

Review article

Interactive Food and Beverage Marketing: Targeting Adolescents in the Digital Age

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Manuscript received December 17, 2008; manuscript accepted April 14, 2009

Abstract

Because of their avid use of new media and their increased spending power, adolescents have become primary targets of a new “Media and Marketing Ecosystem.” Digital media resonate particularly well with many of the fundamental developmental tasks of adolescence by enabling instantaneous and constant contact with peers, providing opportunities for self-expression, identity exploration, and social interaction, and facilitating mobility and independence. Six key features of interactive media—ubiquitous connectivity, personalization, peer-to-peer networking, engagement, immersion, and content creation—are emblematic of the ways in which young people are both shaping and being shaped by this new digital culture. The advertising industry, in many instances led by food and beverage marketers, is purposefully exploiting the special relationship that teenagers have with new media, with online marketing campaigns that create unprecedented intimacies between adolescents and the brands and products that now literally surround them. Major food and beverage companies, including Coca-Cola, McDonald’s, Burger King, and Kentucky Fried Chicken (KFC), have incorporated these elements into their interactive marketing strategies, posing particular risks to adolescents, who are not being addressed in the current U.S. policy and self-regulatory regimens. However, recent and emerging neuroscience and psychological research on adolescents suggests a need to revisit the traditional approach to regulation of advertising. Despite the growth of interactive marketing, academic research on the impact of digital advertising on children and youth remains underdeveloped. Additional research and policy initiatives are needed to address the growing health threat facing youth in the digital marketplace. © 2009 Society for Adolescent Medicine. All rights reserved.

Keywords: Internet; Advertising; Policy

Today’s adolescents are growing up at the center of an exploding digital media culture. According to a 2007 survey by the Pew Internet & American Life Project, “93% of teens use the Internet, and more of them than ever are treating it as a venue for social interaction—a place where they can share creations, tell stories, and interact with others.” [1] In many ways, teenagers are the defining users of this new culture, avidly embracing an expanding array of Web sites and digital devices, and forging a new set of cultural practices that are quickly moving into the mainstream. They are especially enthusiastic participants in online social networks such as

MySpace and Facebook, which are among the fastest-growing platforms [2,3]. It has been reported that 55% of youth between the ages of 12 and 17 have created a profile on a social networking site [1,4].

Adolescents are also primary targets for digital marketing [5]. A combination of factors has made them particularly valuable to interactive marketers, including their role as “early adopters” of new media practices and their steadily rising spending power. In the United States, 12–17-year-olds had some \$80 billion in income in 2007, with parents spending \$110 billion more for them on “key consumer categories such as apparel, food, personal care items, and entertainment.” It is predicted that by 2011 teen income will have grown to \$118 billion [6]. A 2008 market research survey found that 58% of youth between the ages of 13 and 17 years have made a purchase online, spending an

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average of \$46 per month, with more than a quarter of teens spending \$50 or more [7]. Food and beverage companies are playing a prominent role in the digital marketing arena, developing interactive advertising campaigns, many of which are tailored specifically for adolescents and youth. The major brands—including Coca-Cola, McDonald's, Burger King, and KFC—are employing a panoply of digital marketing practices across a variety of platforms—social networks, videogames, mobile services, online videos, instant-messaging, and even virtual worlds [8].

In its 2005 report, *Food Marketing to Children and Youth: Threat or Opportunity?*, the Institute of Medicine acknowledged the increasingly important role that the Internet and other new marketing practices are playing in promoting food and beverage products to children and adolescents. However the report also noted the serious lack of research on digital marketing in the peer-reviewed literature (resulting in part from the proprietary nature of the research within the marketing industry itself) [9,10]. There have been only a few studies of online food marketing practices in the years since the report was published [8,11–17]. The most recent reviews of research on children, youth, and advertising include descriptions of some Internet marketing techniques [18–20]. However, even though adolescents are at serious risk for obesity, food marketing to this age group has not received the same level of scholarly attention that has been focused on younger children [9,21]. Although a robust field has emerged to study digital media in teens' personal, social, and political lives, academic research on the role of marketing in youth digital culture remains seriously underdeveloped [22,23].

