Online Dating: A Critical Analysis From the Perspective of Psychological Science

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Summary

Online dating sites frequently claim that they have fundamentally altered the dating landscape for the better. This article employs psychological science to examine (a) whether online dating is fundamentally different from conventional offline dating and (b) whether online dating promotes better romantic outcomes than conventional offline dating. The answer to the first question (uniqueness) is yes, and the answer to the second question (superiority) is yes and no.

To understand how online dating fundamentally differs from conventional offline dating and the circumstances under which online dating promotes better romantic outcomes than conventional offline dating, we consider the three major services online dating sites offer: access, communication, and matching. Access refers to users' exposure to and opportunity to evaluate potential romantic partners they are otherwise unlikely to encounter. Communication *refers to users' opportunity to use various forms of computer-mediated communication (CMC) to interact with specific potential partners through the dating site before meeting face-to-face.* Matching *refers to a site's use of a mathematical algorithm to select potential partners for users.*

Regarding the uniqueness question, the ways in which online dating sites implement these three services have indeed fundamentally altered the dating landscape. In particular, online dating, which has rapidly become a pervasive means of seeking potential partners, has altered both the romantic acquaintance process and the compatibility matching process. For example, rather than meeting potential partners, getting a snapshot impression of how well one interacts with them, and then slowly learning various facts about them, online dating typically involves learning a broad range of facts about potential partners before deciding whether one wants to meet them in person. Rather than relying on the intuition of village elders, family members, or friends or to select which pairs of unacquainted singles will be especially compatible, certain forms of online dating involve placing one's romantic fate in the hands of a mathematical matching algorithm.

Turning to the superiority question, online dating has important advantages over conventional offline dating. For example, it offers unprecedented (and remarkably convenient) levels of access to potential partners, which is especially helpful for singles who might otherwise lack such access. It also allows online daters to use CMC to garner an initial sense of their compatibility with potential partners before deciding whether to meet them face-to-face. In addition, certain dating sites may be able to collect data that allow them to banish from the dating pool people who are likely to be poor relationship partners in general.

On the other hand, the ways online dating sites typically implement the services of access, communication, and matching do not always improve romantic outcomes; indeed, they sometimes undermine such outcomes. Regarding access, encountering potential partners via online dating profiles reduces three-dimensional people to two-dimensional displays of information, and these displays fail to capture those experiential aspects of social interaction that are essential to evaluating one's compatibility with potential partners. In addition, the ready access to a large pool of potential partners can elicit an evaluative, assessment-oriented mindset that leads online daters to objectify potential partners and might even undermine their willingness to commit to one of them. It can also cause people to make lazy, ill-advised decisions when selecting among the large array of potential partners.

Regarding communication, although online daters can benefit from having short-term CMC with potential partners before meeting them face-to-face, longer periods of CMC prior to a face-to-face meeting may actually hurt people's romantic prospects. In particular, people tend to overinterpret the social cues available in CMC, and if CMC proceeds unabated without a face-to-face reality check, subsequent face-to-face meetings can produce unpleasant expectancy violations. As CMC lacks the experiential richness of a face-to-face encounter, some important information about potential partners is impossible to glean from CMC alone; most users will want to meet a potential partner in person to integrate their CMC and face-to-face impressions into a coherent whole before pursuing a romantic relationship.

Regarding matching, no compelling evidence supports matching sites' claims that mathematical algorithms work— that they foster romantic outcomes that are superior to those fostered by other means of pairing partners. Part of

the problem is that matching sites build their mathematical algorithms around principles—typically similarity but also complementarity—that are much less important to relationship well-being than has long been assumed. In addition, these sites are in a poor position to know how the two partners will grow and mature over time, what life circumstances they will confront and coping responses they will exhibit in the future, and how the dynamics of their interaction will ultimately promote or undermine romantic attraction and long-term relationship well-being. As such, it is unlikely that any matching algorithm that seeks to match two people based on information available before they are aware of each other can account for more than a very small proportion of the variance in long-term romantic outcomes, such as relationship satisfaction and stability.

In short, online dating has radically altered the dating landscape since its inception 15 to 20 years ago. Some of the changes have improved romantic outcomes, but many have not. We conclude by (a) discussing the implications of online dating for how people think about romantic relationships and for homogamy (similarity of partners) in marriage and (b) offering recommendations for policymakers and for singles seeking to make the most out of their online dating endeavors.

Introduction

For as long as humans have recognized the urge to form romantic relationships, they have also recognized that finding an appropriate partner can be challenging, and that sometimes it is useful to get some help. From the Jewish *shadchan* immortalized in the musical *Fiddler on the Roof*, to the *khastegari* customs of Iran, to the arranged marriages still prevalent in parts of Southeast Asia, there is a tradition—millennia old—of romantic relationships arising not only from chance encounters between two individuals but also from the deliberate intervention of third parties (Coontz, 2005). For most of those millennia, the resources available to these third parties remained the same: a broad social network, strong opinions about the sorts of people who belong together, and the willingness to apply those judgments to the formation of actual couples (Ahuvia & Adelman, 1992).

In the modern age, the desire to find a romantic partner endures, as does the sense that doing so can be challenging. But the resources available for meeting these challenges have changed, and many of these changes can be traced to the invention, spread, and now ubiquity of the Internet. According to recent data, some 30% of the 7 billion people on our planet now have access to the Internet (InternetWorldStats.com, 2011). In North America, where Internet usage is highest, that figure reaches 78%. Every domain of contemporary life, from commerce and politics to culture, is now touched by the Internet in some way.

With respect to forming romantic relationships, the potential to reach out to nearly 2 billion other people offers several opportunities to the relationship-seeker that are unprecedented

in human history. First, whereas the "field of eligibles" (Kerckhoff, 1964) for an individual was once limited primarily to members of that individual's social network, the Internet now affords access to a vastly wider network of potential partners who would have been unknown or inaccessible in former eras. Second, whereas interaction between potential partners once depended on their proximity to each other, the Internet now facilitates nearly instantaneous communication via multiple channels (i.e., text, voice, image, and video) without partners having to be in the same location and even without partners' conscious awareness (e.g., by allowing others to view one's information online). Third, whereas the choice of a mate once relied largely upon the individual's intuitions and personal opinions, the Internet promises to create matches between suitable partners using new tools that draw upon data provided by thousands, or millions, of users.

Recognizing the unique possibilities afforded by the Internet, numerous commercial Web sites have arisen to provide these services to users seeking romantic relationships. Specifically, the past 15 to 20 years have witnessed the development of Web-based companies that specialize in providing some combination of:

a. *access* to potential romantic partners
b. *communication* with potential romantic partners
c. *matching* with compatible romantic partners.

Each year, millions of hopeful relationship seekers use these sites, often paying substantial fees for the privilege.

To attract customers, online dating sites typically emphasize two aspects of the services they offer. First, they emphasize that their services are *unique* to dating through the Internet; that is, the sites are offering a service that cannot be duplicated in any other way. The homepage of PlentyOfFish, for example, claims that membership on the site gets you access to "145 million monthly visitors" and that "you are not going to find any other site that has more singles looking to meet new people" (PlentyOfFish.com, 2011). Presumably that claim refers not only to other Web sites but also to other venues where single people gather to meet, such as bars, parties, churches, or libraries. Second, online dating sites emphasize that forming relationships using their services is *superior* to dating offline. The Web site for eHarmony, for example, asserts that the services the site offers "deliver more than just dates"; instead, it promises connections to "singles who have been prescreened on . . . scientific predictors of relationship success" (eHarmony.com, 2011b, para. 1). The implication is that eHarmony possesses knowledge about relationships that most people lack and that applying this knowledge will lead to more favorable relationships than subscribers would experience without this knowledge. The OkCupid Website also implies access to knowledge unavailable to the layperson with

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the straightforward claim, "We use math to get you dates" (OkCupid.com, 2011). By referring to millions of users, science, and math, online dating sites suggest that meeting romantic partners online is not only different from, but also better than, searching for partners in conventional ways.

Each of these claims raises questions that can be answered empirically. For example, with respect to uniqueness, does the rise of online dating represent a fundamental change in the process of forming and maintaining romantic relationships? With respect to superiority, are the users of online dating sites in fact improving their chances of experiencing positive romantic outcomes compared to individuals who rely entirely on more conventional methods of meeting partners?

Addressing such questions is of great public importance for several reasons. First, romantic relationships—their presence, as well as success or failure—play a central role in individuals' physical and emotional well-being. The need to connect deeply with others has been described as a "fundamental human motivation" (Baumeister & Leary, 1995). When that need is fulfilled by a satisfying intimate relationship, couples experience better health (Cohen et al., 1998), recover from illnesses more quickly (Kiecolt-Glaser et al., 2005), and live longer (Gallo, Troxel, Matthews, & Kuller, 2003; Holt-Lunstad, Smith, & Layton, 2010). Indeed, the presence of a satisfying intimate relationship is one of the strongest predictors of happiness and emotional well-being that has been measured (Diener & Seligman, 2002). Loneliness and distressed relationships, in contrast, predict increased risks of depression and illness (Cacioppo et al., 2002) and incur enormous national costs in terms of lost productivity (Forthofer, Markman, Cox, Stanley, & Kessler, 1996), and they are the leading reasons why people seek therapy or help from lay counselors in the United States (Veroff, Kulka, & Douvan, 1981). Thus, online dating sites are treading in deep waters, and whatever the implications of these sites, those implications are likely to have strong ripple effects.

Second, as commercial dating sites become increasingly accepted as a means of forming romantic relationships, more and more couples are meeting online (Rosenfeld, 2010). One industry trade report estimated that almost 25 million unique users around the world accessed an online dating site in April, 2011 alone (Subscription Site Insider, 2011). If some of the individuals who form relationships online would not otherwise have found partners, then the availability of the unique services that the Internet provides may be a boon to relationship seekers. Moreover, if relationships formed through the Internet are in fact superior to those formed via more conventional means, then the increasing popularity of online dating sites has the potential to boost happiness and to reduce the great suffering and costs associated with relationship distress and dissolution (e.g., Amato & DeBoer, 2001; Forthofer et al., 1996; Kiecolt-Glaser et al., 2005; Sbarra, Law, & Portley, 2011). If the claims of online dating sites are unfounded, however, then increasing numbers of people are pursuing relationships that are actually no better than matches formed offline and that may even be worse.

A third reason to evaluate the claims of online dating sites is that online dating now consumes vast resources in the United States and around the world. Online dating has grown into a billion-dollar industry, and it is one of the few growth industries during a period of worldwide recession (Visualeconomics.com, 2011). In pursuit of these revenues, online dating sites spend hundreds of millions of dollars annually to promote the value of the services they provide (Nielsenwire.com, 2009). Believing these messages, millions of users are not only spending their money on memberships and subscriptions, but they are also investing considerable time. One estimate suggests that users spend an average of 22 minutes each time they visit an online dating site (Mitchell, 2009), and another suggests that they spend 12 hours per week engaged in computer-based online dating activity (Frost, Chance, Norton, & Ariely, 2008). Across millions of users, this represents an enormous allocation of time that might otherwise be spent on other activities, including engaging in social interactions offline. These costs in time and money are warranted if online dating actually provides improved, cost-effective access to successful romantic relationships. If such evidence is lacking, however, then people seeking romantic partners may be wasting significant time and money that they could direct toward more productive activities.

There is now a strong foundation of scientific research from which to evaluate the implications of online dating for the initiation and development of romantic relationships. This research spans multiple domains, many of which directly investigate personal relationships. Although the scholarly literature on personal relationships is relatively young (for an historical analysis, see Reis, 2012), it already spans the disciplines of clinical, developmental, and social-personality psychology; sociology; communication; and family studies; and reaches into various other disciplines as well. In addition to research that directly addresses relationships, decades of research on topics such as decision making, interpersonal communication, and motivated cognition also provide relevant findings. Extrapolating from these literatures, and drawing upon the nascent literature on online dating specifically, we can now examine how the advent of the Internet is affecting processes and outcomes relevant to romantic relationships. Moreover, we can compare the results of this body of research to the specific claims of online dating sites, critically evaluating the degree to which these claims are supported by scientific evidence.

The overarching goal of this article is to draw upon the accumulated scientific literature on romantic relationships and other psychological phenomena to evaluate (a) whether online dating represents a fundamental rather than an incremental shift in the process of relationship initiation (the uniqueness question) and (b) whether online dating yields better romantic outcomes than does conventional offline dating (the superiority question). In pursuit of this broad goal, we begin by providing an overview of the present analysis, elaborating upon the three key services of online dating (access, communication,

and matching), addressing issues of scope, and defining key terms. Next, we address the two major questions we seek to answer. Part I compares and contrasts online dating with conventional offline dating in terms of pervasiveness, the acquaintance process, and compatibility matching, concluding that online dating is fundamentally different from conventional offline dating on all three of these fronts. Part II examines whether online dating yields romantic outcomes that are superior to those emerging from conventional offline dating. This section demonstrates that the claims of superiority made by online dating sites lack scientific validity, and it scours diverse scientific literatures to discern the ways in which the access, communication, and matching offered by online dating sites improve versus undermine romantic outcomes. After addressing these two major questions, we discuss implications of online dating for how people think about and approach romantic relationships, for homogamy (similarity of partners) in marriage, and for public policy. Finally, we offer recommendations for relationship seekers.

