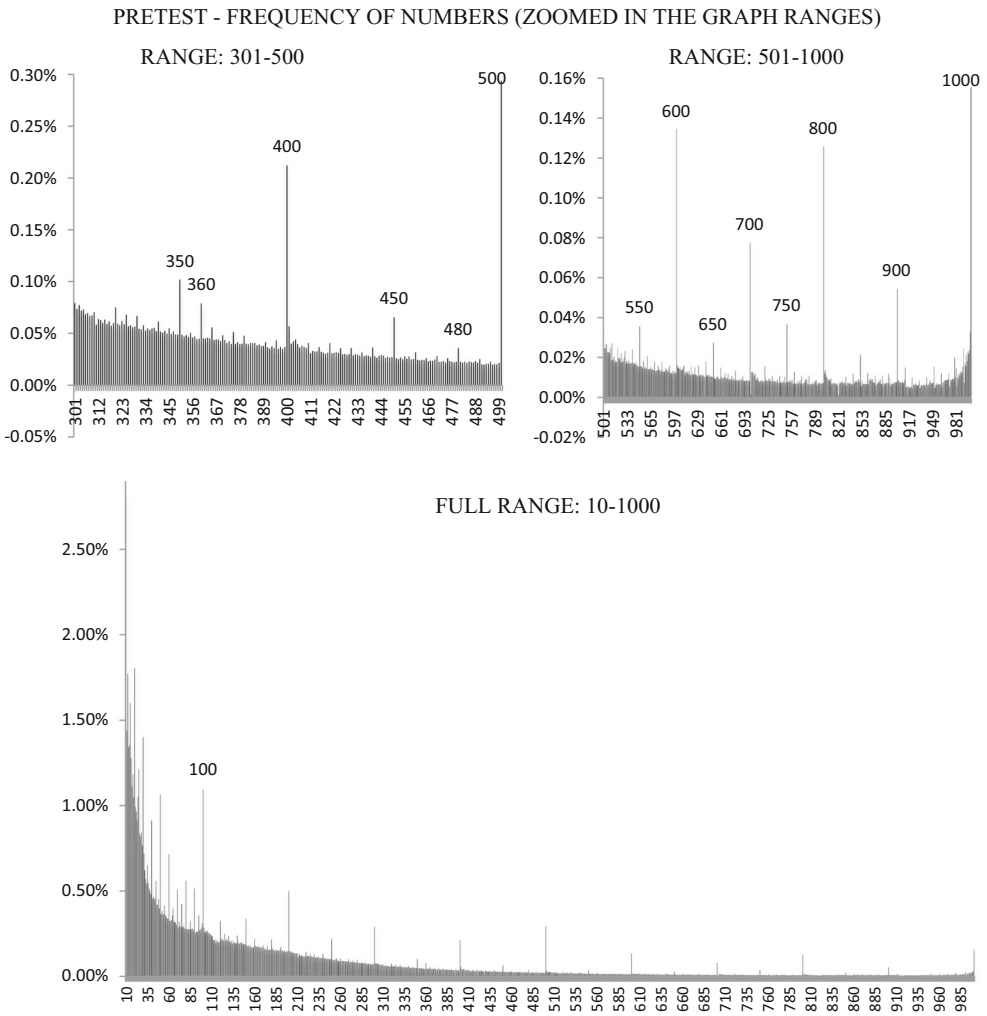

Fig. 1 continued

out of 1000 words in any given book (i.e., all types of words, including non-numerals), on average 5.6 words were MCN whereas only .8 were non-MCN. This indicates that MCN were used seven times more frequently than other numbers in a diverse set of domains. We further divided the data into three groups as different sources of MCN. First, we analyzed the MCN frequency for the numbers between 10 and 60. Based on our theoretical review, we defined 10, 12, 15, 20, 24, 25, 30, 35, 36, 40, 45, 48, 50, 55 and 60 as the MCN in this range. A one-way ANOVA showed that MCN have a significantly higher frequency than non-MCN within that bracket of numbers (M = 1.11 vs. .69%; $F(1,49) = 10.01$, $p < .005$). We ran another ANOVA for the MCN between 60 and 360, defined as 60, 100, 120, 150, 180, 200, 240, 250, 300, 350 and 360. Our results here also showed MCN were used four times more frequently than the non-MCN in this range (M = .15 vs. .036%; $F(1,299) = 44.23$, $p < .001$). Finally, we found significantly higher frequencies for MCN between 360 and 1000 (e.g., 450, 500) (M = .01 vs. .0015%; $F(1,638) = 346.65$, $p < .001$) (Fig. 1).

Because smaller numbers are known to be used more frequently than larger numbers (Sigurd 1988), we also ran a model including number size as a covariate. As expected, an increase in the size of a number decreased its frequency ($F(1,988) = 460.40$, $p < .001$). However, the effect of MCN remained significant ($F(1,988) = 211.7$, $p < .001$) when controlling for number size. Overall, our examination of all books published in the one-year study period showed that MCN are used more frequently in numerous domains.

Study 1: relative preferences for MCN

To explore whether inclusion of MCN in brand names would increase the preference for product extensions, we compared the preference of brand names with and without

numbers and manipulated the numbers to be MCN and non-MCN.

Methods

Three hundred and seventy-eight Amazon mTurk workers (M_{age} = 35, 56% female) were assigned to two conditions in which they were told to imagine that brand managers of several well-known brands were exploring the idea of including or excluding a numeric component in their brand names for upcoming product launches. In both conditions, participants evaluated a binary set of brands in which one brand included a number and the other did not. We manipulated whether MCN or non-MCN (including numbers ranging from 10 to 1000) were used in the 13 binary sets of brands, which were presented in random order (see Table 1). For example, in the non-MCN condition, one brand set was *Intel 11* versus *Intel* game console, whereas in the MCN condition, the corresponding brand set included *Intel 10* versus *Intel* game console. To minimize potential confounding through the "the higher the better" effect, established by Gunasti and Ross (2010), we set all non-MCN to be higher than the MCN. Thus, any significant preferences for the MCN should not be due to numerical magnitude. As shown in Table 1, we used well-known consumer brands that valued at least $1 billion, and we included a variety of both near and far extensions, ranging from Amazon freight and logistics to BMW headphones.

Results and discussion

Table 1 shows the choice shares of brand names including MCN versus non-MCN compared to brand names without numbers. The results confirmed our prediction that inclusion of MCN in ABN led to higher relative preferences of brand names in all categories. We noted that 24 and 360 had particularly stronger results that might be partially explained by their overall fit with the product categories. For example, 24 used in deodorant brands may imply all-day protection, and 360 used in logistics brands might imply that they ship everywhere. However, there were consistent and significant increases across all MCN conditions even when there was no apparent meaning or association with the number (e.g., Gillette 240 versus 241 and Nike 36 versus 38; see Table 1 for other brand–number matches). This study demonstrates the direct, favorable impact of MCN versus non-MCN on choice shares in certain product categories.