In the following pages, we will briefly explain the central role that adolescents are playing in the growth of a new "Media and Marketing Ecosystem" [24,25]. We will discuss the ways in which digital media tap into the adolescent experience, and will then identify six key features that are emblematic of the ways in which young people interact with digital media. We will show how major food and beverage companies have incorporated these features into their interactive marketing strategies, and will address several developments in the advertising industry that are influencing the future direction of interactive marketing. We will review the research framework behind the current U.S. policy and self-regulatory regimens concerning children's advertising, pointing to several recent and emerging areas of research that suggest a need to revisit how policymakers and industry leaders regard adolescents in the marketplace. Finally, we will call for research and policy initiatives to address the growing health threat facing youth.

Our analysis is based on a larger qualitative study that we conducted in 2007, as well as our ongoing examination of the interactive marketplace. The original study, along with updated analysis and documentation of contemporary interactive food marketing practices, is available online. Although the primary focus of this article is on the digital marketing strategies targeted at adolescents, the actual categories in much of the digital marketing landscape reflect an evolving

conceptualization of what is considered the youth market. Many of the current Web sites and online platforms are directed at broad demographic categories encompassing children, teens, and young adults [26,27]. We have relied on a body of industry market research focused on the 13–17 demographic group and have based our analysis on digital marketing strategies, Web sites, and interactive platforms known to target, or to be attractive to, large numbers of teens [8,12,28–30].

Tracking "Cyberteens"

Digital media resonate strongly with the fundamental developmental tasks of adolescence [31–34]. Teens are using a variety of new-media platforms—including social networks, instant messaging, interactive games, mobile phones, and virtual, three-dimensional environments—for identity development, peer relationships, learning, and civic engagement [35–43]. "Society's traditional adolescent issues—intimacy, sexuality, and identity—have all been transferred to and transformed by the electronic stage," note media scholars Kaveri Subrahmanyam and Patricia Greenfield. "Among the hallmarks of the transformation are greater teen autonomy, the decline of face-to-face communication, enhancement of peer-group relations at the possible expense of family relations, and greater teen choice" [39]. Social networking sites are particularly attuned to the adolescent experience, and since their dramatic rise in popularity, social networks have spawned a burst of academic research, much of it focused on how these platforms are accessed and used by adolescents [44–47]. As Danah Boyd observes, online networks provide a unique forum whereby youth can negotiate their social relationships, explore their own identities, and form communities. Online environments also grant young people a significant measure of freedom, allowing them to "participate in unregulated publics," and thus transcend "adult-regulated physical spaces such as homes and schools" [44].

Since the launch of the World Wide Web in the mid-1990s, the advertising industry has paid particularly close attention to this special relationship that adolescents have with the Internet. A growing number of advertising agencies, market research firms, and trend analysis companies have been monitoring how "Cyberteens" are incorporating digital media into their daily lives, and are developing marketing strategies tailored to key psychosocial needs of adolescence [5,42,48–50]. The interactive nature of digital technologies makes it possible for market research to be woven into the content of new media, offering marketers the opportunity to remain in constant contact with teens and creating a feedback system for the refinement of marketing techniques. In 2008, the Finnish company Sulake tapped into the huge international user base on its virtual world, HabboHotel, to conduct its second Global Youth Survey. The 2-month-long poll surveyed 58,486 teens in 31 countries, gleaned information and insights on media usage patterns and brand

preferences for fast food, beverages, mobile services, and other products [51,52]. Marketers are also closely monitoring how specific racial and ethnic groups use new media [53–55].