Overview
Online dating's three key services

As discussed previously, dating sites provide some combination of three broad classes of services: access, communication, and matching (for a similar tripartite typology, see Ahuvia & Adelman, 1992). *Access* refers to users' exposure to and opportunity to evaluate potential romantic partners whom they are otherwise unlikely to encounter. Specifically, dating sites typically accumulate *profiles*—Web pages that provide information about potential partners—that users can browse. Because many sites have thousands, sometimes millions, of users, online dating offers access to a larger number of potential partners than anybody could have access to in the offline world. In principle, users can contact any of these new potential partners through the dating site, although, in practice, many of the potential partners to whom users are given access might not reply. As such, the access that users acquire through dating sites does not necessarily yield access to a relationship partner; rather, it simply alerts users to the existence of available partners.

Communication refers to users' opportunity to use various forms of computer-mediated communication (CMC) to interact with specific potential partners on the dating site before meeting face-to-face. The mechanisms of communication vary considerably across the online dating landscape. Asynchronous forms of communication, including messaging systems that approximate e-mail and simpler, less personalized forms of communication (e.g., virtual "winks") that quickly and concisely convey some measure of interest, are commonplace. Alternatively, users may also choose real-time, synchronous forms of communication, such as live instant-message (text-based) chat and live interaction via webcams that allows users to see and hear each other.

Matching refers to a site's use of a mathematical algorithm to identify potential partners, called "matches," for their users. These matches are presented to the user not as a random selection of potential partners in the local area but rather as potential partners with whom the user will be especially likely to experience positive romantic outcomes. A key assumption underlying matching algorithms is that some pairs of potential partners will ultimately experience better romantic outcomes, in the short term or the long term (or both), than other pairs of potential partners because the individuals are more romantically compatible from the start. Another assumption is that the seeds of this compatibility can be assessed using self-reports or other types of individual-difference measures before two people even become aware of each other's existence. If these assumptions are valid, then an algorithm directing users' attention to the smaller pool of potential partners with whom they are especially compatible would be useful, increasing the likelihood of, efficiency with which, or degree to which users achieve relationship success. Although all sites offer some degree of access and communication, many sites do not offer matching.

In this article, we draw upon research in psychology and related disciplines to answer the uniqueness and superiority questions. This task would be straightforward if scholars had conducted controlled experiments investigating how the presence or implementation of access, communication, or matching services offered at dating sites alters the dating process or yields superior romantic outcomes compared to conventional offline dating. Consider, for example, a hypothetical online dating "clinical trial." Researchers might randomly assign single participants to pursue romantic partners by either (a) using a matching service, perhaps one already in use at a particular dating site or one created by the research team; or (b) exploring their romantic options using whatever offline options they choose—akin to a wait-list control. Unfortunately, to our knowledge, no such study exists.

Nevertheless, even without controlled experimental studies that compare online with offline dating, a vast scientific literature can address the degree to which the two dating contexts differ and whether those differences are likely to alter romantic outcomes. To extend the clinical-trial metaphor, scholars have amassed considerable knowledge about the many "active ingredients" of each specific implementation of access, communication, and matching, even in the absence of clinical trials of specific forms of online dating per se. Although it would be best to have scientific studies of both (a) the functioning of the whole product in an experimental setting (as is typically the case with pharmaceuticals, for example) and (b) the underlying active ingredients, this article by necessity focuses only on the workings of the online dating active ingredients—specific implementations of access, communication, and matching. Many of the workings of online dating sites are shrouded in proprietary mystery, but reviewing the extant scientific literature to investigate the active ingredients can yield important insights.

Scope

Our task was not to provide a comprehensive topography of the online dating landscape. This landscape is constantly changing—new sites are created and old sites go out of business, change forms and names, and have facelifts—so any attempt to be comprehensive would achieve immediate obsolescence.[1] By focusing broadly on the ways dating sites implement the services of access, communication, and matching, we were able to examine the psychological essence of online dating without becoming preoccupied with any particular claim of any particular site (although we did not shy away from examining particular claims where doing so was instructive). Many online dating sites offer services beyond access, communication, and matching, including dating advice, personality assessment, and, on occasion, summaries of scientific studies of romantic relationships. Although these features could have important benefits, we excluded them from this analysis both because they are readily accessible outside of online dating sites (e.g., through self-help books) and because their influence involves individual daters obtaining new knowledge rather than processes occurring between two potential daters.

In addition, our goal was not to review all Internet sites through which people could conceivably meet someone online for a romantic relationship. As presented in Table 1, there is a huge variety of Internet sites that individuals could use to meet potential romantic partners. We focused on those sites with the explicit and primary goal of introducing singles to potential romantic partners who are hoping to form dating and perhaps marital relationships. They included self-selection sites in which people browse profiles of potential partners, either from the general population of possible online daters (Row 1 in Table 1) or from a particular subpopulation (Row 2); sites that allow users' family members or friends to play matchmaker for them (Row 3); sites that allow for live interaction, either through webcam-based video dating (Row 4) or avatar-based virtual dating (Row 5); matching sites based primarily either on users' self-report data (Row 6) or on non-self-report data, such as genetic data (Row 7); and global-positioning-system-based smartphone apps (Row 8). We did not examine general personal advertising sites where the formation of romantic relationships is a by-product of the site's main function (Row 9), sex or hookup sites (Row 10), infidelity sites (Row 11), sites for arranging group dates (Row 12), general social networking sites (Row 13), or massively multiplayer online games (Row 14). In addition, our primary emphasis was on online dating as it is practiced in the United States and other Western countries, which means certain types of online dating sites that are prevalent elsewhere (e.g., matrimonial sites in India) were beyond the scope of this article. Finally, also beyond our scope was speed-dating, a dating approach developed in the 1990s in which singles attend an event where they engage in a series of brief face-to-face interactions with a series of potential romantic partners and decide whether they would ("yes") or would not ("no") be willing to get together with each of them in the future (Eastwick & Finkel, 2008b; Finkel, Eastwick, & Matthews, 2007).

Furthermore, we did not seek to provide an exhaustive review of all studies that have been conducted on the topic of online dating. This article is less a review of the online dating literature than an empirically based analysis of whether online dating represents a fundamental change in the process of romantic relationship initiation and whether the forms of access, communication, and matching offered by online dating are likely to improve romantic outcomes. In cases where scholars have not conducted the optimal empirical investigations in the romantic domain in general or in the online dating domain in particular, we extrapolated from related scholarly literatures to address our major questions of uniqueness and superiority.

Definitions

Before addressing these two questions, we define several important terms beyond those we have already defined (access, communication, matching, and profiles). We use the term *dating sites* to refer to those Web sites that primarily focus on offering the user opportunities to form a new romantic relationship that has the potential to become a dating and perhaps a long-term committed relationship, such as marriage (i.e., the top half of Table 1). We use the term *online dating*, sometimes called Internet dating, to refer to the practice of using dating sites to find a romantic partner.[2] Throughout the manuscript, we frequently compare online dating with *conventional offline dating*. This term encompasses the myriad ways that people meet potential romantic partners in their everyday lives through non-Internet activities—through their social network (e.g., a mutual friend introducing two single people to each other), a chance face-to-face encounter (e.g., approaching a new coworker or a stranger at a coffee shop), or some combination of the two (e.g., chatting with a friend-of-a-friend at a party).[3] Although conventional offline dating is a heterogeneous category that comprises many contexts for meeting potential partners (e.g., meeting at a bar vs. in church), these contexts collectively differ from online dating in that they do not offer the same forms and degree of access, communication, and matching. To the extent that some precursors of dating sites share these features (e.g., video-dating, newspaper personal ads), they are excluded from the term conventional offline dating.

A crucial term when evaluating whether online dating yields superior outcomes to conventional offline dating is *positive romantic outcomes*, which refers to the extent to which someone positively evaluates, and/or intends to persist in pursuing, a specific (potential or current) romantic partner and/or a specific (hypothetical or actual) relationship. This definition is deliberately broad, as the term applies to the level of attraction someone might experience when browsing a profile to the level of love someone feels toward

Table 1. Types of U.S. Online Dating Sites and Their Distinctive Features

Row	Type of site	Distinctive feature	Example sites
		Site types within the purview of the present article	
1	General self-selection sites	Users browse profiles of a wide range of partners	Match, PlentyOfFish, OkCupid
2	Niche self-selection sites	Users browse profiles of partners from a specific population	JDate, Gay, SugarDaddie
3	Family/friend participation sites	Users' family/friends can use the site to play matchmaker for them	Kizmeet, HeartBroker
4	Video-dating sites	Users interact with partners via webcam	SpeedDate, Video dating, WooMe
5	Virtual dating sites	Users create an avatar and go on virtual dates in an online setting	OmniDate, Weopia, VirtualDateSpace
6	Matching sites using self-reports	Sites use algorithms to create matches based on users' self-report data	eHarmony, Chemistry, PerfectMatch
7	Matching sites not using self-report	Sites use algorithms to create matches based on non-self-report data	GenePartner, ScientificMatch, FindYourFaceMate
8	Smartphone apps	GPS-enabled apps inform users of partners in the vicinity	Zoosk, Badoo, Grindr
		Site types beyond the scope of the present article	
9	General personal advertisement sites	Users can advertise for diverse goods and services, including partners	Craigslist, most newspaper sites
10	Sex or hookup sites	Users meet partners for casual sexual encounters	OnlineBootyCall, AdultFriendFinder, GetItOn
11	Infidelity sites	Users or partners (or both) pursue extrarelationship affairs	AshleyMadison, IllicitEncounters, WaitingRoom
12	Sites for arranging group dates	Users propose get-togethers with a group of strangers	Ignighter, Meetcha, GrubWithUs
13	Social networking sites	Users can meet friends of friends	Facebook, MySpace, Friendster
14	Massively multiplayer online games	Users can meet partners using avatars in a complex online environment	SecondLife, TheSims, WorldOfWarcraft

Note: The content in this table is illustrative, not comprehensive. The distinctive feature of a particular type of site does not imply that it is the sole purpose or method the site uses; many sites have multiple features or use multiple methods to help users access potential partners. In addition, due to the rapid pace of technological and entrepreneurial innovation, the methods that people use to meet potential romantic partners online are constantly changing. This table represents a snapshot from 2011. GPS = global positioning system.

his or her long-term spouse, and everything in between. As such, this definition encompasses both *attraction contexts*, in which individuals are evaluating potential romantic partners with whom they do not yet have a romantic relationship (i.e., they are not "officially" romantic partners), and *relationship contexts*, in which individuals are evaluating someone with whom they already share a romantic relationship. We refer to both contexts as *romantic contexts* and to the relationships people pursue in both contexts as *romantic relationships*.[4]

Turning to the people involved in the online dating process, the term *users* refers to those who are pursing potential partners through online dating. The term *potential romantic partner* refers to any member of one's preferred sex whom one believes is available and interested in finding a romantic partner of the user's sex, with the term *match* restricted to a potential romantic partner whom a mathematical algorithm has

selected as an especially compatible potential romantic partner for a given user.

Part I: Is Online Dating Fundamentally Different From Conventional Offline Dating?

With these definitions in hand, we now turn to the first of the two major questions in this article: Is online dating fundamentally different from conventional offline dating (the uniqueness question)? Our goal was not to compare online dating to conventional offline dating on every possible dimension. Rather, we focused on three crucial dimensions, examining whether online dating represents fundamental rather than incremental alterations of the dating landscape. First, is online dating a pervasive means through which singles seek to meet

potential partners, or is it a fringe approach pursued by a small fraction of singles? Second, does online dating fundamentally alter the process of becoming acquainted with potential romantic partners, or is this acquaintance process largely similar in online dating and conventional offline dating? And third, does online dating fundamentally alter the process of compatibility matching, or does it simply represent a variant of the same matching procedures that professional and familial matchmakers have used for centuries?

How pervasive is online dating?

We begin to address the uniqueness question by examining whether online dating is a pervasive versus a fringe means for singles to meet potential romantic partners. Rather than simply presenting a brief snapshot of present usage rates, we situate these rates in a broader context by providing an historical overview of online dating and discussing how societal attitudes toward online dating have evolved in recent years. This analysis will suggest that although online dating functions as the most recent outgrowth of an endeavor with a long history, the rapid increases in its prevalence and mainstream acceptability over the past 15 years have resulted in a fundamental shift in how large swaths of single people seek to meet romantic partners.

The history and prehistory of online dating. Social and commercial institutions that facilitate courtship and marriage are diverse and long-standing (e.g., Ahuvia & Adelman, 1992). Matchmaking and introductory intermediaries, particularly for the purpose of facilitating marriage, have been a component of the marriage-courtship market long before the emergence of online dating. In addition, computers have been used for romantic matching, both commercially and in university settings, for over 60 years.