Another interesting question is how the use of the identical MCN may affect brand attitudes across different product categories. To test this idea, we conducted another study in which we manipulated the number portions of ABN and compared their effectiveness across various product categories.

Study 2: preference for MCN versus numbers highly associated with specific contexts

The purpose of this study was to examine how inclusion of MCN in brand names affects consumer attitudes in multiple unrelated product categories. We compared the favorability of MCN brands (brand names including MCN) to that of non-MCN brands (brand names including non-MCN) that had clear and strong associations with particular products in specific contexts.

Table 1 Study 1: choice share of MCN versus non-MCN compared to the same brand without a numeric component

N = 378	MCN	MCN % share	Non-MCN	Non-MCN % share	$\chi^2(377)$
Intel game console	10	60.0	11	51.1	3.06**
BMW head phones	12	30.0	14	20.2	4.81**
Disney Deodorant	24	25.3	26	5.9	27.03***
Nike diving masks	36	26.3	38	17.6	2.35**
Louis Vuitton phone case	40	16.8	43	10.6	3.07**
Canon selfie stick	100	41.6	102	28.2	7.45***
IBM Ultra HDTV	120	54.2	122	43.6	4.24**
Samsung binoculars	180	54.2	183	35.1	13.95***
Gillette grooming kit	240	34.7	241	23.4	5.88**
H&M professional apparel	300	21.1	302	13.3	3.99**
Amazon freight and logistics	360	57.4	364	18.6	60.17***
Rolex smartwatch	500	61.6	503	43.6	12.23***
Target home delivery service	1000	12.6	1004	7.4	2.81*

*$p < .1$; **$p < .05$; ***$p < .005$

Methods

We employed a mixed design: 4 (brand name: four sets of brand names) by 16 (number: 16 numbers including MCN and non-MCN numbers), in which the first factor (brand name) is between-subjects and the second factor (number) is within-subjects. The 16 numbers are grouped into four sets. Participants are randomly assigned to one of the four brand sets and then evaluate the combinations of the brand names and the 16 numbers. We first picked four MCN: 24, 100, 360 and 1000. Then, we chose three other numbers near each to form four sets of four numbers: (i) 21, 23, 24, 28; (ii) 69, 86, 100, 101; (iii) 312, 314, 360, 401; (iv) 1000, 1024, 1040, 1080. Based on our examination of number definitions from various sources, including urbandictionary.com ("Appendix 2"), we also identified four brand/products to match with these sets of numbers: (i) Cuisinart toaster, February magazine, Smirnoff vodka, Nike Jordan shoes; (ii) Holmes air purifier, Trojan condoms, Raid bug spray, Sushi for Beginners; (iii) Clif protein bar, Chicago taxi, St. Louis limo, H&R Block retirement; and (iv) Ikea sofa bed, TurboTax software, Dell external hard disk, Sony HDTV. The experiment was designed in such a way that three of the four products in each brand set (i, ii, ii, iv) would be highly associated with one of the non-MCN in the corresponding number set (i, ii, iii, iv). As shown in Table 2, sets were as follows: (i) 21, the legal age for drinking, was associated with Smirnoff vodka; 23, Michael Jordan's jersey number, was associated with Nike Jordan shoes; and 28, the number of days in February, was associated with February magazine. None of these numbers was associated with Cuisinart toasters. In set (ii), 101, an introductory college course number, was related to the Sushi for Beginners book; 86, which means "to terminate" in slang, was related to Raid bug spray; and 69, which has sexual connotations, was related to Trojan condoms. In set (iii), 401 was associated with H&R Block retirement; 312, Chicago's area code, was associated with Chicago taxi; and 314, St. Louis' area code, was related with St. Louis limo (these cities are the two main areas from which we recruited our participants). Finally, in set (iv), 1024, the number of bits in a byte of data, was related with Dell hard disk; 1040, the number on tax forms, was associated with TurboTax; and 1080, common in pixel resolution, was associated with Sony HDTV. The products shown in the first rows of each set in Table 2 and "Appendix 2"—Ikea bed, Cuisinart toaster, Holmes air purifier and Clif protein bar—were not associated with any of the numbers in the sets.

Using an online survey tool, we randomly assigned 172 participants from a large Midwestern university (M_{age} = 21, 56% female) to one of the four conditions, which consisted of four brand names (one from each brand set) matched with the corresponding numbers in each of the number groups. Thus, each participant was exposed to the same 16 numbers (all four sets of numbers), but was randomly assigned to one of the brands in each set. For example, one participant evaluated TurboTax 1000, 1024, *1040* and 1080 tax software; Smirnoff *21*, 23, 24 and 28 vodka; H&R Block 312, 314, 360 and *401* retirement software; and Trojan *69*, 86, 100 and 101 condoms (italicized numbers are category relevant). Another participant rated the favorability of number sets for different combinations, such as Sony 1000, 1024, 1040 and 1080 HDTV; Nike Air Jordan 24, 23, 21 and 28 shoes; Chicago 360, 312,

Table 2 Study 2: favorability of MCN versus highly relevant non-MCN

Products	MCN	Non-MCN			$F_{3,160}$	η^2
	100	69	86	101		
Holmes air purifier	5.29^{a}	3.63^{b}	3.93^{b}	5.15^{a}	14.9	.22
Trojan condoms	5.24^{a}	**5.00^{a}**	4.07^{b}	4.20^{b}	5.7	.10
Raid bug spray	5.10^{a}	4.02^{b}	**4.59^{ab}**	4.39^{b}	3.2	.06
Sushi For Beginners	4.80^{b}	3.32^{c}	3.15^{c}	**6.24^{a}**	37.3	.41
Products	MCN	Non-MCN			$F_{3,160}$	η^2
	360	312	314	401		
Clif protein bar	5.46^{a}	4.05^{b}	4.3 9^{b}	4.88^{ab}	6.4	.11
Chicago taxi	5.34^{a}	**4.95^{ab}**	4.15^{c}	4.49^{bc}	5.1	.09
St. Louis limo	4.80^{a}	4.05^{b}	**4.68^{a}**	3.83^{b}	4.3	.08
H&R Block retire.	4.71^{a}	3.90^{b}	4.00^{b}	**4.88^{a}**	6.6	.11
Products	MCN	Non-MCN			$F_{3,160}$	η^2
	24	28	21	23		
Cuisinart toaster	5.15^{a}	4.63^{b}	4.37^{b}	4.66^{b}	2.5	ns.
February Magazine	4.41^{ab}	**4.68^{a}**	3.76^{b}	3.80^{b}	3.3	.06
Smirnoff vodka	4.56^{ab}	4.22^{b}	**4.88^{a}**	3.51^{c}	7.1	.12
Nike Jordan shoes	4.61^{b}	4.05^{bc}	4.00^{c}	**5.90^{a}**	13.8	.21
Products	MCN	Non-MCN			$F_{3,160}$	η^2
	1000	1040	1024	1080		
Ikea sofa bed	5.15^{a}	4.66^{a}	4.54^{a}	4.56^{a}	1.4	ns.
TurboTax software	4.73^{a}	**4.63^{a}**	3.90^{b}	3.93^{b}	4.5	.08
Dell Ext. hard disk	5.17^{ab}	4.56^{bc}	**5.56^{a}**	4.44^{c}	5.4	.09
Sony HDTV	5.24^{b}	4.32^{c}	4.41^{c}	**6.17^{a}**	13.9	.21