The Digital Marketing Paradigm

The advertising industry has played a particularly influential role in the growth and development of digital media content and services [56]. Advertising agencies, market research firms, and new-media companies continue to work collaboratively with major advertisers (with significant representation from food and beverage corporations) to develop technical standards for all new media delivery platforms—including mobile, online gaming, video, and social networks—that embody a common set of practices designed to ensure the efficacy of advertising [57]. These initiatives combine research from a broad range of disciplines, including semantics, artificial intelligence, auction theory, social network and behavioral analysis, data mining, and statistical modeling [58,59]. A number of these research and development efforts are focused on interactive marketing technologies designed for adolescents and youth [60].

The forms of advertising, marketing, and selling that are emerging as part of the new media depart in significant ways from the more familiar commercial advertising and promotion in television. In today's digital marketing system, advertising, editorial content, measurement, and content delivery have been intertwined [8]. Through our analysis of the major trends and practices in digital marketing, we have identified six key defining features of both the digital media environment and interactive marketing: *ubiquitous connectivity*, *personalization*, *peer-to-peer networking*, *engagement*, *immersion*, and *content creation*. We will briefly explain these features below, illustrating how each has become integral to the strategies used by food marketers to target adolescents and youth in the digital media.

Ubiquitous connectivity. Young people are growing up during a period when the digital media are rapidly approaching anytime/anyplace connectivity. Although concerns about a digital divide remain, there is growing evidence that online access is increasingly available to most adolescents, including African-American and Hispanic youth. For example, Hispanic youth are avid users, or, as the industry explains, a “significant sub-market” for mobile communications, and a recent study reported that more than 90% of African-American teens were online, spending some 26 hours a week on the Internet [61,62]. The growth of residential broadband use, the emergence of the “mobile Web” and wireless networks, and a range of services, such as instant messaging and texting, have created an “always-on” Internet experience. Marketers are designing campaigns that take advantage of young peoples' constant connectivity to technology, their multi-tasking behaviors, and the fluidity of their media experiences. This “360 strategy” is one of the core principles of contemporary youth marketing, aimed at

reaching viewers and users repeatedly wherever they are—in cyberspace, listening to music via a portable player, or watching television. Interactive marketers are not just tapping into these new patterns but are also actively cultivating and promoting them to foster ongoing relationships with brands. Teens are engaging with a growing range of advertising-supported and other commercial digital activities, from online videos to social networks to gaming. For example, instant message services are building communication “environments” around particular brands, encouraging individuals to use them as a way of defining who they are to their friends and acquaintances [8,63]. Internet-enabled cell phones are fueling the dramatic growth of new services, including mobile video and mobile social networks, many of them advertising-based. Many food, beverage, and quick-service restaurant companies in the U.S.—including Coca-Cola, Burger King, Pepsi, KFC, and McDonald's—are using various forms of mobile marketing, such as text messaging, electronic coupons, and video “mobisodes,” to promote their products. Increasingly, mobile users will be receiving targeted electronic pitches, based on their profiles and actual street locations [12,64].

Growing consolidation within the entertainment media, advertising, and technology fields further enhances the ability of companies to deploy a variety of advertising and brand promotion strategies across a wide spectrum of media properties, all of them designed to build user awareness of a particular brand or product [65].

Personalization. This generation of young people has grown used to customizing and personalizing their interactive media experiences. This can include assembling an individual play list on an MP3 player, creating a personal profile on a social networking site, or designing an avatar to represent oneself in virtual online worlds [48]. As one global market research study reported, “youth thrive on self-directed, self-programmed usage of technology and media,” actively seeking, choosing, and modifying products and services that “suit their moods and desires” [66]. Whereas earlier generations turned to conventional media to deal with their moods and explore their identities, today's teenagers have an unprecedented array of powerful new digital tools to help them with these processes [67–70]. For example, social networking platforms provide an accessible, user-friendly template for creating and expressing one's public and private persona in cyberspace [71,72]. Teenagers can use these tools on a daily or even minute-by-minute basis for constant attention to, and adjustments in, their personal images [73].