Matching, pre-Internet. Human matchmakers, working for pay or barter, have recommended matches for centuries and are even described in the Bible. Traditional matchmaking was often a side role for rabbis, priests, clergy, and sometimes elderly women in the community, and these matchmakers were sought out by parents who were searching for spouses for their children. Today, human matchmakers continue to offer matching assistance, although in the United States and in most other Western societies, the service typically is initiated not by parents but by the single adults themselves who may be dissatisfied with their other options (including online dating) for seeking a partner. Today's commercial matchmakers often work with a small base of clientele, whom they get to know personally. Their matching decisions are typically based on intuition and experience, not mathematical algorithms (Adelman & Ahuvia, 1991; Gottlieb, 2006; Woll & Cozby, 1987).

In addition, personal advertisements for dating and matrimony have existed for centuries. Indeed, shortly after the advent of the modern newspaper, people used it to advertise for a spouse (Cocks, 2009), with the first printed personal advertisements dating to the early 1700s (Orr, 2004). Printed personal advertisements were especially prevalent when unusual circumstances caused groups of unmarried individuals (predominately men) to be isolated from potential partners. For example, American soldiers in war, beginning with the Civil War, advertised for partners and pen pals, as did those who settled America's Western frontier in the early 1900s (Orr, 2004).

By the 1970s, personal advertisements were becoming more popular, both in mainstream publications and in niche newspapers and magazines, even in the absence of highly asymmetric sex ratios in the immediate environment. Many factors contributed to this trend, including a rise in age at first marriage, which resulted in singles seeking partners after leaving the mate-rich environments of high school and college; a growing dependency on media for information in general and for mating information in particular; and a consumerist shift in society toward a service economy in which it was increasingly acceptable for businesses to perform services once performed primarily by individuals and families (e.g., Ahuvia & Adelman, 1992; Merskin & Huberlie, 1996; Smaill, 2004).

In printed personal advertisements, the advertiser typically provided a description of his or her qualities, stated a preference for the type of relationship sought, and described a few qualities desired in an ideal partner. The publisher charged the advertiser based on the number of words or lines, and the responders typically paid for the service of transferring their responses to the advertiser. Although printed personal advertisements became more prevalent in the 1960s and 1970s, only a small percentage of people met their partners in this way. Nationally representative surveys conducted circa 1980 (Simenauer & Carroll, 1982) and in 1992 (Laumann, Gagnon, Michael, & Michaels, 1994) demonstrated that only a fraction of 1% of Americans met romantic partners through personal advertisements.

Video-dating, a channel for mate seeking that involved members providing profile descriptions and photographs and then participating in a brief videotaped interview, emerged in the 1980s (Ahuvia & Adelman, 1992; Woll & Cozby, 1987). To make their choices among dating prospects, members conducted an initial screening based on the prospects' photos and profile information and then viewed the videotapes of those who most interested them. Members then expressed interest in meeting specific others, and, if the interest was mutual, contact information was exchanged and pairs could then meet face-to-face. As with personal advertisements, however, video-dating remained more of a fringe than a mainstream approach to meeting partners.

Just as printed personal advertisements followed the emergence of newspapers, and just as video-dating followed the emergence of video cassette recorders, computer-based matching services followed the emergence of computers. Indeed, computers were used for romantic matching decades before the development of the Internet, both in conjunction with academic research on the attraction process and as a component of commercial adventures in matching. As one example of the former, a group of students developed the "nation's first foray

into computers in love" for a final class project in a Stanford University mathematics course in 1959 (Gillmor, 2007, p. 74). The project, entitled "Happy Families Planning Services," involved programming an IBM 650 computer to pair up 49 men and 49 women for a computer-date matching party. The men and women completed a questionnaire assessing characteristics like age, height, weight, religion, personality traits, and hobbies, and the students wrote a program to calculate the difference score for each possible male–female pair. The pair with the lowest difference score was selected as the first and "best" match, but as fewer couples remained in the pool, the couples had larger difference scores and made for some "odd couples" (Gillmor, 2007). Although the project yielded one eventual marriage and an "A" grade in the course, it did not progress beyond the class assignment.

Commercial enterprises soon followed. For example, a group of Harvard students who were unhappy with traditional ways of meeting dates founded a corporation and, in 1965, launched Operation Match, which was designed to use computers to identify compatible matches (Leonhardt, 2006; Mathews, 1965). Questionnaires were sent to campuses around the country, with student participation increasing when *Look Magazine* ran a feature article on the company (Shalit, 1966) and television and radio talk shows discussed the new "high-tech" dating system. The questionnaire asked the students to rate their own characteristics (e.g., physical attractiveness, intelligence) and to indicate how their ideal mate would rate on those same characteristics. The student entrepreneurs charged their student clients $3 (U.S. currency) for the promise of a list of compatible matches. Unfortunately, their rented Avco 1790 computer, which was the size of a small room, could not easily process the questionnaire data, resulting in long delays. Operation Match closed its doors in 1968, but not before its proprietors introduced several couples who eventually married (Leonhardt, 2006; Mathews, 1965).

In the 1970s, additional dating companies sought to make computer matching work and to build a clientele interested in purchasing the service. For example, a 1970 advertisement for a computer dating company made the following claim: "Utilizing the most advanced and sophisticated computer techniques with IBM 360/16, Compatibility can GUARANTEE you 2 to 10 compatible referrals every 30 days for five full years" (reported in Orr, 2004, p. 22). However, these forays into the business of computer dating also failed. The computers were not powerful enough to handle data from many users, and there was no Internet platform for efficiently communicating with customers and obtaining data from them.

An historical analysis of the early use of computers for matching would not be complete without a description of "Project Cupid," which involved the attempted recruitment of a group of eminent psychologists to develop a dating service. In July of 1969, George Levinger, a psychologist at the University of Massachusetts and one of the pioneers of relationship science, received a visit from a psychology department chair at another university, who asked Levinger to join with other social psychologists and develop a nonprofit computer dating entity that could also become a source for valuable research data. The department chair was representing a wealthy trustee of his university, who was inspired by his adult daughter's failure to find suitable dating partners (Levinger, personal communication, September 15, 2009). Levinger teamed up with two other luminaries in the relationships field, Elaine Hatfield (then Walster) and Zick Rubin, and they met in 1970 in New York on a trip sponsored by the trustee, who offered to donate $100,000 to start a nonprofit corporation. After their second meeting, when they had reviewed numerous matching instruments, Levinger wrote as follows (personal communication, September 15, 2009):

> Our meeting was a mixed success. On one hand, Elaine, Zick, and I had each reviewed numerous matching instruments and had submitted them for the group's consideration. On the other hand, our reviews gave us little confidence in our ability to devise satisfactory "matches" for our clients. . . . We were not ready to promise that our "expertise" would give them better matches than they could find on their own.

Following two additional meetings, which included outside experts, Levinger and the others terminated the project because of their concern that it would neither serve their clients well nor generate sufficiently worthwhile research data.

By the 1980s, online communication was possible through bulletin board systems, which collectively served as a precursor to the current Internet (Whitty, 2007). People could communicate and fall in love in cyberspace chat rooms without meeting in person (Ben-Ze'ev, 2004; Whitty & Carr, 2006; Whitty & Gavin, 2001). However, in the era before widespread availability of Web browsers, usage of Internet-based bulletin boards remained a niche activity for a small group of particularly tech-savvy people. In short, although commercial mating intermediaries have been around a long time and have undergone technological advances, none of them achieved widespread use. In particular, none of them has attained anything approximating the scale or prevalence achieved by online dating in recent years.

Development of online dating sites. As computers became cheaper, smaller, and more powerful, and as the Internet became widespread, a new generation of computer dating businesses emerged. We categorize these online dating businesses into three generations: (a) online personal advertisement sites, (b) algorithm-based matching sites, and (c) smartphone-based dating applications. The first generation began in earnest when Match launched in 1995. Many sites followed Match's lead in the ensuing years, providing singles with a broad range of options for posting and browsing online personal advertisements. Such dating sites essentially functioned as search engines, allowing users to post a profile and to browse the profiles of potential partners. Whereas Match and many other sites (e.g., PlentyOfFish) have a broad

user base, other sites, typically referred to as niche sites, are designed for specific subpopulations. For example, online dating sites cater to users seeking partners of a particular age (e.g., SeniorPeopleMeet), religious orientation (e.g., JDate), sexual orientation (e.g., GaySinglesOnline), race (e.g., BlackSingles), social status (e.g., DateHarvard$_{sq}$), disability status (Dating4Disabled), and hobby preference (e.g., VampireLovers). Although many online dating sites charge fees for membership, some are free, generating revenue through advertisements and optional services (e.g., OkCupid, PlentyOfFish).

The second generation began when eHarmony launched in 2000, ushering in a new online dating service: "science-based" online matching systems, also referred to as algorithm-based matching or compatibility matching. Many companies offering matching services now exist, including PerfectMatch, which launched in 2002, and Chemistry, which launched in 2005. These sites distinguish themselves from the sites focusing on online personal advertisements by claiming to take a scientific approach to matching. At such sites, users are required to provide data about themselves, frequently in the form of self-reports tapping aspects of their personality, background, interests, values, and characteristics desired in a partner. The sites then process the data to provide matches based on the site's compatibility algorithm, which is typically proprietary. These sites, some of which have hired behavioral or social scientists to assist in the matching process, typically charge higher monthly fees than first-generation sites do.

Whereas the matching algorithms at sites like eHarmony, PerfectMatch, and Chemistry appear to rely primarily upon users' self-reports, the matching algorithms at other sites appear to rely heavily upon non-self-report data. For example, some sites claim to create matches based upon genetic and immunological compatibility between potential partners (Frazzetto, 2010). GenePartner, which launched in 2008, markets its genetic testing as a supplementary matching tool for online dating sites, matchmakers, or even couples themselves who, for $99, can order a kit and mail in a saliva sample to find out their score on biological compatibility (McGrane, 2009). ScientificMatch, launched in 2007, claims to be a full-fledged Internet matching system that combines genetic and immunological compatibility matching with personality and values matching and users' personal preferences, charging $2,000 for a lifetime membership.

In recent years, the distinction between self-selection sites and algorithm-selection sites has blurred. Recognizing the financial success of sites like eHarmony, many sites that began as a platform for online personal advertisements now offer suggested matches alongside the continued opportunity for users to search, on their own, through hundreds or thousands of profiles. As one example, Match has developed a matching algorithm that is based not only on users' stated preferences but also on their ratings of the matches sent to them (Gelles, 2011).

The third generation began in 2008, shortly after Apple Inc. opened its App Store to coincide with the release of the second version of the iPhone, a popular and influential smartphone. The App Store provided a forum in which independent companies could build software programs, called "apps," for the iPhone. Other smartphone makers soon followed suit, and now many smartphones run a vast range of apps, including many location-based online dating ("mobile dating") apps that capitalize on mobile Internet technology and global positioning system functionality to inform users of potential partners in the immediate vicinity (e.g., Zoosk, Badoo). For example, a user at a museum or on a train can browse rudimentary profiles of potential partners, typically consisting of a photograph and some very basic information—as long as those potential partners are members of the dating site, have made themselves available to browsing, and are in the immediate vicinity.

These mobile dating apps, which are frequently launched within broader social networking sites like Facebook, are rapidly becoming extremely popular. For example, as of late 2011, Badoo's Web site claimed it had over 133,000,000 users worldwide, seeking to entice potential users to join "the hundreds of thousands who sign up daily" (Badoo.com, 2011). Although users join Badoo for free, they can pay to have their profile given greater prominence on the site for a period of time. According to *Wired* magazine, many millions of people pay for this service, helping to increase the company's market valuation into the billions of U.S. dollars (Rowan, 2011).

Attitudes toward online dating. Just as the technologies to facilitate romantic relationship initiation have changed, attitudes toward online dating have changed as well. Personal ads in magazines and newspapers never became a widely socially acceptable way to search for a partner. Indeed, people who used personal advertisements to find partners frequently did so furtively to minimize their embarrassment (Darden & Koski, 1988). The stigma associated with personal advertisements extended initially to online dating. Although no academic research was published on attitudes toward online dating at its inception, online dating historians have referred to the stigma that existed in the 1990s about seeking partners online, as well as the perceived risks associated with doing so, including the possibility of encountering a sexual predator or "psycho" (Anderson, 2005; Gwinnell, 1998). In addition, online dating was assumed to be for "nerds," "the desperate," and the "socially inept" (Goodwin, 1990; Orr, 2004; Smaill, 2004; Whitty & Carr, 2006; Wildermuth & Vogl-Bauer, 2007). One commentator has suggested that there might have been a kernel of truth in these stereotypes, observing that that the early adopters of the technology were "a little on the shy side or a little on the sleazy side" (Orr, 2004, p. 29).

In the late 1990s and early 2000s, however, online dating started becoming more mainstream and shedding its stigma (e.g., Harmon, 2003; Lawrence, 2004; Tracy, 2006). Movies and other aspects of pop culture were beginning to present online romance in a positive way. For example, the 1998 movie,

You've Got Mail presented two attractive professionals (played by Meg Ryan and Tom Hanks) who had an acrimonious business rivalry but who fell in love with each other while communicating anonymously over the Internet, unaware of each other's offline identity. This film "worked wonders in erasing negative stereotypes" about using the Internet to meet a romantic partner (Orr, 2004, p. 32).