First products in each set (sofa beds, toasters, protein bars, air purifiers) have no associations with any numbers

Bold numbers diagonal in each table indicate the highest contextual relevancy (e.g., 1040-TurboTax)

^{abc} Different letters in each row indicate significant differences among number labels for products at $p < .05$ level starting with "a" as the highest favorability. Eight subjects have some missing data points. (SDs ranged 1.07–1.91)

401 and 314 taxi service; and Holmes 100, 69, 86 and 101 air purifier. Thus, each participant saw four randomly distributed brands with four number combinations that remained consistent across these groups. The first column in Table 2 represents MCN (24, 100, 360, 100), whereas the bold numbers correspond to the ratings of category-relevant numbers (see "Appendix 2" for a list of specific associations).

This experimental design enabled us to compare both the between-subject evaluations of different product categories for the same brand number (e.g., TurboTax 1040 vs. Sony HDTV 1040) and the within-subject evaluations of different numbers for the same product category (e.g., TurboTax 1040 vs. TurboTax 1080). Thus, we were able to examine the favorability of attitudes when the number was associated or not associated with the product. In addition, we were able to examine changes in the favorability ratings of brand names with MCN versus non-MCN for different products. We anticipated that the brand numbers most relevant to the product category would be favored more, but MCN would be favored regardless of product category relevancy.

Results and discussion

A set of MANOVAs conducted for each number range set yielded significant effects of brand names on the favorability of 14 product types (range of Fs(3,160) = 3.18-37.3, all p's $< .05$), a marginally significant effect for toasters ($F(3,160) = 2.5$, $p < .1$) and no effect for beds ($F(3,160) = 1.41$, $p > .1$) (eight subjects had missing data). Table 2 shows the favorability ratings and F-values for individual products along with detailed comparisons. The non-MCN brands received higher ratings only when they defined a highly relevant product (bold in Table 2). For example, 401 was favored more than other number as an H&R Block retirement software brand due to its contextual relevancy (401K plans), but 401 did not have such favorability for a limo service, taxi service or protein bar. On the other hand, the MCN achieved very high ratings across all product categories regardless of contextual associations. Importantly, for the majority of cases, the favorability levels of MCN brands were not statistically different from the most contextually relevant non-MCN brands in the set, suggesting high favorability of MCN regardless of product categories. As a limitation of this study, the MCN we employed did not produce identical results. For example, MCN such as 100 and 360 increased attitudes in all four brands tested, whereas 24 produced a slightly less consistent attitude impact.

Another important indicator for the favorability of MCN was their single-handed high favorability in product categories that had no specific relation to any of the numbers in the set (toasters, protein bars, air purifiers, sofa beds). Unlike non-MCN brands, positive attitudes toward MCN brands appeared independent of contextual associations. It is important to note that based on the "the higher the better" rule (Gunasti and Ross 2010) and the cardinality principle (Fitousi 2010), brand names that include higher numbers should be preferred. The fact that some smaller-number MCN brands were favored over larger numbers in a direct comparison demonstrates the robustness of MCN effects. MCN could achieve the highest ratings even when they were the lowest number in the competitive context (e.g., $1080 > 1040 > 1024 > \mathit{1000}$) and when they were competing against non-MCN with more divisors (e.g., 1040 has 20 divisors). Thus, neither magnitude (Gunasti and Ross 2010) nor divisibility (King and Janiszewski 2011), both known to increase favorability, could explain the positive attitudes toward MCN.

Overall, this study helped to establish that the use of MCN in brand names creates product favorability that cannot be accounted for by contextual associations between the numbers and specific product categories. Only when we used a set of very familiar non-MCN with close links to particular products could MCN be challenged, yet in most cases MCN brands still shared the highest favorability ratings with the category-specific non-MCN, which did not achieve statistically significantly higher ratings. Our direct comparison of MCN with other numbers in various product domains demonstrated the strength of their effects. However, one might also argue that the uses of competitive and comparative contexts boosted the relative effects of MCN. Thus, it is important to demonstrate the effects in singular evaluation contexts to prevent halo effects. We addressed this issue in another study.

Because the current study focused on the match between numbers and product categories, we employed products that had good fit with the parent brand names (e.g., H&R Block retirement software, as opposed to H&R Block HDTVs). Thus, the non-MCN we referred to as highly associated with the product (e.g., 401) were also congruent with the brand names (e.g., H&R Block 401 retirement as opposed to H&R Block 401 HDTVs). It would be interesting to examine the role of brand name–number associability effects along with product–number associations on MCN effects. For example, would MCN be even more effective when a brand is extending to a relatively incongruent category? This is another interesting question to answer in the context of brand extensions. In the current study, we used a judgment task to compare evaluations of different brands. Consumers can have equal attitudes toward several brands, but their preferences may still vary in a choice task. It is also important to examine how MCN affect consumer choices. We addressed these issues in the next study.

Study 3: the roles of product–number, brand name–number and brand name–product associations/fit

The purpose of this study was to examine how congruity between in name–number, product–number and brand name–product influences product choice. We tested preferences for MCN in the absence of such congruity and compared the use of numbers associated with product categories and brand names in a choice context.

Methods

We asked 138 mTurkers to make a choice among three Baskin Robbins (BR) ketchup brands: BR31, BR57 and BR100 (a mock-up product extension). Number 31 was highly associable with the parent brand name Baskin Robbins; 57 was highly associated with ketchup products (e.g., Heinz 57) and the number 100 was an MCN. Although we randomly assigned the participants to three conditions, the choice task and focal dependent variable (chosen option) remained identical. The only difference among the conditions was the specific number about which participants were questioned.