This increasing personalization of technology has also created new opportunities for digital marketers. Market research has shown that members of the so-called “My Media Generation” are more receptive to advertising that is tailored to their specific needs and inserted into these personalized media experiences [48]. Behavioral targeting—a form of database or “customer relationship” marketing (CRM)—enables companies to develop unique, long-term relationships

with individual customers. Its goal is to create personalized marketing and sales appeals based on a customer's unique preferences, behaviors, and psychological profile. Behavioral targeting has become a core strategy of contemporary youth marketing, a linchpin of many digital media campaigns—not only online, but also on cell phones, video games, and other new platforms [74,75].

Social networking sites are particularly effective for behavioral targeting. Digital marketers are closely tracking the content that young people post, their verbal and nonverbal behaviors, and even their psychological states of mind [76–78]. As its media kit for advertisers explains, “MySpace users want to share personal information—it’s a fundamental part of how they express themselves and connect with others.... The freely expressed data in a user’s profile offers marketers more authentic, powerful, and direct targeting beyond common proxy methods.” The company’s “hyper-targeting” plan offers its advertising clients a “detailed profile of each user and their friends, including age, gender, location and interests,” providing access to its large teenage user base [79]. “For advertisers, it’s the potential for a level of intimacy that they could never have dreamed of 20 years ago,” explained one MySpace executive [80].

Recent innovations in technology and software have created a sophisticated and rapidly evolving data collection apparatus, including the growing use of “personalization engines” for behavioral advertising. By compiling demographic data, purchasing history, and responses to past advertising messages, digital marketers can create and refine advertising messages tuned precisely to the psychographic and behavioral patterns of the individual. Advertising executives for some of the largest food and beverage companies frequently speak of the importance of such behavioral targeting to their efforts [81]. For example, the My Coke Rewards program encourages consumers to use special personal identification number (PIN) codes from Coke products to go online and access a Web site where they can earn a variety of rewards, such as downloadable ring tones, sports, and entertainment. According to Coca-Cola’s technological partner company, Fair Isaac, this “next-generation” promotion is “the most sophisticated example of how brands can utilize code promotions to capture behavioral and psychographic information about consumers” [82].

Peer-to-peer networking. In place of the top-down, one-to-many relationship that characterizes the traditional media, the Internet provides a more democratic and participatory forum for peer-to-peer communication. For years, companies have purposefully sought out the most influential young “connectors” within their social groups and encouraged them to promote brands among their friends [5]. With the growth of digital media, peer-to-peer marketing (sometimes called “buzz,” “word-of-mouth,” or “viral” marketing) has become a staple among youth advertisers [83–86]. Today’s market researchers continue to refine their ability to identify and cultivate “influencers.” For example,

a 2006 ethnographic market research study of 10,000 young people found that between 15% and 20% of respondents fell into the category of “Brand Sirens,” described as “super-influential” individuals who can “have a profound network effect on marketing through their ability to influence friends and family via word-of-mouth, viral video and applications such as instant messaging and blogs” [87].

Participatory Web 2.0 platforms are further enhancing marketers’ ability to know the nature and extent of an individual’s social relationships and to exploit them to encourage brand promotion. Online monitoring can identify the most influential person in a social network—sometimes called the “Alpha” user—and then enlist that individual to help transmit the brand message [88]. An entire infrastructure has emerged—from specialty advertising agencies to tracking and measurement services to “third-party developers”—to facilitate what is now called “social media marketing.” Food and beverage companies such as Coca-Cola, Kraft, Pepsi, and Taco Bell are among the pioneers of this new marketing strategy, which is designed to take advantage of the network of relationships and connections individuals have with each other on Facebook, MySpace and other social networking sites [77,89,90].