Still, academic research on attitudes about online dating at the turn of the millennium found that college students, for example, had more negative than positive attitudes about online dating. In one study, students expressed concern that people on the Internet would lie, that meeting romantic partners online was unsafe, and that it would take longer to get to know someone online than in person (Donn & Sherman, 2002). The graduate students in this study had more favorable attitudes than did the undergraduate students, perhaps because graduate students face a crunch in which the desire to find a life partner increases (as people age) just as the access to potential partners declines (as the college years recede further into the past). In an experimental follow-up study, these researchers randomly assigned students either to learn minimal (written) information about two popular dating sites or to spend several minutes (in a computer lab) taking the online introductory tour to the two sites plus viewing a printout of the survey questions that these sites used to develop profiles (Donn & Sherman, 2002). Participants in the latter group, who received first-hand exposure to the dating sites, expressed a neutral impression of dating sites on average, whereas the former, who did not receive first-hand exposure, expressed a negative impression on average. In general, attitudes toward online dating tend to grow more positive as one's immediate social milieu provides less bountiful access to potential romantic partners (Doan & Meyers, 2011; Hogan, Dutton, & Li, 2011; Madden & Lenhart, 2006; Sautter, Tippett, & Morgan, 2010).

The first large-scale study to examine public attitudes toward online dating in a diverse sample was conducted in 2005 by the Pew Internet & American Life Project, which monitors the effects of the Internet on Americans' lives. As reported by Madden and Lenhart (2006), the Pew study found that Internet users were divided in their views about whether online dating is a good way to meet people (44% agreed, 44% disagreed), although more agreed than disagreed (47% vs. 38%) that online dating allows people to find a good match because they get to know a lot more people. In addition, only 29% of the Pew respondents believed that online daters are desperate, although 66% believed that online dating can be dangerous because of personal information being available on the Internet.

In sum, although the public may have had negative attitudes toward online dating in its early years, "people no longer think of online dating as a last resort for desperadoes and creeps" (Paumgarten, 2011, p. 41). Attitudes and behaviors are linked, of course, and greater experience with online dating can lead to more positive attitudes. In addition, positive attitudes can emerge simply from exposure to online dating through the experiences of members of one's social network. Positive attitudes and awareness about others' favorable experiences can then lead to the desire to try online dating. Although some stigma about online dating may still exist (e.g., Doan & Meyers, 2011), rates of participation in online dating have grown dramatically in recent years.

Prevalence of online dating. Match asserts, in a popup window on its homepage, that "1 in 5 relationships start online" (Match.com, 2011, para. 1). Is this claim true, and on what evidence is it based? Furthermore, if it is true, how did the United States transition from less than 1% of the population meeting partners through printed personal advertisements or other commercial intermediaries in 1992 (Laumann et al., 1994) to a substantial proportion of singles meeting partners through online dating sites today?

Some experts have suggested that the online dating industry had a slow start because of the early stigma, including the carryover negative views based on printed personal advertisements. Because early adopters of online dating were viewed negatively, users were embarrassed to admit that they were trying it, and therefore "the industry for a long time enjoyed almost no benefit of word-of-mouth referrals and moved along at a painfully slow growth rate, taking that much longer to reach a critical mass" (Orr, 2004, p. 13). Some have argued that 1997 was the tipping point, when the number of users reached critical mass; usage of online dating sites thereafter increased rapidly as people shared their dating experiences (e.g., Hogan et al., 2011). Not coincidentally, 1997 also marked the widespread emergence of Web 2.0 technologies, which involved more dynamic, user-centered information sharing.

A few small-scale studies conducted in the 1990s with targeted samples of Internet users (e.g., participants of online newsgroups or online games) demonstrated that relationships could begin online and then progress offline (e.g., Parks & Floyd, 1996; Parks & Roberts, 1998; Utz, 2000). In 2005, the Pew Internet study surveyed a nationally representative sample of 3,215 Americans, Internet users and nonusers, to examine how common it was for relationships to begin online (Madden & Lenhart, 2006). Among the two thirds of participants in the sample who were married or in a committed relationship, most reported having met their partners in "real world" settings, such as at work or school (38%); through family or friends (34%); or at a nightclub, bar, café, or other social gathering (13%). Only 3% reported meeting their partners through the Internet—although many of the respondents presumably met their partners before online dating was a viable option. In contrast, among the single adults in the sample who were Internet users and currently seeking romantic partners, 37% reported having dated online.

With an industry that is changing rapidly and with the continuing diffusion of online dating experiences through social networks (e.g., Sautter et al., 2010), prevalence data collected in 2005 are sorely outdated. A nationally representative survey of 4,002 adults (including 3,009 with a spouse or romantic

partner) conducted in 2009 examined how people had met their current partners (Rosenfeld, 2010; Rosenfeld & Thomas, 2010). Among the participants who met their partners between 2007 and 2009, 22% of the heterosexual couples had met on the Internet, which made the Internet the second-most-common way to meet a partner, only behind meeting through friends. Figure 1, which shows the percent of participants in this sample who met a partner online as a function of the year in which the relationship began, demonstrates a steep increase over time. Of course, not all couples who meet online actually meet through an online dating site (others meet through social networking sites or in other online venues), but it is likely that online dating accounted for much of the increase in online meeting over the period covered in Figure 1.

We discussed earlier that several societal changes in earlier decades contributed to single adults placing printed personal advertisements and participating in video-dating and other commercial avenues for finding a mate. These trends, including the delay in marriage and the increasing consumeristic society, have continued apace. Other contributing social forces include greater mobility in society, which creates a need to meet partners in new ways (Sautter et al., 2010), and increasing sensitivity to sexual harassment in the workplace, which has led to widespread implementation of rules against sexual relationships with coworkers, potentially reducing the likelihood of finding a partner at work. Consistent with this possibility, the prevalence of meeting partners through work has decreased since 1990 (Rosenfeld, 2010). Additional factors that may have contributed to an increase in online dating include (a) technological changes that make the Internet accessible, efficient, and fun; (b) the pervasiveness of media messages, including testimonials from successful couples, about finding the perfect partner through dating sites; and (c) social network diffusion effects (Christakis & Fowler, 2009), facilitated by social network sites, in which behavioral tendencies spread from person to person.

Pervasiveness—conclusion. For many decades, people have used technological innovations such as the invention of the computer and video-recording devices to meet potential romantic partners, and entrepreneurs have sought to build profitable businesses based upon helping people do so. Thus, in one sense, online dating represents the next step in a long-term process of using new technologies to meet romantic partners. However, such a view fails to appreciate that the prevalence of online dating usage represents a fundamental departure from all previous uses of technology to introduce people to potential romantic partners. Whereas personal advertisements and video-dating never became a pervasive or socially acceptable means of meeting potential partners, online dating has entered the mainstream, and it is fast shedding any lingering social stigma. As a result, by 2005, 37% of single Internet users were dating online (a percentage that is almost certainly much higher today), and, by 2007–2009, more new romantic relationships had begun online than through any means other than meeting through friends.
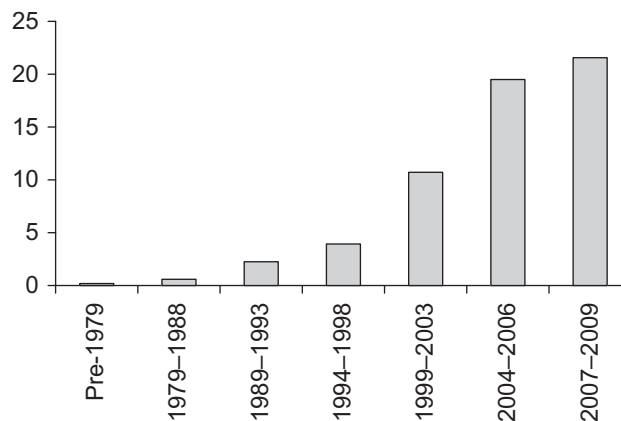

Fig. 1. Percentage of Americans who met their partners online as a function of year met. Data are from Wave 1 of the national data set, How Couples Meet and Stay Together (collected in 2009), for 2,535 heterosexual respondents who were married or in a romantic relationship (cohabiting, dating). The percentages for same-sex couples were generally higher, particularly in the most recent period (61%). Adapted from Table 7 in Rosenfeld and Thomas (2010) with permission from the authors.

In short, online dating has rapidly become a pervasive means through which singles seek to meet potential romantic partners. Although this fact is sufficient to allow for the conclusion that online dating has fundamentally altered the dating landscape, it does not allow for the conclusion that the acquaintance process or the matching process has fundamentally changed. We now examine whether online dating has fundamentally changed each of these processes as well.

Has online dating fundamentally altered the romantic acquaintance process?

The online dating process varies across dating sites and across users. Figure 2 depicts this process in a prototypical, idealized form. This idealized version of the process, which involves nine steps, begins with a potential user seeking information about one or more dating sites and ends with him or her developing a relationship with a partner met through a dating site. In discussing the mechanics of the process, we rely upon several sources, published and unpublished, academic and journalistic (e.g., Baker, 2008; Fiore & Donath, 2004; Gottlieb, 2006; Lawson & Leck, 2006). In particular, we rely upon Bridget Long's (2010) dissertation, which garnered insights into the psychological experience of online dating through both (a) an ethnographic content analysis of eHarmony, Match, and PlentyOfFish and (b) in-depth interviews of online daters. Our analysis will suggest that online dating has indeed fundamentally altered the romantic acquaintance process.

Online dating: A nine-step process. As we progress through the steps depicted in Figure 2, we compare and contrast the online dating process with more conventional (offline) forms of dating. Toward this end, we consider three prototypical ways in which a person might meet a stranger in his or her
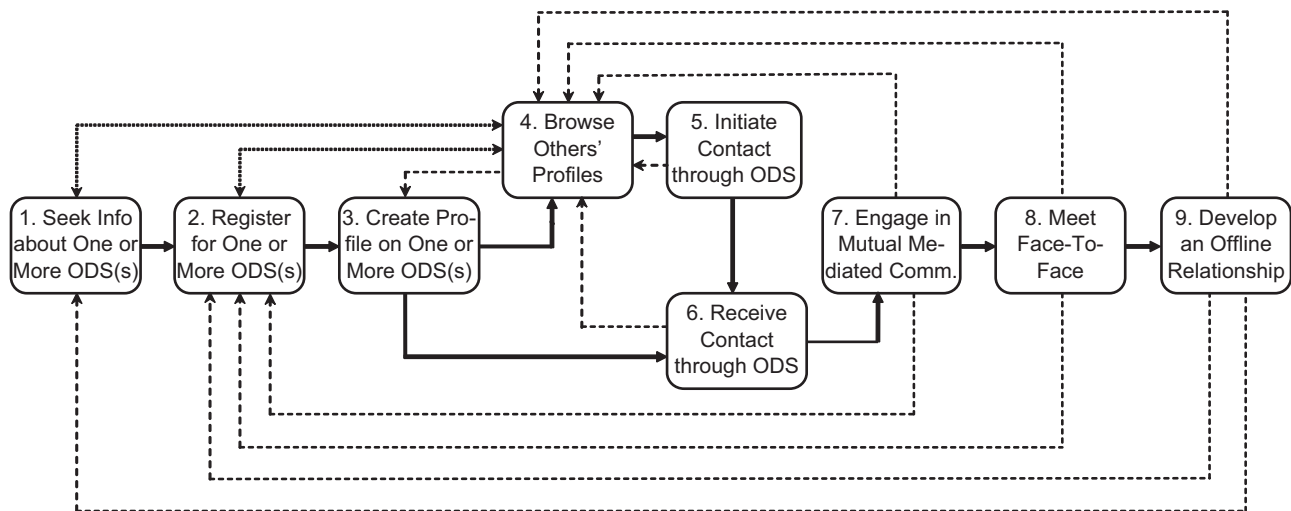
Fig. 2. The nine steps in the prototypical, idealized online dating process. The solid arrows represent the sequence in logical order. A given user can be at various steps in this process with multiple potential partners simultaneously (e.g., at Step 7 with one potential partner and at Step 5 with another). The two solid arrows emerging from Step 3 illustrate the two pathways through which a user can receive contact from potential partners through the dating site: (a) indirectly by browsing others' profiles (Step 4), initiating contact with one or more of them (Step 5), and receiving one or more replies through the dating site (Step 6); or (b) directly by receiving contact from one or more potential partners through the dating site (Step 6). The dotted, double-headed arrows represent the mutual influence between the earliest steps in the process—seeking information about one or more dating sites (Step 1) and registering for one or more of them (Step 2)—and the browsing of profiles (Step 4). The dashed, single-headed arrows represent feedback loops that can emerge when users remain invested in finding a partner through online dating despite experiencing some amount of dissatisfaction with their current circumstances at a certain step in the process. Users can drop out of the online dating process altogether at any stage, although we do not depict this dropout process in the figure. ODS = online dating site.

everyday life who could potentially become a romantic partner: (a) by approaching the stranger directly in person (e.g., at a coffee shop), (b) by having a member of their social network introduce them in person (e.g., at a party), and (c) by having a member of their social network set them up for a blind date to be coordinated by the daters themselves. As this section illustrates, Steps 1 through 6 in the online dating process are largely irrelevant to, or at least markedly different from, the process for these more traditional means of meeting a potential partner, although the motives underlying these steps (e.g., to date desirable partners) frequently have analogs in offline dating. Step 7 (mutual mediated communication) might on rare occasions precede Step 8 (meeting face-to-face) in offline forms of dating, such as when potential partners use e-mail to arrange an initial meeting location for a blind date. Once online daters reach Steps 8 and 9, the process becomes increasingly similar to that experienced through conventional means of dating, at least cosmetically; scholars have yet to determine whether relationship development and maintenance processes differ depending upon whether people met online versus offline (or whether such processes differ depending whether online daters met through one dating site versus another).