To avoid any confounding, in each condition we asked participants to indicate their agreement with the following questions for a different number (N = 31, 57 or 100) on 7-point Likert scales: *BR is strongly associated with number N* (brand name–number association); *ketchup is strongly associated with number N* (brand name–product association); *BR is strongly associated with ketchup* (brand name–product association); *BR is associated with many different products* (brand broadness). In addition, we questioned participants about their familiarity with the Baskin Robbins brand name, ketchup products and number N on a 7-point scale (1 = Not at all familiar, 7 = Extremely familiar). Thus, we were able to conduct between-subject comparisons of all these ratings for each brand name–number combination. After participants completed this individual evaluation for each alternative, they were directed to make a choice among these three products and were dismissed afterward.

Results

Manipulation and confound checks

A set of ANOVAs was conducted to compare the familiarity and associations of brands, products and numbers. As expected, there were no significant differences in the ratings for BR's association with ketchup (M_{Range} = 1.6–1.9) or the broadness of the BR brand (M_{Range} = 3.2–3.5), familiarity with BR (M_{Range} = 4.5–4.7) or familiarity with ketchups (M_{Range} = 5.3–5.5) in the three conditions (all Fs(2,135) < 1). On the other hand, we observed significant differences in perceived product–number associations ($F(2,135) = 13.4$, $p < .001$), brand name–number associations ($F(2,135) = 6.4$, $p < .01$) and familiarity with the number ($F(2,135) = 33.4$, $p < .001$).

More specifically, 57 had a stronger association with ketchup products ($M_{57\text{-Prod}} = 3.7$) compared to both 31 ($M_{31\text{-Brd}} = 2.4$, $t_{135} = 3.75$) and 100 ($M_{100\text{-Brd}} = 2.0$, $t_{135} = 4.95$). In parallel, 31 had a stronger association with the BR brand ($M_{31\text{-Brd}} = 3.5$) compared to 57 ($M_{57\text{-Brd-}} = 2.4$, $t_{135} = 3.6$) and 100 ($M_{100\text{-Brd}} = 2.4$, $t_{135} = 2.1$). These results suggest a successful manipulation of number associations. Finally, as expected, the MCN 100 was more familiar ($M_{100\text{-Fam}} = 5.3$) to consumers compared to both 31 ($M_{31\text{-Fam}} = 3.9$, $t_{135} = 4.2$) and 57 ($M_{57\text{-Fam}} = 3.8$, $t_{135} = 4.5$).

Choice

All participants made a choice among the three options. BR57, with the highest level of product association, received 33.2% of the choice share, not significantly different from chance, ($t_{135} < 1$). BR31, with the highest level of brand association, achieved 22.5%, significantly lower than 1/3 chance ($t_{135} = -2.96$), whereas BR100, containing the MCN, received the highest choice share of 44.3%, significantly larger than chance ($t_{135} = 2.64$). Overall, a brand name including MCN was preferred to brand names containing numbers associated with the brand name or the specific product. When we ran the choice data across different evaluation groups (BR31, BR57, BR100), the choices in the three conditions were not significantly different ($\chi^2(4) = 1.5$, $p = .83$), suggesting that the condition that participants were presented initially did not affect preferences. Regardless of the manipulation group to which the participants were initially assigned, the BR100 choice share did not significantly differ across initial evaluations (range: 40.4%-51.1%).

We further tested whether the perceived brand name–product (Baskin Robbins–ketchup), product–number (N–Ketchup) and brand name–number (N–Baskin Robbins) associations affected the specific options' choice shares. The product–number association had a significant effect on preference for BR100 ($b = .19$, Wald = 4.4, $p < .05$), whereas brand name–number ($b = .15$, Wald = 1.1, $p > .1$) and brand name–product associations ($b = .04$, Wald = .36, $p > .1$) did not play a significant role. Similarly, the choice of BR57 was driven only by product–number association ($b = .21$, Wald = 5.3, $p < .05$); that is, it was driven neither by brand name–number ($b = .06$, Wald = .50, $p > .1$) nor by brand name–product associations

(b = .03, Wald = .05, $p > .1$). For the choice of BR31, however, none of the associations had a significant role (brand name–number: b = .1, Wald = 1.5; product–number: b = .00, Wald = .00; brand name–product: b = .2, Wald = 2.3). Overall, product–number associations directed the preferences. Yet, the MCN 100 was still preferred over 57, the number with the greatest association.

Discussion

Our examination of preferences for MCN in the absence of a fit between brand names and product categories enabled us to gain important insights into which numbers might be more effective when naming brand extensions. We observed that using a number highly associated with a brand name was not the best strategy when extending to an unrelated domain (e.g., BR31 ketchups). Overall, consumer preferences seemed to be driven by product–number associations as opposed to brand name–number associations. More interestingly, although MCN (e.g., BR100) did not have the highest product–number association, they were able to achieve the highest choice share. This result suggests that when extending to a far product category, firms can effectively use MCN brands because MCN are preferred over numbers that have stronger associations with the product category (e.g., BR57 ketchup) or the brand name (e.g., BR31 ketchup). Note that in this study we purposefully used a product category that was incongruent with the brand name (i.e., BR and ketchup), and this enabled us to tease out the effects of product–number and brand–number fit. Our next step is to extend our investigation of fit to simultaneously examine the underlying roles of brand name–product, brand name–number and product–number associations for the effects of MCN and non-MCN on consumer attitudes.

Study 4: the mediating roles of product–number associations/fit on consumer preferences of MCN

This study had three main purposes. First, we wanted to replicate the findings of Study 2 and Study 3 in a between-subjects design. We compared attitudes toward brand names labeled with MCN and non-MCN in both non-comparative, singular evaluation contexts and in joint, comparative evaluation contexts. Second, we examined non-MCN that were highly associable with only the product or with both the product and brand name to distinguish the incremental effects of brand name–product match. Third, in Study 3, we found that choices of MCN were driven by product–number associations rather than brand name–number associations. In this study, we further examined the mediating role of both product–number and brand–number associations in an attempt to shed more light on the underlying processes.

Methods

We used a 2 Brand Name–Product match (Match: Fidelity Retirement Plan versus Mismatch: Fidelity Phone Service) × 3 Number (860, 401, 360) between-subjects design. We randomly assigned 293 students to six conditions in which they all evaluated Fidelity brand products. This design enabled us to manipulate various levels of match among brand names, products and numbers. For retirement plans, 401 had a good match both with the product and the brand name; whereas 860 had no match with either the brand or the product. For phone services, 860 had a match only with the product (i.e., the area code of the study participants) but not with the brand, whereas 401 only had a match with the brand name but not with the product category. Neither for retirement plans, nor for phone services 360, the MCN had any obvious match with brand or product.