Digital marketers have developed a variety of techniques to encourage young users to communicate with their friends about a brand or a service, creating subtle forms of product endorsement that are spread (like a digital-age chain letter) to a vast population of recipients [91]. For example, Facebook’s “social ad” system, launched in November 2007, relies heavily on penetrating what is called the “social graph,” the complex web of relationships among individuals facilitated and tracked online [92]. Among the 12 major advertisers that signed up for the initial Facebook “social ads” launch was Coca-Cola, creating a Facebook page that invited users to add an application to their account called “Sprite Sips,” which enabled them to “create, configure and interact with an animated Sprite Sips character” [93–95].

These “widgets”—small, downloadable applications that allow users to customize their personal pages while also serving as a means of delivering advertising and tracking user responses to those ads—are expressly designed and promoted as viral devices, what one company calls “Snag-gable Ads” that can be shared across social networks, start pages, and blogs [96–98]. From games, such as Scrabulous (based on Scrabble), to entertainment, such as iLike (which lists your favorite music), to Google’s “gadget” utility, widgets are becoming omnipresent devices in the world of social networks. Food and beverage marketers have embraced widget advertising, with Pizza Hut, Papa John’s, Coca-Cola, Pepsi, and 7-11’s Slurpees all recently promoting their products via widgets [99,100].

Peer-to-peer marketing has moved onto a number of digital platforms popular with teens. Google’s YouTube, for example, introduced its new “buzz targeting” product, based on an algorithm that monitors viewing trends and predicts which videos are about to “go viral.” By examining

several factors, including the acceleration of views, designation of favorites, and recent ratings activity, the system invites advertisers to target their ads specifically to those videos poised to become popular items on YouTube [101].

The growth of peer-to-peer social networking platforms is creating what some scholars consider a powerful new form of “mass interpersonal persuasion” (MIP). By structuring and transmitting a “persuasive experience” at great speed to many users—all of whom can be tracked and measured—attitudes and behaviors can be changed on a mass scale [102].

Engagement. In contrast to the passive experience of watching television, the increasingly participatory environment of interactive media facilitates active engagement. This is particularly the case for adolescents and youth, whose enthusiastic involvement with social networks, blogs, text messaging, and online video makes them the most engaged of demographic groups [66]. In the world of digital marketing, “engagement” also refers to “the ability of the brand to interact with the consumer, to pull the consumer in, to become part of one’s life” [103,104]. The Advertising Research Foundation (ARF) and others have been working with experts in the field of neuroscience to develop an “engagement measurement model” for identifying and testing “quantitative measures of behavior and emotion feelings” [105,106].

As one leading online marketing executive explained it, engagement is the “subtle, subconscious process in which consumers begin to combine the ad’s messages with their own associations, symbols and metaphors to make the brand more personally relevant.” [107] Using this approach, advertisements are not designed to articulate the compelling, factual features and benefits of products, but rather to “seduce the consumer into beginning that subconscious processing of the brand” [107]. In some ways, it is an extension of earlier advertising strategies, including the notion of “brand loyalty,” which for years has been considered a core element in “cradle-to-grave marketing” [108–112]. However, technological advances have enabled the advertising industry to further refine both the concept of engagement and the mechanisms for measuring it [113,114].

Food and beverage brands, and their advertising agencies, are among the leading companies collaborating on ARF’s engagement initiative [115,116]. Increasingly, marketers are using such techniques as functional magnetic resonance imaging (fMRI), eye-tracking studies, galvanic skin response, and electroencephalography (EEG) to finely hone their engagement strategies for digital marketing. A recent study noted there were 90 private neuromarketing research firms in the U.S [117]. Neuroscience is being used to develop new marketing approaches designed to increase “mind-share” for products, such as fostering “brand-related memories” that influence consumer behavior [118]. Marketers are particularly interested in research that addresses how “specific patterns of brain activation predict purchasing,” the potential “shopping centers in the brain,” and the

neurological basis of purchasing [119–121]. Coca-Cola, McDonald’s, and Yum Brands (Kentucky Fried Chicken [KFC] and Pizza Hut), have already used some form of neuromarketing research in an effort to understand the brain’s role in triggering emotions, thoughts, and actions [122,123].