Step 1: Seek information about one or more dating sites. Online dating provides an expedient way to learn about potential partners and eliminate those who seem unappealing (Henry-Waring & Barraket, 2008; Whitty & Carr, 2006). In the words of one online dater, "Where else can you go in a matter of 20 minutes, look at 200 women who are single and want to go on dates?" (quoted in Heino, Ellison, & Gibbs, 2010, p. 438).

Many factors predict whether people are likely to seek information about dating sites, some of which are similar to those that predict whether people are likely to seek information about ways to meet potential partners offline. The two strongest predictors of engaging in online dating are being an Internet user and being single (Sautter et al., 2010). In addition, people are especially likely to seek information about online dating if they are having difficulty finding appealing potential romantic partners. Many people confront such difficulty, particularly if they lack established social networks or if their social encounters are largely saturated with people who are not suitable romantic partners for them. Indeed, online dating is especially prevalent among people who have a minority sexual orientation (Hogan et al., 2011; Rosenfeld, 2010); who have recently moved to a new area or experienced a breakup (Yurchisin, Watchravesringkan, & McCabe, 2005); who are middle-aged rather than young-adult (G. Gonzaga, 2011; Hogan et al., 2011; Rosenfeld, 2010; Stephure, Boon, MacKinnon, & Deveau, 2009; Valkenburg & Peter, 2007; Whitty & Buchanan, 2009); who are divorced rather than never-married (Sautter et al., 2010); who have limited time to meet potential partners because of factors such as working long hours or being a single parent (Barraket & Henry-Waring, 2008); or who have lost interest in the bar scene and lack insight into or options for where they can meet singles, especially appealing singles, in their age range (Long, 2010). Furthermore, people are frequently inspired to date online if they learn about friends or family members having positive experiences with online dating (Long, 2010).

Scholars have examined the personality characteristics of people who date online and people who do not, discovering that the two groups tend to be much more similar than different. They are approximately equal in terms of self-esteem and the Big Five personality dimensions (Aretz, Demuth, Schmidt, & Vierlein, 2010; Steffek & Loving, 2009). The literature offers conflicting evidence about whether online daters are more versus less socially skilled than people who do not date online (Aretz et al., 2010; Kim, Kwon, & Lee, 2009; Valkenburg & Peter, 2007; Whitty & Buchanan, 2009); overall, there do not appear to be important main-effect differences on this dimension. Even when the two groups differ (e.g., online daters tend to be somewhat less religious, less likely to endorse traditional gender roles, and more likely to say that they try new things; Madden & Lenhart, 2006), these differences tend not to be large.

Step 2: Register for one or more dating sites. Once people have gathered information about dating sites, they can either register with one or more of them or decide not to pursue a partner online. If they decide to register, how do they decide which dating site (or sites) to join? One consideration is the manner in which the dating site presents users with profiles of potential partners—through self-selection or algorithm-selection or through some combination of the two. A second factor people consider is financial cost. As noted previously, some dating sites, including PlentyOfFish and OkCupid, are free. Many other dating sites, however, charge fees. For example, in 2011, Match charged $35 for a 1-month membership, $60 for a 3-month membership, and $102 for a 6-month membership; eHarmony charged $60 for a 1-month membership, $120 for a 3-month membership, and $180 for a 6-month membership (LittleRedRails.com, 2011a; LittleRedRails.com, 2011b). A third factor people consider is the degree to which the brand or culture of a given dating site dovetails with their goals. Proprietors of dating sites work hard to cultivate their brands. As in more conventional dating contexts, where certain people might prefer to meet somebody through a religious organization rather than at a dance club or vice versa, online daters might prefer the culture or brand at some sites more than others. For example, because of its ambitious advertising campaign, its clear emphasis on long-term compatibility, and its relatively high user fees, eHarmony tends to be especially appealing to people interested in forming serious, long-term relationships (Long, 2010). In contrast, because of its particularly strong emphasis on physical appearance, fun, and its absence of user fees, PlentyOfFish frequently draws people who are interested in casual dating (Long, 2010).

Ultimately, users' decisions about which dating site (or sites) to join involve a cost/benefit analysis. After gathering information about online dating, people decide whether joining a given dating site is likely to yield sufficient benefits—including efficiency, access to appealing potential partners, and the potential to form a strong relationship—to outweigh the costs—including money, time, and the potential awkwardness of having one's dating profile available to strangers.

Step 3: Create a profile on one or more dating sites—and, where relevant, complete a matching questionnaire. A user's first step after joining a dating site is to create and post a profile, after which potential partners can contact the user immediately. The moment at which a user posts a profile is the point at which the romantic acquaintance process in online dating starts to diverge fundamentally from the romantic acquaintance process in conventional offline dating. In conventional offline dating, an individual cannot create a finely crafted synopsis of him- or herself that potential partners can access at any hour of the day, even when its creator is sleeping.

In online dating, an individual creates such a synopsis in the form of a profile, which can be updated at any time and which functions as one's "own personal 'shop window'" (Henry-Waring & Barraket, 2008, p. 21). It typically includes one or more photos of oneself, basic demographic information (e.g., age, sex, education, profession, number of children, geographical location, religion, relationship status, sexual orientation), information about behaviors and interests (e.g., smoking and drinking behavior, hobbies), and descriptions of the characteristics sought in a potential partner. Dating sites generally encourage users to post at least one photo, and with good reason: Users who do not post photos are much less likely to be contacted (e.g., Fiore, Taylor, Mendelsohn, & Hearst, 2008).

The information users present in their profiles tends not to be entirely veridical. One reason for this tendency is that people generally lack perfectly accurate self-perceptions (Ellison, Heino, & Gibbs, 2006). Perhaps a more common reason, however, is that people engage in strategic self-presentation when constructing their profiles (Ellison et al., 2006; Whitty, 2008), just as they do in traditional dating. One study analyzed the profiles of 21,745 users at a dating site and compared the data presented in the profiles with data of national averages for the same characteristics (Hitsch, Hortaçsu, & Ariely, 2010a). Men and women at the dating sites were slightly taller than the objective national averages (1.3 inches for men and 1.0 inch for women). Women reported weighing from 5.4 pounds less (the 20–29-year-old age group) to 22.9 pounds less (the 50–59-year-old age group) than the national averages; men's reported weight generally aligned closely with the national averages. These comparisons to national norms are suggestive of biased reporting on profiles, but more direct evidence comes from a study comparing the profiles of 80 online daters to their actual characteristics (Toma, Hancock, & Ellison, 2008). When the researchers assessed height with a tape measure, weight with a scale, and age as reported on an individual's driver's license, they discovered that 81% of these online daters reported inaccurate information on at least one of these three characteristics on their profile; about 60% lied about their weight, 48% about their height, and 19% about their age. This sample, however, was relatively young (inaccurate reporting about age would perhaps be greater for an older sample). Men tended to overestimate their height and women tended to underestimate their weight. Generally, the degree of deception was small and would be difficult to detect face-to-face.

At dating sites that offer matching, users provide additional information that is used for matching rather than for the profile and that potential partners cannot see. Some dating sites use a questionnaire to asses this matching information. Responses on this questionnaire can be crucial because strict matching sites only allow users to view profiles of potential partners whom the algorithm declares, based on the responses, to be a match.

Step 4: Browse others' profiles (optional). In conventional offline dating, people have various forms of access to potential partners, sometimes even learning bits of information about them before meeting them in person, but people do not have access to finely crafted synopses of potential partners to help make the decision whether they would be interested in meeting them in person. In contrast, many online dating sites offer precisely such information at any hour of the day. Sites primarily emphasizing self-selection typically allow users to browse the profiles of all the potential partners fitting their search criteria (e.g., heterosexual men between 35 and 50 years old who live within 10 miles of a certain zip code, who do not have children, and who are nonsmokers). In urban areas, popular self-selection dating sites frequently present users with access to the profiles of thousands of potential partners, depending upon the breadth of the search criteria (e.g., within 25 vs. 10 miles of a certain zip code, with vs. without smoking-status restrictions). The logic underlying self-selection sites is that shopping for a romantic partner has crucial features in common with shopping for goods or services. Such sites allow users to browse all of the available profiles with the expectation that they can later contact those potential partners whose profiles they find most enticing. The process of browsing through hundreds, even thousands, of profiles on self-selection sites can be time-consuming, however. For example, a sample of users of one (unnamed) self-selection site reported that they spent an average of 5.2 hours per week browsing profiles (and another 6.7 hours writing and responding to e-mails), a process they did not particularly enjoy and that yielded only 1.8 hours of face-to-face interaction (Frost et al., 2008).

In contrast to sites emphasizing self-selection, sites emphasizing algorithm selection (i.e., matching sites) typically allow users to browse only the profiles of potential partners whom the site's matching algorithm has deemed compatible with them. Such sites frequently provide only a handful of profiles at a time, although they typically contact users periodically with additional matches. The logic underlying algorithm-selection sites is that users may lack the ability or motivation to evaluate which partners are especially compatible with them and that the algorithm can increase the odds that they will meet such partners.

Browsing others' profiles is a central activity—perhaps *the* central activity—in online dating, although it plays a smaller role at matching sites than it does at self-selection or hybrid sites. Indeed, browsing profiles is the primary means through which dating sites offer access; the opportunity to browse profiles is one of the three major services of online dating (and the

profiles to which users have access are sometimes determined through an algorithm-based matching process, another of the three major services). In the online dating process depicted with the solid arrows in Figure 2, a user browses others' profiles (Step 4) after creating his or her own profile (Step 3). However, the user can also arrive at profile browsing from any other step in the process. Users are particularly likely to return to browsing profiles from Steps 5 through 9 if they remain invested in finding a partner through a given dating site despite experiencing some amount of dissatisfaction with their current level of success at those later steps.

At both self-selection and matching sites, the metaphor of shopping characterizes how users select which potential partners are interesting enough to make it past the profile-browsing stage. Indeed, Heino and colleagues (2010) conceptualized online dating as "relationshopping" (also see Whitty & Carr, 2006), suggesting that it can result in the objectification of potential partner (a topic upon which we elaborate below). Participants in that study tended to view others' profiles as sales pitches or promotional devices in which the product others were selling was themselves, and they frequently became suspicious that others had embellished their profiles.

The shopping mentality seems to emerge in part from having immediate access to the profiles representing all of these "products" (potential partners). One online dater illustrated this mentality as follows: "You know, 'I'll take her, her, her'—like out of a catalog" (quoted in Heino et al., 2010, p. 437). A second online dater agreed (quoted in Long, 2010, p. 206):

> I think [shopping is] a perfect analogy for it. I can pick and choose; I can choose what size I want, it's like buying a car, what options am I looking for. I can test drive it, eh it's not really my fit, I'll put it back and go try another car. . . . You might say I only want to look for redheads today, so I'll save the search where all my other criteria are the same, education, professional, but I only want to look for people who have red hair.

Of course, you can surely buy a car from a dealer if you are willing to spend enough money, whereas you can only procure a redhead from a dating site if she wants you in return.

Although the shopping metaphor also applies to traditional forms of dating, it reaches new heights in online dating, especially at self-selection dating sites. This mentality emerges in part because of the sheer quantity of potential partners that users can evaluate and in part because of the manner in which they do so. In particular, online dating typically requires that people seek partners on the basis of searchable attributes like income and religion rather than experiential attributes like sense of humor and rapport (Frost et al., 2008). In the words of one online dater, "You're constantly evaluating as opposed to meeting someone and not knowing anything about them but knowing there's already a spark" (quoted in Heino et al., 2010,

p. 437). Thus, despite the tendency for profiles to convey a significant amount of information, sometimes deeply personal information, most romantic relationships will not begin until a face-to-face interaction takes place.

Step 5: Initiate contact through the dating site (optional). Steps 5 through 7 are relevant to the communication service offered through online dating, the last of the three key services (access and matching were most relevant to Step 4). As in traditional dating, users' decisions regarding whether to contact potential partners are not random. For example, users reported that they were especially likely to initiate contact with potential partners whose profiles made them appear to be physically attractive, to have similar interests and values to the users, and to be in the same general age and educational attainment ranges as the users (Rosen, Cheever, Cummings, & Felt, 2008; Skopek, Schulz, & Blossfeld, 2011; Whitty, 2008).