Table 3 Study 4: results

Matches among brand names, products and numbers	Conditions	Attitudes (*Individual Evaluations*)	Choice Share %	Ranking
None (**MCN**)	Fidelity **360** Phone	**5.53**$^{a+}$	**52%**^{a}	**1.7**
Brand name–number	*Fidelity 401* Phone	4.58^{bc}	17%^{b}	2.3
Product–number	Fidelity *860 Phone*	5.00^{c+}	31%^{c}	2.1
Brand name–product (**MCN**)	Fidelity **360** Retirement	5.68^{a+}	3 49%^{a}	1.7
Brand name–product number	*Fidelity 401 Retirement*	**6.26**$^{b+}$	**52%**^{a}	1.7
Brand name–product	Fidelity 860 Retirement	5.02^{c}	9%^{c}	2.6

^{abcde} Different letters indicate significant differences at $p < .05$ levels, $^{+/\sim}$significant at $p < .1$ level

These six conditions were as follows (also see Table 3):

1. Fidelity 401 Retirement Plans (brand name–product number match)
2. Fidelity 401 Phone Services (Brand Name–Number match)
3. Fidelity 860 Retirement Plans (brand name–product match)
4. Fidelity 860 Phone Service (product–number match)
5. Fidelity 360 Retirement Plans (brand name–product match, MCN)
6. Fidelity 360 Phone Services (No matches at all, MCN)

First, participants were asked to indicate their attitudes toward the brand in a singular evaluation context on a 9-point scale (1 = Dislike extremely, 9 = Like extremely). They then rated their perceived associations between the numbers and products/brand names by indicating their agreement with a set of statements as in Study 3 (e.g., *Retirement plans/phone services are strongly associated with number 401/360/860*) on 7-point Likert scales. Finally, after completing the scales, participants in all conditions were shown all three numbers in brand names (Fidelity 360, 401, 860) and asked to choose the one they liked. Participants then were also asked to rank the brands in their order of preferences.

Results

Attitudes/evaluations

A 2 Brand Name–Product Match × 3 Numbers ANOVA yielded a significant effect of the brand–product match ($F(1,287) = 11.29$, $p < .001$) and numbers ($F(2,287) = 3.71$, $p < .05$) as well as a significant interaction between numbers and the brand–product match ($F(2,287) = 8.3$, $p < .001$). An analysis of the means of the main effects shows that attitudes toward the brand name–product match were significantly higher than for a non-match ($M_{\text{Match}} = 5.65$ vs. $M_{\text{Non-match}} = 5.04$, $p < .001$). Furthermore, attitudes for MCN (360), brand-match (401) and product match (860) were significantly different as well ($M_{360} = 5.61$ vs. $M_{401} = 5.42$ vs. $M_{860} = 5.01$, $p < .05$).

The detailed means are shown in Table 3. For Fidelity phone services, 860, the number highly associable with the product, received higher ratings than 401, which was strongly associated with the brand name (but not with the product); however, the difference did not reach statistical significance ($M_{401} = 4.58$ vs. $M_{860} = 5.00$, $p > .1$). Importantly, the MCN 360 was favored more than 401 ($M_{401} = 4.58$ vs. $M_{360} = 5.53$, $p < .01$) and marginally more than 860, which was highly associable with the product ($M_{860} = 5.00$ vs. $M_{360} = 5.53$, $p < .1$).

For Fidelity retirement plans, 401 had a good match with both the product and the brand name; it received higher ratings than 860 ($M_{401} = 6.26$ vs. $M_{860} = 5.02$, $p < .01$) and marginally higher than the MCN 360 ($M_{401} = 6.26$ vs. $M_{360} = 5.68$, $p < .1$). However, 360 was significantly higher than 860 ($M_{360} = 5.68$ vs. $M_{860} = 5.02$, $p < .05$). It is important to note that attitudes toward 360 remained equally high regardless of product category ($F(1,287) = .22$), whereas the favorability of 401 significantly depended on its match with the specific product ($F(1,287) = 27.1$, $p < 001$) despite its association with the Fidelity brand.

Choice and ranking

The rankings and choice distributions for the Fidelity brand in each product category are shown in Table 2. A multinominal regression choice model was conducted in which the product type served as the independent variable. The overall model was significant, indicating that choices were affected by the product type ($\chi^2(2) = 48.2$, $p < .001$). For phones, Fidelity 360 received a 52% share, significantly higher than the share of Fidelity 860 ($M = 31\%$, $b = .5$, Wald $\chi^2 = 6.9$, $p < .01$) and triple the share of Fidelity 401 ($M = 17\%$, $b = 1.1$ Wald $\chi^2 = 23.0$, $p < .001$). For retirement plans, the choice share of Fidelity 360 was 39%, not significantly different from the share of Fidelity 401 ($M = 52\%$, $b = .28$ Wald $\chi^2 = 2.6$, $p > .1$) but significantly higher than the share of Fidelity 860 ($M = 9\%$, $b = 1.4$, Wald $\chi^2 = 22.8$, $p < .001$). Overall, compared to phone service, Fidelity 360 was more likely to be preferred over Fidelity 860 for retirement plans ($b = .92$, Wald $\chi^2 = 6.9$, $p < .01$); compared to retirement plans, Fidelity 360 was more likely to be preferred over Fidelity 401 for phone services ($b = 1.4$, Wald $\chi^2 = 23.3$, $p < .001$). Finally, as shown in Table 2, mirroring the choice distributions, Fidelity 360 had the highest ranking (1.7) among the three numbers in both product categories.

Mediating roles of product–number and brand name–number associations

We ran a set of 2 (brand name–product match: Yes, No) × 3 (Number: 360, 401, 860) ANOVAs to examine the perceived product–number and brand name–number associations. There were significant interactions between number and brand name–product match factors both for perceived brand name–number associations ($F(2,287) = 5.06$, $p = .007$) and for perceived product–number associations ($F(2,287) = 29.10$, $p < .001$). The detailed means and contrasts for both variables are shown in Table 4. Overall, 860 and phone ($M = 4.70$) as well as 401 and retirement ($M = 5.22$) had the highest product–

Table 4 Study 4: results

Matches among brand names, products and numbers	Conditions	Perceived product–number match	Perceived brand name–number match
None (**MCN**)	Fidelity **360** Phone	3.31^{a+}	3.41^{a}
Brand name–number	*Fidelity 401* Phone	4.09^{b}	3.51^{a}
Product–number	Fidelity *860 Phone*	$4.70^{c\sim}$	3.08^{a}
Brand name–product (**MCN**)	Fidelity **360** Retirement	3.40^{a}	3.22^{a}
Brand name–product number	*Fidelity 401 Retirement*	$5.22^{d\sim}$	4.42^{b}
Brand name–product	Fidelity 860 Retirement	2.80^{e+}	3.02^{a}

^{abcde} Different letters indicate significant differences at $p < .05$ levels, $^{+/\sim}$significant at $p < .1$ level

number match perceptions. However, Fidelity 401 retirement led to the highest brand name–number match ($M = 4.42$). Overall, Fidelity 860 retirement had the lowest product–number match ($M = 2.80$) and the lowest brand name–number match ($M = 3.02$).