Immersion. State-of-the-art animation, high-definition video, and other multi-media applications are spawning a new generation of immersive environments, such as interactive games and three-dimensional virtual worlds, many of which are attracting an increasing number of teens. Interactive games are the fastest-growing form of entertainment, a \$9.4 billion business that surpasses even the movie box office in earnings. Of the more than 25 million 12–17-year-olds in the U.S., 20 million are gamers, according to industry research [124]. As research from the Interactive Advertising Bureau notes, teens are tied for the most time spent playing online per week (13 hours) [125]. In-game advertising has become a highly sophisticated, finely tuned strategy that combines product placement, data collection, and viral marketing to foster deep, ongoing relationships between brands and individual gamers. Through “dynamic product placement,” ads can be incorporated into the game’s storyline, and programmed to respond to a player’s actions in real time, changing, adding, or updating messages to tailor their appeal to that particular individual [126,127]. In-game advertising can also be used to encourage online impulse purchases. For example, Sony partnered with Pizza Hut to build into its “Everquest II” videogame the ability to order pizza. When players type a command for “pizza,” Pizza Hut’s online order page appears [128].

Three-dimensional virtual worlds are extensions of online “multiplayer” games, where hundreds of players can interact in real time on the Internet. However the newer virtual worlds are also complex, multi-layered enterprises that combine many of the most popular online activities—such as instant messaging, interactive gaming, and social networking—into elaborate three-dimensional settings designed to engage users for long periods of time. One of their most powerful appeals is the ability for individuals to create their own online identities through avatars, which can then form relationships with other avatars in the virtual spaces. For example, Virtual Laguna Beach is an online extension of the popular television series. Through their own personal avatars, teens can “immerse themselves” in “virtual versions of the show’s familiar seaside hangouts” [129,130].

Advertising itself is becoming increasingly immersive. Interactive, “rich-media” ads are now a growing part of the adolescent online journey—from social networks and virtual worlds to online videos, games, and emerging mobile services. Immersive advertising can also incorporate sophisticated measurement and tracking tools to create a more personalized experience [131–133]. For example, *MyCoke.com* is a virtual, immersive environment where “teens hang out as their alter-identities, or ‘v-egos,’” and are “encouraged to associate personal identity with brand identity” [134–136].

Coca-Cola has also established a presence in Second Life, where Coke vending machines can be seen dotting the landscape of the highly popular three-dimensional virtual world [137–140].

Content creation. User-generated content (UGC)—which can include any material (e.g., comment, blog, social network profile, or video) created and uploaded by non-media professionals—is considered one of the fastest growing forms of content on the Internet [141]. For adolescents, these new tools offer particularly compelling opportunities for “self-reflection, catharsis, and self-documentation” [72]. Well over half of all online teens are creating content for the Web [142]. This extraordinary level of participation has caught the attention of marketers, who readily encourage young people to produce and promote commercials for their favorite brands. The strategy is designed to foster powerful emotional connections between consumers and products, to tap into a stable of young creative talent willing to offer their services for free, and to produce a new generation of “brand advocates.” For the Super Bowl, Pepsi’s Frito-Lay division urged consumers to produce their own commercial spots for Doritos tortilla chips and submit them online in the “Doritos Smash the Super Bowl Contest” [143–147]. Pizza Hut launched a contest inviting pizza enthusiasts to create a short video “demonstrating their devotion to Pizza Hut Pizza” and showing why they should earn the title of “Honorary Vice President of Pizza.” Contestants were encouraged to engage in a variety of creative acts to show their loyalty to the brand, such as “decorating their room with Pizza Hut memorabilia.” Entrants submitted their videos on YouTube, ensuring that they would be seen by thousands of viewers, whether or not they won [148,149].