These self-reports were corroborated and extended by an impressive study of the profile-searching and contact-initiation behavior of 6,485 heterosexual users of a major self-selection dating site in the United States (3,702 men, 2,783 women; Hitsch, Hortaçsu, & Ariely, 2010b), a subset of the 21,745 online daters whose height and weight were compared to national averages in a separate article we summarized earlier (Hitsch et al., 2010a). This study examined the likelihood that users would contact a potential partner after viewing his or her profile. Men viewed more than three times as many profiles as women did (597,169 vs. 196,363) and were approximately 40% more likely to initiate contact with a woman after viewing her profile than women were after viewing a man's profile (12.5% vs. 9.0%); the average man sent 3.2 times more first-contact e-mails than did the average woman over a 3.5-month period ($M = 20.1$ vs. 6.3). Users of both sexes were especially likely to initiate contact with potential partners who were rated by objective observers as physically attractive and who claimed to earn a higher income. They also tended to contact partners who were similar to themselves in terms of characteristics like race, religion, political orientation, educational achievement, single versus divorced status, parenthood status, and smoking status. Finally, although online daters sometimes report that they do not pursue the most attractive potential partners (e.g., Heino et al., 2010; Long, 2010), Hitsch and colleagues' (2010b) data suggest that online daters typically pursue particularly desirable potential partners rather than partners who match themselves on social desirability; that is, they shoot for the stars (but see Lee, Loewenstein, Ariely, Hong, & Young, 2008).

If a user elects to initiate contact with a potential partner, this process can be similar to contacting a potential partner via e-mail in conventional offline dating, except that the user has not met the potential partner and no mutual acquaintance has provided the contact information. Aside from these differences, dating sites frequently offer various means of initiating contact other than sending an e-mail-type message. The mechanics of the contact initiation process vary from one dating site to the next (Long, 2010). For example, users of Match can send a virtual wink, a pre-written message, or an open

message they draft themselves. There is no restriction or guidance regarding the communication process. PlentyOfFish is even more freewheeling; users simply send a self-drafted message. In contrast, the communication process at eHarmony is remarkably lengthy and regimented, which makes the initiation process diverge even more sharply from the initiation process in conventional offline dating.

Two additional features of the contact-initiation process warrant comment. First, dating sites that require users to pay for their services typically allow users to browse profiles and initiate rudimentary contact with potential partners without paying but require payment for more elaborate communication (Long, 2010). On Match, for example, users can send a wink without paying, but they must pay to send a message. On eHarmony, users can see their matches' profiles (without photographs) and exchange basic closed-ended messages without paying, but they must pay to see the photographs or to participate in the rest of the communication process. Second, at many fee-based dating sites, potential partners with active profiles frequently are not paid-up members, which means their ability to reply to interested users is heavily restricted unless they subscribe (or resubscribe). Dating sites appear to have an incentive to entice users to send such messages because it can help convert nonpaying members to paying members (Rudder, 2010).

Step 6: Receive contact through the dating site. As noted previously and illustrated in Figure 2, a user can receive contact from potential partners either (a) by browsing others' profiles (Step 4), initiating contact with one or more of them (Step 5), and receiving one or more replies through the dating site (Step 6); or (b) by receiving unsolicited contact from one or more potential partners through the dating site (Step 6). Users vary in the degree to which they favor the more assertive path or the more passive path. Compared to women, men are more likely to favor the assertive path over the passive path (e.g., Hitsch et al., 2010b). The behavior of a 43 year-old female online dater exemplifies the passive path:

> I don't browse profiles. . . . I sit around and wait, if somebody winks at me, I look and see if I'm interested. If I'm intrigued at all by their profile, I'll wink back and we'll start to chat (quoted in Long, 2010, p. 203).

Some users at self-selection dating sites, particularly women with attractive profile photos, can be deluged with first-contacts (Hitsch et al., 2010b). Long (2010, pp. 130, 138) reports that,

> Within the first 20 minutes of creating my profile [on PlentyOfFish] I received four messages. . . . On Match or POF [PlentyOfFish], a date seeker may log onto the site to find 40 new winks or 20 new messages and 50 people who have viewed their profile.

Although it might seem appealing to have so many potential partners clamoring for one's romantic attention, this deluge

can cause users to disengage from the process rather than revel in it.

An ambitious recent study examined which contact initiation messages (Step 5) were especially likely to elicit a reply (Step 6; Schöndienst & Dang-Xuan, 2011). A linguistic analysis of 167,276 contact-initiation messages sent by 3,657 online daters revealed that such messages were more likely to receive a response to the degree they were characterized by lower usage of the pronoun *I*, lower usage of leisure words like *movie*, higher usage of the pronoun *you*, and higher usage of social-process words like *relationship* and *helpful*. Perhaps surprisingly, usage of negative emotion words did not predict the likelihood of a response.

Step 7: Engage in mutual mediated communication. Given that, in conventional offline dating, one almost never receives CMC from a stranger who lacks any ties with one's social network, traditional social norms are not optimally tailored to online dating. Simply ignoring an unwanted date request typically would be considered rude in a face-to-face context, but the relative anonymity at this stage of the online dating process renders it a common and frequently inoffensive strategy, along with the use of impersonal, scripted "no thanks" messages generated by the site (Tong & Walther, 2011). Indeed, the overall reply rate tends to be somewhat low, perhaps in part because of the potential for the initial message deluge and the large number of non-paid-up members. In one recent study, men replied to 26% of the messages they received through the site, and women replied to 16% (Fiore, Taylor, Xhong, Mendelsohn, & Cheshirep, 2010; also see Rosen et al., 2008). This study also found little evidence that eager responses were a turnoff; the faster the reply, the more likely that reciprocal communication would continue.

If a user elects to respond to a contact-initiation attempt from a potential partner, he or she must decide upon the nature of that response, which can be heavily influenced by the features of the given dating site. For example, on Match, users who receive a wink can respond with a wink, a low-effort approach that is likely to convey lukewarm interest. Alternatively, users can, for example, respond with a personalized message demonstrating that they have perused the potential partner's profile and have prioritized giving a personalized response.

More generally, there is a range of mechanisms for communicating through dating sites. For example, two individuals can communicate with each other through e-mail-like messages, instant messaging, webcam conversations, and even virtual dates with avatars, with the specific mechanisms available varying from one dating site to the next. During this stage, users must decide whether to provide personal contact information, such as e-mail addresses or phone numbers. Users who have concerns about safety issues are especially likely to seek additional information about potential partners before divulging much personal information (Gibbs, Ellison, & Lai, 2011).

Although users can go directly from dating-site-mediated communication to a face-to-face meeting (e.g., by scheduling a date through the dating site instant messaging system), most users engage in communication outside of the dating site, frequently via personal e-mail accounts, before deciding to meet face-to-face (Day, Hamilton, Hutchins, Maher, & Vance, 2010).[5] Most of the dyads that progress to the mutual mediated communication stage meet face-to-face within a month, frequently within a week (Rosen et al., 2008; Whitty, 2008).

Step 8: Meet face-to-face. Once two people start engaging in mutual mediated communication outside of the dating site, the dating site frequently becomes irrelevant to the nascent relationship, and it becomes increasingly irrelevant once they meet face-to-face (Whitty & Carr, 2006). Users frequently approach this first date as a screening process rather than as an occasion for a deep romantic connection: "The first meeting was essentially a test to see if there would be a second date" (Long, 2010, p. 238; also see Whitty, 2008; Whitty & Carr, 2006). One important issue is that people (especially women; Gibbs et al., 2011) frequently experience stronger concerns about physical safety issues on a first date when they have met the person through online dating rather than through conventional offline dating. To address these concerns, people typically have their first date in a public place, such as a coffee shop or a restaurant, rather than in a private home. At this point, the myriad factors that predict attraction and relationship initiation in face-to-face settings are surely relevant (for reviews, see Finkel & Baumeister, 2010; Finkel & Eastwick, in press)—factors including familiarity (Reis, Maniaci, Caprariello, Eastwick, & Finkel, 2011a; Reis, Maniaci, Caprariello, Eastwick, & Finkel, 2011b), reciprocal liking (Eastwick, Finkel, Mochon, & Ariely, 2007), and conversation quality (Sprecher & Duck, 1994).

Step 9: Develop an offline relationship. After the first date, each person decides whether he or she would like to go on a second date. If at least one of the two people is not interested, the relationship typically ends, and each person pursues one or more of three paths: (a) browsing additional profiles on a dating site one has already joined (Step 4 in fig 2), (b) seeking information about other dating sites (Step 1) and perhaps joining one or more of them (Step 2), or (c) discontinuing online dating. If both partners are interested in pursuing the relationship further, they typically schedule a second date and perhaps additional dates thereafter. If a relationship starts to become more serious, each person decides whether to keep his or her online dating profile active or to remove it. This decision involves a range of considerations, including the conflicting desires to convey a certain level of interest in this particular partner and to continue exploring potential alternative partners (Long, 2010). As noted previously, scholars have not performed systematic analyses to determine the degree to which relationship development and maintenance processes differ depending upon whether people met online versus offline.

The romantic acquaintance process—conclusion. This section explained how the online dating process works and contrasted this process with conventional offline dating. Although online dating presumably has not altered the nature of intimacy, it has changed the mechanics of relationship initiation in fundamental ways. For example, rather than sharing information about oneself with potential partners in real time, potential partners can browse one's profile at any time without one's awareness. Rather than meeting potential partners and then slowly learning various facts about them, users of online dating sites typically learn a broad range of facts about potential partners (and vice versa) before deciding whether a first meeting is desirable. Rather than periodically learning about one or two potential partners who could be interested in meeting people to date, users of dating sites, especially users of self-selection sites, can learn about hundreds or thousands of potential partners within hours.

This summary illustrates some of the fundamental ways in which the acquaintance process—learning about potential romantic partners and perhaps initiating a relationship with them—differs between online dating and conventional offline dating. As discussed in Part II of this article, the most significant differences involve the ways people (a) access potential partners, (b) communicate with these partners, and (c) get matched with potentially compatible partners by third parties, which are the main services that singles look to online dating sites to perform.

Before concluding this section, we address a final question: How do online daters like online dating? In general, they appear to find online dating and offline dating to be equally satisfying. In one study of 759 online daters from in and around Los Angeles, CA (47% male, 53% female), participants rated their experience with both types of dating as comparably positive (76% rated online dating positively), and 73% of them would recommend online dating to other people (Rosen et al., 2008).

In short, not only has online dating rapidly become a pervasive means through which singles seek to meet potential romantic partners, but it has fundamentally altered the acquaintance process. In the third and final section of Part I, we examine whether online dating has fundamentally altered the process of compatibility matching.

Has online dating fundamentally altered the process of compatibility matching?

As observed at the outset of this article, third parties—religious leaders, parents, elderly women, and so forth—have sought to match compatible partners for many centuries. However, they generally worked on a small scale, introducing potential partners whom they knew personally. Furthermore, they relied primarily upon their intuition when identifying compatible matches. Our analysis will suggest that third-party compatibility matching began to change fundamentally with the emergence of algorithm-based matching sites in the year 2000.

We illustrate algorithm-based matching by providing an in-depth analysis of the approaches taken by three prominent sites that claim their matching process is scientific: eHarmony, PerfectMatch, and Chemistry. Our examples draw most heavily from eHarmony, which is in a league of its own because (a) it was the first of the new generation of matching sites to employ claims of scientific validity; (b) it has the greatest media presence, with television advertisements, other forms of media, and Internet blogs highlighting its matching system; and (c) it has patented its matching system (Buckwalter, Carter, Forgatch, Parsons, & Warren, 2004; Buckwalter, Carter, Forgatch, Parsons, & Warren, 2008).

Matching sites frequently claim, boldly and explicitly, that the key to relationship success is finding the perfect partner and that they offer the optimal procedure to help users find such a partner. For example, eHarmony states, "Out of all of the single people you will meet in your life, only a very few would make a great relationship partner for you—by combining the best scientific research with detailed profiling of every member, we screen thousands of single men and single women to bring you only the ones that have the potential to be truly right for you" (eHarmony Scientific Matching Making, 2011). The PerfectMatch Web site states that it offers the "best approach to finding your perfect match" (PerfectMatch.com, 2011a, para. 1). Although Chemistry's Web site emphasizes finding a partner with whom one has "chemistry," Helen Fisher, the scientific advisor for Chemistry, emphasizes using science to find one's soulmate (e.g., Fisher, 2011).

The industry buzz phrase for the procedures used to generate compatible matches for members is *matching algorithms* (e.g., Gelles, 2011; Mitchell, 2009; Orenstein, 2003; Tierney, 2008). Dating sites often assert that their algorithms are proprietary and cannot be revealed, presumably because the sites would lose an advantage over competitors. For example, Gian Gonzaga, a psychological scientist and the chief scientist at eHarmony, has stated that eHarmony will not submit its matching algorithms to outside inspection because it would "reveal the site's 'secret sauce' to competitors" (as quoted in *The Economist*, 2011, para 21). Although we lack insider information about the specific format of the algorithms used by these sites, we can offer reasonably informed overviews by drawing upon information in the public domain, including the company Web sites; media interviews conducted with the sites' chief executive officers, staff, and creators of the matching systems; and eHarmony's patent.