We have proposed that the perceived fit between product–number and brand name–number pairs will play a mediating role for the effects of numbers included in ABN. To test the relative roles of product–number and brand name–number associations, we conducted a parallel mediation analysis using Hayes' (2013) Process macro (Model 4), based on 10,000 bias-corrected bootstrap samples (to assess the significance of the indirect effects). Because our independent variable was not dichotomous but multi-categorical (360, 401, 860), we followed the instructions provided by Hayes and Preacher (2014) for multi-categorical independent variables (see "Appendix 3" in ESM for details). We used the Hayes and Preacher's (2014) recommended procedure to analyze the mediation. Accordingly, Hayes and Preacher (2014, pp. 455–456) state that, "A general linear modelling approach to estimating the direct and indirect effects when X is multicategorical: Mean differences can be estimated with a linear model by representing groups with a set of $k - 1$ variables, where k is the number of groups. As a consequence, the model, parameter estimates, and model fit statistics (such as R2) retain all the information about how the k groups differ from each other, unlike when groups are collapsed to form a single dichotomous variable. It also allows for simultaneous hypothesis tests if the groups are represented using carefully selected group codes to represent comparisons of interest." In our analysis, we did not explicitly code one group as recommended, meaning all $k - 1$ dummy variables are set to 0 for cases in that group. Accordingly, we formed two dummy codes, d1 and d2: d1 = 0, d2 = 0 for 360; d1 = 1, d2 = 0 for 401; and d1 = 0, d2 = 1 for 860; 360 acted as a control group. Then, we ran two Process models alternating the two dummies as independent variable and control in the two models (see Hayes and Preacher 2014 for a more detailed explanation). The perceived product category–number and brand name–number associations served as the two parallel mediators, and consumer attitudes served as the dependent variable.

The indirect effect of numbers on consumer attitudes via product–number association was significant in both models ($b = .3436$, 95% CI: .1612 ∼ .5803 and $b = .1043$; 95% CI: .0059 ∼ .2606), suggesting a mediation effect of product–number associations. The indirect effect of the numbers on consumer attitudes via brand name–number association was significant in the first model ($b = .1636$; 95% CI: .0455–.3594) but not in the second model ($b = -.0635$; 95% CI: −.1957–.0089). "Appendix 4" illustrates the complete results of the two parallel mediation models conducted following Hayes and Preacher's (2014) instructions for independent coding variables summarized in "Appendix 3" in ESM. Overall, the results suggest that the brand name–number association mainly mediated the effect of the number 401, highly associated with the Fidelity brand, on consumer attitudes. However, it did not mediate the effect of the number 860, unrelated to the Fidelity brand name, on consumer attitudes (Fig. 2).

Overall, consistent with the findings of study 3, the results of study 4 suggested that the product–number association mediates the effects of brand name numbers on consumer attitudes. Brand name–number associations only mediated the effect of numbers strongly associated with the brand name; for all other numbers, the underlying mediator was the product–number association. However, replicating the results of study 3, MCN were even favored over numbers that had the strongest associations with the product category.

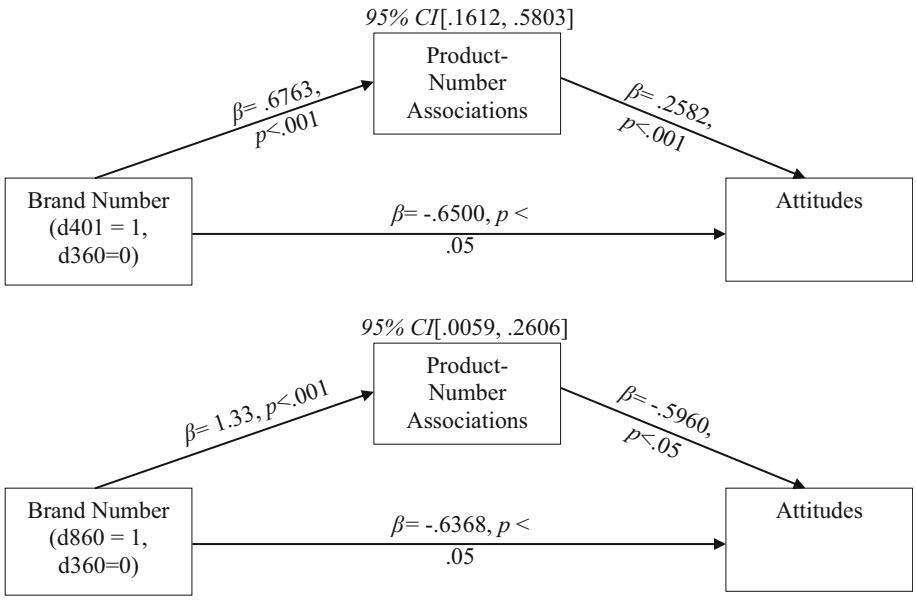

Fig. 2 Mediation effect of MCN via product–number associations

General discussion

Numbers are abstract and complex, and the likability of a number is dependent on the specific context (Dehaene and Mehler 1992). Accordingly, research on numerical cognition has exclusively focused on the increased likability of numbers resulting from contextual primes or repeated exposure in a given context (Bornstein and D'Agostino 1994; King and Janiszewski 2011). Drawing on the literature on numerical processing, we identified a set of frequently used and inherently meaningful MCN that originate from common numeral systems and follow a combination of formulations that have been scientifically established in the numerical processing literature (Sigurd 1988; Dehaene and Mehler 1992; Jansen and Pollmann 2001).

We demonstrated that MCN induce favorable responses independent of context both as raw numbers and as brand names. More specifically, MCN in brands positively affect attitudes toward products and consumer preferences in numerous product categories. Overall, MCN can compete against the well-established heuristics (e.g., the higher the better), high familiarity and strong contextual cues, achieving more positive consumer judgments and higher choice shares compared to non-MCN. Our research contributes to a growing literature on numerical cognition (Kwong and Wong 2006; Thomas and Morwitz 2009) and numbers in brand names (Gunasti and Ross 2010; Lee and Ang 2003) by introducing MCN. Because numbers in brand names are assigned at the discretion of firms (Boyd 1985), the use of MCN brands can be an effective approach in many product categories. Importantly, due to the inconspicuous nature of brands compared to other marketing communications (e.g., product attributes, prices), the effects of MCN may not lead to the consumer skepticism that other marketing efforts such as advertising could produce.