By encouraging consumers to create and distribute personalized advertising for their brands, marketers can also enhance their data collection and behavioral tracking abilities. “CGM [consumer-generated media],” one marketer explained, “is both timely and revealing of consumer attitudes and habits: it is available continuously in real-time, and this spontaneous voice of the consumer provides insight into consumer feelings” [150]. Marketers routinely work with tracking firms that constantly monitor user-generated content [151]. Videos produced and distributed online can be analyzed using “a variety of engagement metrics” that enable marketers to “measure a consumer’s interaction with the ad” [152].

The strategies described above are being used not only by the food and beverage industry but also by many other brands seeking to reach young people through digital media. Some of these practices are extensions of longstanding strategies and techniques in the advertising industry; others are unique to the interactive environment. Taken together—and viewed against the backdrop of the major changes taking place in the worlds of media, advertising, and market research—they reveal the contours of a new digital marketing paradigm that is transforming how companies engage with young people.

Major food and beverage marketers have been increasing their budgets for online marketing, although it is still a relatively modest percentage of their overall U.S. advertising expenditures. The FTC report on 2006 food and beverage expenditures found that “New media—the Internet, digital (such as email and text messaging), and word-of-mouth/viral marketing—have become an important component of promotional activities intended to reach children and adolescents” [153]. In 2007, Coca-Cola spent \$30 million for online display advertising (compared to an overall advertising budget of \$777 million). ConAgra, Mars, Pepsi, Burger King and Yum Brands all increased their Internet display spending in 2007 from the previous year. However, because of the nature of Internet marketing, actual expenditures do not necessarily reflect the impact of an advertisement or a campaign, especially when it involves social media marketing, user-generated ads, and other forms of peer-to-peer creation and transmission, which are very inexpensive to implement. Online marketing will, however, grow as a larger part of advertising budgets [154]. Unlike a more traditional advertising buy on television, a relatively modest amount of money can buy millions of online advertising “impressions.” For example, Nielsen reported that just for the period of March 2 to March 8, 2009, Kraft Foods, General Mills, and Unilever delivered 77 million, 62 million, and 54 million online advertising impressions, respectively [155].

A New Research and Policy Agenda for the Digital Age

The digital media system is dismantling the already weakened barriers that have traditionally separated content and marketing [156]. By seamlessly weaving together content, advertising, marketing, and direct transactions, online media can provide unprecedented access to individual consumer data along with a variety of direct-response and brand-marketing opportunities. Commercial messages no longer interrupt programming; rather, marketing strategies are routinely woven into the very fabric of digital communications and everyday social relationships, and are often purposefully disguised [157]. In the Internet era, children and teens are not passive viewers; they are active participants and content creators in an interactive digital environment that pervades their personal and social lives.

The current framework for U.S. children’s advertising regulation is based primarily on a body of research on television advertising, much of it conducted in the 1970s, during a period of highly contentious public debate [158]. Drawing on developmental theories of Piaget, a substantial number of studies established that children younger than 7 or 8 years lack the cognitive ability to recognize the persuasive intent of advertising messages [158–163]. More recent studies have further refined our understanding of how and when individuals develop “persuasion-coping” skills [164]. This research contributed to the development of a body of regulatory and self-regulatory policies aimed at protecting only young children (under 13 years of age) from unfair and deceptive

television advertising. Some of these rules have been extended to digital TV and the Internet [5,165,166]. The advertising industry's self-regulatory guidelines are also narrowly focused on children under the age of 12 years, as are the recent marketing guidelines developed by food and beverage companies [8,167,168]. Although this model may have been appropriate when television was the primary advertising medium, it has limited utility for addressing the changing media and marketing landscape. Nor does it provide guidance for understanding the role of adolescents in the digital marketplace.