Regardless of the specific implementation of a matching algorithm, the creators would have to consider at least three general issues. First, what type of data should be collected from users—what variables should be measured, and how? Second, how should the data collected from a specific user be combined with the data collected from potential partners to determine the most compatible matches? Third, to what

degree, if at all, does the site consider the "objective" desirability of a given individual as a relationship partner in general (rather than with regard to any specific partner)? All of these questions subsume several additional issues, including how responses to survey items are combined for total composite scores, whether some variables are weighted more heavily than others in the creation of compatibility scores or in the matching procedure, and whether any non-self-report data are incorporated into the matching algorithm.

Variables emphasized in compatibility matching. The three matching sites we review in detail all require that users complete surveys before they can be matched (see Table 2). The matching sites' Web pages (and other sources) refer to the variables or dimensions that are measured by the surveys and used in the sites' matching systems (see the "Dimensions of Variables" column in Table 2). The eHarmony matching system and survey were originally developed by a team that included the founder, Neil Clark Warren, a clinician, and Galen Buckwalter, a psychological scientist. Decisions about which variables to measure were made based on interviews Warren conducted with married individuals (Peel, 2008; Warren, 2002) and a review of "the psychological literature to identify the areas that might be relevant in predicting success in long-term relationships" (as reported in Gottlieb, 2006). Initial psychometric tests were performed on a large sample of couples, although the details of this pilot study are not publicly available.

The current version of the eHarmony survey has 13 sections and approximately 300 items. The survey is designed to measure 29 dimensions, which eHarmony claims are predictive of long-term relationship success (e.g., Warren, 2002). On the eHarmony Web site (eHarmony Scientific Match Making, 2011), these 29 dimensions are grouped into higher-order categories and further distinguished as either core traits, which eHarmony suggests are unlikely to change in adulthood (see first four rows in Table 2) or vital attributes, which eHarmony suggests may change based on learning and experience (see next three rows in Table 2).

The survey presents personality adjectives (e.g., warm, competitive), interests (e.g., volunteering, keeping physically fit), and emotions (happy, angry) and asks users to indicate how well each adjective describes them. Members also respond to self-descriptive statements (e.g., "I have an ability to make others laugh," "I am looking for a long-term relationship that will ultimately lead to marriage"). Information about which items are combined to measure the particular dimensions or clusters of dimensions, or about the reliability and validity of the measures, is not publicly available.

The "Duet Total Compatibility System" at PerfectMatch was developed in part by sociologist Pepper Schwartz. The PerfectMatch survey contains slightly more than 100 items, and is based loosely on the Myers-Briggs Theory and Type Indicator, which was developed decades ago to help managers determine which personality types may work well together on a team (P. Schwartz, 2006). The variables measured in the PerfectMatch survey, which overlap only slightly with the personality types in the Myers-Briggs measure, focus on eight personality characteristics (see the "Dimensions of Variables" column in Table 2). P. Schwartz (2006, p. 10) claims that the Duet system "uses characteristics based on research from the sociology and psychology of love and compatibility."

Each personality type is assessed with seven items, each consisting of two to three sentences or phrases. An example item to measure romantic impulsivity is, "Almost every time I have been in love I had an overall physical response when we met; my heart beat fast, I got sweaty palms, I felt a bit hyper, I was overly talkative, or became uncharacteristically shy." An example item that measures self-nurturing is, "I share my feelings with my partner on my own schedule. I don't feel comfortable if he/she always wants to know what I'm thinking or feeling. It bothers me if a partner doesn't respect my boundaries." The survey also includes questions about money, sex, children, core values, and social life. We are not aware of any research conducted to facilitate the creation of the Perfect-Match survey or to establish the reliability or validity of the dimensions.

The Chemistry matching system and survey were developed by anthropologist Helen Fisher (Fisher, 2009). Fisher proposes that there are four personality types and that these types are linked to two sex hormones (testosterone and estrogen) and two neurotransmitters (dopamine and serotonin). As presented in the "Dimensions of Variables" column of Table 2, these personality types are labeled *Explorer* (adventurous, creative, energetic), *Builder* (calm, cautious, conventional), *Director* (dominant, analytical, decisive), and *Negotiator* (empathetic, idealistic, emotionally expressive). People are classified according to a primary and a secondary type.

The survey has varied in length over time but currently contains about 60 items and includes a question that asks about the length of one's index finger compared to the ring finger, which Fisher argues is associated with level of testosterone (Fisher, Rich, Island, & Marchalik, 2010; also see Manning, 2002). Users are also shown visual representations and asked their interpretation (e.g., "Which of 4 faces have phony vs. real smiles"), with different responses putatively corresponding to the four personality types. In addition, users indicate their level of agreement with self-descriptive statements such as "I am always looking for new experiences" (Explorer/Dopamine), "It is important to respect authority" (Builder/Serotonin), "I pursue intellectual topics thoroughly and regularly" (Director/Testosterone), and "I highly value deep emotional intimacy in my relationships" (Negotiator/Estrogen; Fisher, 2009; Fisher, Rich, Island, & Marchalik, 2010). Fisher has presented reliability information (e.g., Fisher, Rich, Island, Marchalik et al., 2010), but validity information has been scarce to nonexistent.

Although eHarmony, PerfectMatch, and Chemistry have long built their matching algorithms upon self-report data, matching systems are increasingly taking behavioral variables into account (Humphries, 2010). For example, software used at eHarmony

Table 2. The Variables Measured at the Three Major Scientific Matching Sites and Matching Principles Used

Matching site	Domain	Construct	Variables assessed	Matching principle
eHarmony	Core traits: "defining aspects of who you are that remain largely unchanged throughout your adult life"[a]	Emotional temperament	Self-concept, emotional status, energy, passion	Similarity
		Social style	Character, kindness, dominance, sociability, autonomy, adaptability	Similarity
		Cognitive mode	Intellect, curiosity, humor, artistic passion	Similarity
		Physicality	Energy, passion, vitality and security, industry, appearance	Similarity
	Vital Attributes: "based on learning experience, and are more likely to change based on life events and decisions you make as an adult"[a]	Relationship skills	Communication style, emotion management, conflict resolution	Similarity
		Values and beliefs	Spirituality, family goals, traditionalism, ambition, altruism	Similarity
		Key experiences	Family background, family status, education	Similarity
PerfectMatch			Romantic impulsivity, Personal energy, Outlook, Predictability	Similarity
			Flexibility, Decision-making style, Emotionality, Self-nurturing	Similarity or complementarity
Chemistry	Sex hormones	Testosterone	Director personality type	Complementarity
		Estrogen	Negotiator personality type	Complementarity
	Neurotransmitters	Dopamine	Explorer personality type	Similarity
		Serotonin	Builder personality type	Similarity

[a]From www.eharmony.com/why/dimensions

under chief technology officer Joseph Essas is similar to the technology used by Netflix and Google (Shambora, 2010):

> Before Essas's arrival 2 years ago, eHarmony analyzed a few dozen variables per user. Today, its technology takes into account hundreds of different traits, including crucial information about how users behave—like time spent on the site or how long they take to respond to an e-mail about a match. The company collects this behavioral data and uses it to predict how users will respond to proposed matches.

Indeed, eHarmony's "matchmaking software gathers 600 data points for each user, including how often they log in, who they search for, and what characteristics are shared by the people they actually contact" (Humphries, 2010, para. 4). It seems that such sophisticated algorithms are also used at sites, like PlentyOfFish and Match, that offer matching recommendations to supplement self-selections (Brooks, 2006).

In short, the major matching sites rely heavily on self-report data, focusing on a broad range of variables (see Table 2). Many of these variables, including family background, spirituality, and emotionality, presumably overlap considerably with the variables that third-party matchmakers have used for centuries. Other variables, however, represent a fundamental shift

from traditional compatibility matching. For example, it is difficult to imagine that rabbis in the 17th century sought to enhance matching compatibility by examining the length of singles' 2nd and 4th fingers to learn about their levels of testosterone. In addition, although third-party matchmakers almost certainly took account of singles' behaviors (rather than just their self-reports) when searching for a match for them, the types of behaviors that current matching sites use were unavailable until recently. For example, matching algorithms can learn if a particular user tends to click on politically conservative blondes despite claiming to prefer politically liberal brunettes, and the algorithm will subsequently show that user more profiles of the former.

Scientific principles underlying compatibility matching. The stated scientific principle behind the eHarmony Compatibility Matching System is similarity (see the last column in Table 2). According to Neil Clark Warren, eHarmony's founder, "opposites attract, but then they attack" (quoted in Neate, 2009, para 1). Warren (2002, p. 116) elaborates as follows:

> The greater the differences between two people, the greater the drain on their marital energy. So strongly do I believe this that I have repeated over and over my admonition: "For couples, similarities are like money in

the bank, and differences are like debts they owe." Every difference requires an enormous amount of hard work to manage, and this subtracts from the energy needed to keep a marriage thriving.

Echoing these sentiments, eHarmony scientists Carter and Buckwalter (2009, p. 107) wrote that their online system is "accurately understood at a broad level to create pairings based on a schema of maximizing the intra-dyad levels of traits observed in empirical research to be positively related to marriage quality, and minimizing intra-dyad differences on traits where similarities have been observed to be positively related to marriage quality."

The stated scientific principles behind the Duet Total Compatibility System at PerfectMatch appear to be both similarity and complementarity (see the last column in Table 2), and Pepper Schwartz (2006), the site's academic relationship expert and cocreator of the matching system, has argued that both are necessary for romantic compatibility. The Perfect-Match Web site states, "Unlike other matchmaking systems or personality tests that match people based solely upon similar character traits . . . Duet pioneered analyzing and matching individuals who share both similar and complementary traits" (PerfectMatch.com, 2011b, para. 3). P. Schwartz (2006) has stated that couples will be more compatible when they are similar on romantic impulsivity, personal energy, outlook, and predictability—and when they are different on flexibility, decision-making style, emotionality, and self-nurturing.

Regarding flexibility, for example, P. Schwartz (2006) argues that similarity works if both partners are flexible but not if both partners are inflexible; pairing a highly inflexible person with a highly flexible person works. Similarly, someone who has a dominant personality works better with someone who is willing to compromise than with another dominant person. Schwartz also argues that although similarity on intensity/passion can work, as can similarity on being reserved, differences on emotionality can also be desirable because it can foster growth and interdependence. Finally, she argues that relationships work better when at least one partner is extroverted than when both partners are introverted.

Chemistry's matching process focuses more on initial attraction than on long-term compatibility, and Fisher (2009) has argued that falling in love depends on both similarity and complementarity. For example, Fisher (2008, para. 9) argues (a) that "we are unconsciously attracted to those who complement ourselves biologically, as well as socially, psychologically, and intellectually"; and (b) that "we fall in love with someone who has a different chemical profile for dopamine, serotonin, estrogen, and testosterone that complements our own." She also argues that individuals' prominent neurochemical determines whether their preference is for similarity or complementarity; Explorers and Builders prefer similarity to themselves, whereas Directors and Negotiators select one another (Fisher, 2009).

In short, the primary scientific principle emphasized at the major matching sites is similarity, although complementarity also plays a prominent role at certain sites. Hybrid sites that recommend matches as a complement to their primary emphasis on self-selection (e.g., PlentyOfFish, OkCupid) also emphasize similarity (e.g., Brooks, 2006; Gelles, 2011). Although the variables on which similarity and complementarity are assessed have changed since the advent of algorithm-based matching sites, these fundamental principles have presumably been staples of third-party matching for centuries.

Individual variation in matchability. Users of matching sites are likely to vary in their "matchability," which can be affected by several factors, including the degree to which they have characteristics that are likely to be generally attractive to potential partners, their mate standards (selectivity), and perhaps the number of potential partners in the users' particular geographical region. It appears that eHarmony classifies some people as poor prospects for a serious relationship and rejects them from joining the site, even though doing so requires that the company forfeit the money they would have gained from having such users as members. Media articles (e.g., Komblum, 2005), including those based on interviews with Warren (eHarmony's founder), suggest that people are rejected for being married too many times, for responding to items in a way that suggests that they may have emotional problems such as depression, and for being identified by the algorithm as providing misleading or inaccurate information on the survey.[6] In interviews, Warren also claims that people are rejected from the site when they are on the tail of distributions that make them too desirable—too intelligent, too educated, etc.—because of the difficulty of finding an appropriate match (Gottlieb, 2006). The unfortunate irony here is that eHarmony appears to exclude the very people who are in the greatest need of a matching service: those who have the most difficulty finding a compatible partner. Although third-party matchmakers presumably have long classified people according to their level of general desirability, they presumably tried to match particularly undesirable people with people they determined to have comparable levels of desirability.

Mathematical matching algorithms—conclusion. Mathematical matching algorithms make it possible to incorporate a level of systematic complexity into the romantic matching process that would have been impossible before the advent of powerful computers. Such computational feats represent another major distinction between conventional offline dating and online dating: Although matching has existed for millennia, basing matching decisions upon scientific principles and sophisticated mathematical algorithms is a 21st-century innovation.