Our research also makes an important contribution to the broad literature on brand extensions. Although the concept of brand fit has been widely studied, past studies have solely focused on the match between the parent brand names and the product extension category (Aaker and Keller 1990, Mao and Krishnan 2006; Park, Milberg and Lawson 1991). Our study was one of the first to consider how the fit of numbers included in brand names and the product category affects consumer responses to potential brand extensions. We demonstrated that product–number associations mediate the effect of MCN on consumer attitudes. Yet, regardless of the product category, MCN were even more effective than the numbers that had the strongest associations with the brand names or the product context.

Our integration of MCN with branding strategies has important implications for brand managers by illustrating the importance of choosing the right numbers to include in ABNs. This research indicates that numbers may affect consumer decision-making and should be taken seriously. Furthermore, given the prevalence of MCNs in numerous industries, our findings suggest that, especially when extending in a far category, brand managers would be better off using MCN in the brand names as opposed to other number alternatives. For example, when naming their brands with an alphanumeric component, if there is no

inherent numerical figure that can be connected to the brand, brand managers may pick an MCN. Our research shows that such strategy may be more reasonable than picking a random number.

This research also has a number of limitations. We used experimental studies with mostly attitudinal measures to test our research questions. Future studies may benefit from incorporating other behavioral outcomes that directly affect profitability, such as market share and sales of products with MCN. Although our findings are relevant in establishing the positive effect of MCN within brand names, further research is needed to investigate this effect in other contexts, such as goal setting, number processing and other potential human behavior in which numbers are used as benchmarks.

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

Appendix 1

Common numeral system	Uses
Decimal (10)	All metric system measures (height, weight, volume, length, area)
History/Origins:	Military units, ranks, money bills, rankings, ratings, percentages, pricing, grouping, financial indices
Dates back to beginning of writing. Written evidence of its use in ancient Egyptian and Cretan hieroglyphs. Based on human anatomy, currently used by all modern civilizations	Roman, Greek, Brahmi, Chinese, Hindu-Arabic numerals are all based on the decimal system including special notations for 1, 10, 100, 5, 50, 500…etc
Duodecimal/dozenal (12)	All non-metric measurements of length/ area/ weight
History/Origins:	1 ft = 12 inches, 1sq ft = 144 sq inches, 12 ounce = 1 tory pound
Dates back to Sumerians and Babylonians. Based on human anatomy and single-hand counting method using thumb to count 4 × 3 finger bones	Monetary/Math: 1 shilling = 12 pence, 240 pence = 1 pound sterling (English and Irish), prices quoted as 12ths, Roman fraction system in 12s
Widely adopted in Anglo-Saxon cultures and continued even after decimalization	Packaging/grouping: dozen, 12-pack, 24-pack, gross = 144 (12 dozens), great gross = 12^3 = 1728
	Time: 1 year = 12 months, 1 day = 24 h, day/night (am/ pm) = 12 h, ½ year = 6 months, Chinese calendar has 12 year cycles, 12 lunar cycles
	Babylonians originally had 12 h in a day
	Other: 12 zodiac signs, 12 apostles, 12 imams, 12 wars, 12 petals, 12 jurors
	12 Functional keys on key boards (F1-12) and telephones (0–9,*,#,)
	12 notes in an octave, 12 teams in rugby, soccer leagues, finals, etc
Sexagesimal (60)	Time: 1 h = 60, 1 min = 60 s (i.e., 2nd order [1/60] of an hour)
History/Origins:	e.g., 4:22:33 = $4 \times 60^2 + 22 \times 60^1 + 33 \times 60^0$ s
Dates back to 3100BC Sumerians and Babylonians. It is a combination of the single-hand counting method (12 system) with the right-hand counting (× 5) to reach 60.	Chinese calendar has a sexagenary cycle, in which days or years are named by positions in a sequence of ten stems and in another sequence of 12 branches. The same stem and branch repeat every 60 steps throughout this cycle.
It became popular in second- and eighteenth-century mathematics and astronomy especially for Hellenistic civilizations	Geometry/trigonometry, mathematical astronomy (fractions), arcs, circle,
	angles, degrees, 360, 180, 90, 60, 30
	Geographic locations: Degrees of Parallels and Meridians, Seconds
	French: 70 = soixante-dix (sixty ten) 75 = soixante-quinze (sixty fifteen)
	Other: 60 mph as a common speed limit and reference for acceleration 0–60
Binary (2)	In 1617, John Napier's location arithmetic system. Multiples of 2 are often observed in technology contexts: 32, 64, 128, 256, 512, 1024
History/Origins:	
Morse code, data processing	

Appendix 2

Study 1: Experimental scenario and an example for the choice set

"Imagine that some well-known brands are planning to sell certain products that they don't offer right now. To launch these products, brand managers are going back and forth with using brand name number combinations such as Porsche 911 or Heinz 57. You are asked to evaluate these brands with or without brand name number combinations and pick one of them as your choice."

Please pick one of the alternatives as your preference.

Intel 10 Game Console	Intel Game Console

Study 2: stimuli

Number sets rated for each brand/product	*Brand*/product sets listed in the order of matching associations with numbers	Specific semantic associations
100 (MCN)	*Holmes* air purifier*	MCN
69	*Trojan* condoms	Has a sexual reference

Number sets rated for each brand/product	*Brand*/product sets listed in the order of matching associations with numbers	Specific semantic associations
86	*Raid* bug spray	Means "to terminate" in slang language
101	*Sushi for Beginners* Text Book	Associated with introductory courses
360 (MCN)	*Clif* protein bar*	MCN
312	*Chicago* taxi service	Chicago's area code—participants' location
314	*St. Louis* limo service	St. Louis' area code—participants' location
401	*H&R Block* retirement software	Number used in retirement plans
24 (MCN)	*Cuisinart* toaster*	MCN
21	*Smirnoff* vodka	Legal age for drinking
23	*Nike Jordan* shoes	Michael Jordan's jersey number
28	*February* Fashion Magazine	Total number of days in February
1000 (MCN)	*Ikea* sofa bed*	MCN
1024	*Dell* hard disk drive	Bits of data computing
1040	*TurboTax* tax software	Number label on federal tax forms
1080	*Sony* HDTV	Associated with HDTV resolutions

*These products were not associated with any of the numbers

All four numbers in each set were rated for all four products (e.g., 100, 69, 101, 86) and were compared as brand names for each of Holmes, Trojan, Raid and Sushi for Beginners

MCN Multi-context numbers

Study 3: Stimulus example

Which one of these ketchup alternatives would you pick?