Some scholars in the U.S. and Europe have begun to challenge the cognitive framework that underlies much of traditional children's advertising regulation, and to call for a broader, more interdisciplinary approach that addresses both adolescents and contemporary marketing strategies [169–172]. Constance Pechmann et al reviewed research within the fields of neuroscience, psychology, and marketing and identified several biological and psychosocial attributes of the adolescent experience that may make members of this age group more susceptible to certain kinds of marketing [169]. For example, scientists studying the development of the adolescent brain have found that the prefrontal cortex, which controls inhibitions, does not fully mature until late adolescence or early adulthood [173–176]. As children reach puberty, their bodies also undergo hormonal changes that make them more receptive to stressful environmental stimuli. As a consequence, during the same period of their lives when they experience particularly intense urges, adolescents have not yet acquired the ability to control these urges. Teens are particularly inclined to act impulsively when they are experiencing negative mood states, which they do much more often and frequently with greater intensity than either adults or children. This impulsivity may lead them to use risky, addictive products such as alcohol and tobacco, or to engage in dangerous, thrill-seeking activities [177,178]. Adolescents may be more susceptible to advertising when they are distracted or in a state of high arousal. Teens are also vulnerable to peer pressure, including anti-social influences from friends and acquaintances [169]. Agnes Nairn and Cordelia Fine cite recent research challenging the notion that cognitive defenses enable adolescents to resist advertising more effectively than younger children [179]. They draw particular attention to a host of new marketing strategies (which include viral marketing, brand engagement, advergames, etc.) to which adolescents are increasingly subjected. Rather than communicating rational or factual appeals, these researchers argue, these techniques are forms of "implicit persuasion," which promotes "subtle affective associations," often circumventing a consumer's explicit persuasion knowledge [170].

These findings have important implications for understanding the ways in which adolescents respond to interactive food marketing. For example, in-game food advertisers can now direct personalized advertising messages at the most intense points in the games—when users are in high states of arousal—offering immediate gratification through online

purchases and triggering mood-enhanced impulsive behaviors. By using a growing array of sophisticated behavioral tracking tools, companies can forge intimate, ongoing relationships with individual teens. The growing use of neuroscience by marketers suggests that digital advertising is increasingly designed to foster emotional and unconscious choices, rather than reasoned, thoughtful decision making. Campaigns that purposely tap into one's innermost needs, anxieties, fears, and sense of identity may have particularly powerful effects, especially when combined with shifts in mood, peer influence, and negative self-concepts. In addition, through social media marketing, brands can insert themselves strategically into the complex web of adolescent social relationships, leveraging the power of peer pressure to promote their soft drinks, candies, and snack foods.

As the media marketplace continues its rapid transformation, becoming a ubiquitous presence in young people's lives, further academic research is needed to understand fully the nature, scope, and extent of interactive advertising's impact on youth. However, long-range, in-depth, and longitudinal research projects are not sufficient in themselves. The childhood obesity epidemic is a serious problem that requires more immediate action. The Institute of Medicine called for a number of research and policy interventions, including government funding for research and designation of a federal agency to monitor progress on the issue [9]. In March 2009, Congress passed a federal appropriations bill that establishes an Interagency Working Group on Food Marketed to Children. With representatives from several federal agencies, the group is charged with studying and developing recommendations for standards for food marketing directed to youth under the age of 17 years. This development reflects a growing concern among policy makers that adolescents need to be included in the regulatory and self-regulatory framework [180].

There is a clear need to ensure more responsible marketing practices and to increase transparency in industry research concerning behavioral targeting in general and marketing to youth in particular. Interactive marketing's ability to reach and influence consumers will continue to grow, as it further incorporates knowledge from semantics, artificial intelligence, neuroscience, and many other scholarly fields. In the face of these changes, sound public policy is all the more urgent now to protect youth from increasingly invasive and manipulative marketing techniques. Finally, given the increasing interest in addressing the role food marketing plays in the global youth obesity crisis, there is a need for a coordinated international research and policy effort.

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