Please rate your attitude toward the following brand name number combinations (1–7 Extremely dislike/Extremely like)

Baskin Robbins 31 Ketchup, Baskin Robbins 57 Ketchup

Please indicate your agreement with the following statements:

Baskin Robbins is strongly associated with Ketchup
Ketchups are strongly associated with number 31
Baskin Robbins is strongly associated with number 31
Ketchups are strongly associated with number 57
Baskin Robbins is strongly associated with number 57
Ketchup is a typical product for Baskin Robbins
31 is a typical brand name number for Ketchup
31 is a typical number for Baskin Robbins brand
57 is a typical brand name number for Ketchup
57 is a typical number for Baskin Robbins brand

Appendix 4

Detailed results of mediation model 1—based on d1 coding as discussed in "Appendix 3" in ESM (*d1=0, d2=0 for 360; d1=1, d2=0 for 401; d1=0, d2=1 for 860, and 360 acts as a control group*)

Model 4: Y = Attitude; **X = No401**; Mediator1 = Product number; Mediator2 = Brand Number; **Control = No860**

Outcome: product number	$R = .3392$, $R^2 = .1150$, $F(2,290) = 18.8472$, $p < .001$					
	B	Se	*T*	*p*	LLCI	ULCI
Constant	3.3535	.1552	21.6110	.0000	3.0481	3.6590
No401	1.3307	.2218	6.0007	.0000	.8942	1.7671
No860	.4040	.2195	1.8411	.0666	− .0279	.8360

Outcome: brand number	$R = .2853$, $R^2 = .0814$, $F(2,290) = 12.8509$, $p < .0001$					
	B	se	*T*	*p*	LLCI	ULCI
Constant	3.3131	.1334	24.8332	.0000	3.0505	3.5757
No401	.6763	.1907	3.5475	.0005	.3011	1.0516
No860	− .2626	.1887	− 1.3919	.1650	− .6340	.1087

Outcome: attitude			R = .3927, R^2 = .1542, $F(4,288)$ = 13.1315, $p < .001$			
	b	Se	*T*	*p*	LLCI	ULCI
Constant	3.9390	.2970	13.2609	.0000	3.3544	4.5236
Product number	.2582	.0626	4.1237	.0000	.1350	.3814
Brand number	.2418	.0728	3.3207	.0010	.0985	.3852
No401	− .6500	.2334	− 2.7845	.0057	− 1.1095	− .1906
No860	− .6368	.2203	− 2.8899	.0041	− 1.0705	− .2031

Total effect model

Outcome: attitudes			R = .1551, R^2 = .0240, $F(2,290)$ = 3.5724, $p < .001$			
	B	se	*T*	*p*	LLCI	ULCI
Constant	5.6061	.1644	34.0937	.0000	5.2824	5.9297
No401	− .1429	.2350	− .6082	.5436	− .6054	.3196
No860	− .5960	.2325	− 2.5628	.0109	− 1.0536	− .1383

Total, direct and indirect effects

Total effect of X on Y

B	SE	*t*	*P*	LLCI	ULCI
− .1429	.2350	− .6082	.5436	− .6054	.3196

Direct effect of X on Y

B	SE	*t*	*P*	LLCI	ULCI
− .6500	.2334	− 2.7845	.0057	− 1.1095	− .1906

Indirect effect of X on Y

	b	Boot SE	BootLLCI	BootULCI
Total	.5071	.1204	.2953	.7637
Product number	*.3436*	*.1066*	*.1612*	*.5803*
Brand number	*.1636*	*.0773*	*.0455*	*.3594*
Contrast	.1800	.1420	− .0990	.4690

Contrast: Product number minus brand number

Detailed results of mediation Model 2 based on d2 coding as explained in "Appendix 3" in ESM (*d1 = 0, d2 = 0 for 360; d1 = 1, d2 = 0 for 401; d1 = 0, d2 = 1 for 860, and 360 acts as a control group*)

Model 4: Y = Attitude; **X = No860**; Mediator1 = Product number; Mediator2 = Brand number; **Control = No401**

Outcome: product number			R = .3392, R^2 = .1150, $F(2,290)$ = 18.8472, $p < .001$			
	B	se	*T*	*p*	LLCI	ULCI
Constant	3.3535	.1552	21.6110	.0000	3.0481	3.6590
No860	.4040	.2195	1.8411	.0666	− .0279	.8360
No401	1.3307	.2218	6.0007	.0000	.8942	1.7671

Outcome: brand number			R = .2853, R^2 = .0814, $F(2,290)$ = 12.8509, $p < .0001$			
	B	se	*T*	*p*	LLCI	ULCI
Constant	3.3131	.1334	24.8332	.0000	3.0505	3.5757
No860	− .2626	.1887	− 1.3919	.1650	− .6340	.1087
No401	.6763	.1907	3.5475	.0005	.3011	1.0516

Outcome: attitude			R = .3927, R^2 = .1542, $F(4,288)$ = 13.1315, $p < .001$			
	b	se	*T*	*p*	LLCI	ULCI
Constant	3.9390	.2970	13.2609	.0000	3.3544	4.5236
Product number	.2582	.0626	4.1237	.0000	.1350	.3814
Brand number	.2418	.0728	3.3207	.0010	.0985	.3852
No860	− .6368	.2203	− 2.8899	.0041	− 1.0705	− .2031
No401	− .6500	.2334	− 2.7845	.0057	− 1.1095	− .1906

Total effect model

Outcome: attitudes			R = .1551, R^2 = .0240, $F(2,290)$ = 3.5724, $p < .001$			
	B	se	*t*	*p*	LLCI	ULCI
Constant	5.6061	.1644	34.0937	.0000	5.2824	5.9297
No860	− .5960	.2325	− 2.5628	.0109	− 1.0536	-.1383
No401	− .1429	.2350	− .6082	.5436	− .6054	.3196

Total, direct, and indirect effects

Total effect of X on Y					
b	SE	*t*	*P*	LLCI	ULCI
− .5960	.2325	− 2.5628	.0109	− 1.0536	− .1383

Direct effect of X on Y					
b	SE	*t*	*P*	LLCI	ULCI
− .6368	.2203	− 2.8899	.0041	− 1.0705	− .2031

Indirect effect of X on Y	*b*	Boot SE	BootLLCI	BootULCI
Total	.0408	.0954	− .1389	.2391
Product number	.1043	.0641	.0059	.2606
Brand number	− .0635	.0503	− .1957	.0089
(C1)	.1678	.0646	.0560	.3082

Contrast: product number minus brand number

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