In addition, although many variables relevant to algorithm-based matching are similar to those that matchmakers presumably have emphasized for millennia, some of the variables are quite new (e.g., Chemistry's emphasis on neurotransmitters and hormones). The basic principles underlying matching algorithms appear to be similarity and complementarity,

principles that matchmakers presumably have also considered. Although matchmakers have long used intuition or gossip to assess a single's level of desirability as a partner, declaring some people too desirable or too undesirable even to *attempt* to match, as sites like eHarmony do, may have been rare in previous eras, especially in the absence of knowing anybody who had ever actually met the individual in question.

Part I—conclusion: Online dating is fundamentally new

Part I examined whether online dating is fundamentally different from conventional offline dating. Although there are many similarities, there are also many fundamental differences. First, online dating has become pervasive, overshadowing many of the ways singles used to meet. Second, online dating has fundamentally altered the romantic acquaintance process. For example, millions of singles now first encounter potential partners in the form of profiles rather than in the form of first-person meetings or first-hand accounts. In addition, these singles frequently have immediate access to (the profiles of) hundreds or thousands of potential partners at any hour of the day, and those potential partners have comparable access to users' own profiles. Furthermore, the means through which singles initiate contact with potential partners is, in many cases, fundamentally different from how they do so in conventional offline dating, especially regarding the various forms of CMC that typically precede a face-to-face encounter. Third, whereas both matchmakers and algorithm-based matching sites emphasize principles like similarity and complementarity when establishing compatibility, matching sites frequently emphasize variables (e.g., serotonin) that matchmakers have historically ignored, and they seek to use vast amounts of data to build their algorithms. In addition, certain matching sites' (e.g., eHarmony's) decision to omit some people from the dating pool is presumably a more extreme approach than conventional matchmakers would have pursued. In sum, online dating has fundamentally altered the dating landscape, especially vis-à-vis the forms of access, communication, and matching they offer to singles. We now examine whether these changes have generally improved people's romantic outcomes.

Part II: Is Online Dating Superior To Conventional Offline Dating?

The preceding discussions of prevalence, the mechanics of the online dating process, and mathematical matching algorithms converge upon the conclusion that online dating differs fundamentally from conventional offline dating (the uniqueness question). We now examine whether online dating fosters better romantic outcomes than conventional offline dating does (the superiority question). Toward that end, we critically evaluate dating sites' claims of superiority before reviewing the scholarly literature relevant to evaluating whether specific implementations of access, communication, and matching offered by online dating are likely to yield superior romantic outcomes.

Does the available evidence support online dating sites' claims of superiority

What claims of superiority do online dating sites make?
Perhaps not surprisingly, online dating sites' claims of superiority are pervasive. We briefly review the general thrust of these claims, offering a handful of concrete examples, before discussing the legal context for considering such claims and evaluating whether the evidence underlying them meets conventional standards of scientific validity.

Online dating sites make a broad range of explicit and implicit claims about their access, communication, and matching services. Table 3 presents illustrative explicit claims, using verbatim quotes from a range of online dating sites. By design, the dating sites included in Table 3 represent a broad range of methods and market share; for example, eHarmony has a large market share, whereas Weopia does not. As illustrated in the table, claims regarding access frequently involve information about how many people use the site and how useful the profiles are for learning about potential partners. Claims regarding communication frequently involve information about what forms of mediated communication the site offers and how these forms of communication are especially effective and efficient at helping users (a) develop a nuanced view of what potential partners are like and (b) discern whether those potential partners are likely to be compatible with them. Claims regarding matching frequently provide a broad-brushstroke analysis of how the site implements the matching process (e.g., personality matching, genetic matching) and why this means of implementation is likely to be effective.

News agencies frequently parrot these claims uncritically. They often do so in awed tones, presenting the coverage as news even though it sometimes more closely approximates an infomercial for the dating site. For example, *Good Morning America* (*GMA*), ABC's popular morning television program, recently featured GenePartner, a dating site that claims to match potential partners based on their DNA. As part of this segment (downloadable from GenePartner.com, 2011), *GMA* interviewed Tamara Brown, co-founder of GenePartner, who informed viewers that her company's system of establishing "biological compatibility" is "really, really accurate." Fortunately for her, *GMA*, with the ABC News logo featured prominently on the screen, was happy to spread the gospel, introducing the segment as follows: "Now, hard science is making it easier to find true love. A new matchmaking system uses DNA to help find your dream date, and it's redefining what it means to be compatible." *GMA* elaborated: "But making that first match has always been an inexact science, kissing a few frogs, unavoidable. Until now. With the use of DNA technology, the science of online dating has become a whole lot less inexact." Despite a paucity of evidence that

Table 3. Quotes From Online Dating Sites Illustrating (a) the Means Through Which They Implement a Given Service (Access, Communication, or Matching), (b) Claims That Implementing the Service Through Those Means Is Successful, and (c) the Stated Theoretical Rationale Underlying Those Means of Implementation

Function	Means of implementation	Claims of success	Underlying theory
Access	PlentyOfFish: "With over 145 Million monthly visitors Plentyoffish is by far the market leader in online dating. You are not going to find any other site that has more singles looking to meet new people."	PlentyOfFish: "the vast majority of singles hear about us because their friends have had a really good experience using our dating service."	PlentyOfFish: "Do you want to be with someone? Do you want to find your soulmate? Think about it, where else are you going to find millions of singles all in one place looking for someone?"
	JDate: "JDate has hundreds of thousands of members worldwide and is one of the few personals sites around that boasts a nearly perfect 50:50 male-to-female ratio."	JDate: "Each week, hundreds of JDaters meet their soul mates."	JDate: "You can also get to know people and what they're looking for before you contact them, thanks to detailed profiles with photos, essays and all kinds of personal tidbits."
Communication	SpeedDate: "In under an hour on SpeedDate, you can meet up to 15 people using live video and instant messaging."	SpeedDate: "What differentiates our product is our real-time dating system. . . .We took the online profile model and the super-matching algorithm model, and took them one step further."	SpeedDate: "What made more sense to us was to design an online dating site where you could tell quickly whether you clicked or not, by going on live online dates with other singles from the comfort of home."
	Weopia: "Weopia users select an avatar and meet their date in an intimate person-to-person 3D virtual world. They use voice and text chat while engaging in dating activities and conversation stimulators to get a better sense of each other."	Weopia: "By allowing daters to meet in virtual worlds and to experience each other beyond mere text chat, their collective risk is reduced and their likelihood of success is increased."	Weopia: "It's easy to fall for a perfect profile picture and e-mail messages that are rehearsed, massaged and not spontaneous. Weopia helps to bring out the real person, quickly, in the comfort and security of your own home."
Matching	eHarmony: "eHarmony's patented Compatibility Matching System allows eHarmony members to be matched with compatible persons with whom they are likely to enjoy a long-term relationship."	eHarmony: "On average, 542 people get married every day in the United States because of eHarmony; that accounts for nearly 5% of new U.S. marriages."	eHarmony: "eHarmony matches singles based on a deeper level of compatibility, not likes and dislikes, but true compatibility."
	ScientificMatch: "Discover the magic of chemistry with genetic matchmaking. Our private, secure, personalized system will find you the most perfect matches possible."	ScientificMatch: "The 6 benefits of scientific matching: (1) Chances are increased that you'll love the natural body fragrance of your matches. (2) You have a greater chance of a more satisfying sex life. (3) Women tend to enjoy a higher rate of orgasms with their partners. (4) Women have a much lower chance of cheating in their exclusive relationships. (5) Couples tend to have higher rates of fertility. (6) All other things being equal, couples have a greater chance of having healthier children with more robust immune systems."	ScientificMatch: "Physical chemistry is based on the immune system. When we analyze your DNA, we look exclusively at your immune system genes. So, quite literally, when we say that two people have 'chemistry', we're saying that their immune system genes are perfectly matched with each other."

Note. The first column in the table clarifies which service a given quote illustrates (access, communication, or matching), the second presents the means through which the sites implement that service, the third presents the sites' claims of success, and the fourth presents the sites' stated rationale for why implementing that service through these means is likely to yield success.

DNA-based compatibility has an important influence on romantic outcomes (a topic upon which we elaborate later), *GMA* functioned in this instance as a crucial component of GenePartner's public relations efforts. And, of course, *GMA* is not alone, and GenePartner is not the only dating site covered so effusively. Comparable segments pervade coverage of online dating across the news media, which makes it especially important for psychological scientists to provide a critical evaluation of dating sites' claims.

What is the legal context for considering online dating sites' scientific claims? Dating sites' claims do not exist in a vacuum. The online dating industry is part of the broader business world, and governmental agencies have long regulated what sorts of claims businesses are allowed to make. Many dating sites, especially algorithm-based matching sites, claim that their methods have been scientifically demonstrated to yield positive romantic outcomes. Some sites, including Match and eHarmony, even report results from studies they have conducted or commissioned in support of their claims. However, these sites typically do not reveal the specifics of how their procedures work, especially vis-à-vis matching algorithms. As elaborated below, disclosure of these specifics is necessary for substantive evaluation of the validity of such claims. For example, the general claim that a dating site matches potential partners on the basis of the compatibility of their personality or values cannot be evaluated meaningfully because it omits information about which personality traits or values are considered and assessed, which are given greater or lesser weight, and how compatibility is established.

We recognize that these procedures, especially the matching algorithms, represent the proprietary intellectual property of their firms, who are understandably reluctant to reveal the formulae that make their services distinctive and possibly more effective relative to competitors. Secrecy of this sort is standard in the for-profit sector. The formula for Coca-Cola is famously clandestine, and Apple reveals the inner workings of its operating systems only to software developers who sign nondisclosure agreements. Nevertheless, firms like Coca-Cola and Apple rarely make explicit reference to a scientific basis for their marketing claims, perhaps in part because the Federal Trade Commission (FTC) Act

> prohibits unfair or deceptive advertising in any medium. . . . Advertising must tell the truth and not mislead consumers. . . . Claims must be substantiated, especially when they concern health, safety, or performance. . . . If your ad specifies a certain level of support for a claim— "tests show X"—you must have at least that level of support (Bureau of Consumer Protection, 2011a, paras. 2–4).

Moreover, the FTC enjoins companies from using consumer testimonials (a common tactic used by online dating sites in their advertisements) as a means of bypassing scientific substantiation:

> By "competent and reliable scientific evidence," the FTC means tests, studies or other research based on the expertise of professionals in the field who have been objectively conducted and evaluated by qualified people using procedures that give accurate and reliable results. . . . *Claims made through consumer testimonials also require scientific evidence.* Some advertisers mistakenly think they can get around the substantiation requirement by couching efficacy claims as consumer testimonials— "My arthritis pain vanished!" or "This product relieved my allergy symptoms!" They're wrong. Testimonials aren't "competent and reliable scientific evidence." If you don't have solid science to prove the underlying representation, don't try to "back door" it through a testimonial. Furthermore, don't forget that by using a testimonial, you've made an efficacy claim that has to be substantiated" (Bureau of Consumer Protection, 2011b, paras. 2–3; emphasis in the original).

These and similar rules have fostered legal action when the research does not actually support claimed benefits of a product (e.g., the 2007 Coca-Cola/Nestlé Enviga calorie-burning controversy, in which these firms were prohibited from making weight-loss claims for certain products; Casewatch, 2011). Indeed, at least one online dating firm has demanded that another firm cease making claims it deems unsubstantiated about the number of dates and relationships it has produced and the number of members it has (Gigaom, 2011). In several other instances, online dating firms have formally objected to one another's advertised claims of effectiveness through the self-regulatory program of the National Advertising Review Council, objections that the Council has upheld (NARC, 2011).

It may be instructive to draw an analogy to the pharmaceutical and medical-device industries, two other industries in which a product may have substantial implications for the health and well-being of its users (much as online dating may have, as discussed earlier). These companies also assert that the benefits of their products are based on substantial scientific research. In fact, such evidence is a prerequisite for receiving approval from the U.S. Food and Drug Administration (FDA), consistent with this organization's responsibility to protect the public's welfare. Nevertheless, the sponsor of an investigative drug or device must submit detailed information about its chemical or mechanical properties and the underlying manufacturing process before being allowed to conduct a study on humans. Furthermore, although the FDA keeps certain proprietary information confidential, patent applications, which are public documents, must disclose key details. Thus, by the time a drug or device becomes available to the public, key information about its central components is accessible to scientists and other interested people. To our

knowledge, no dating site has provided information of this sort to any regulatory agency.

Does the evidence underlying online dating sites' claims meet conventional standards of scientific validity? These legal considerations notwithstanding, a crucial question is whether dating sites' claims are scientifically valid. An affirmative answer to this question depends, at minimum, upon the matching site (a) reporting the research methods and statistical analyses in sufficient detail to allow for independent replication and (b) adhering to consensually accepted standards for interpreting data as free from artifact. To date, dating sites fall short on both of these necessary criteria.

The impossibility of independent replication. Regarding the first criterion—reporting the research in sufficient detail to allow for independent replication—dating sites collect proprietary data and report whichever results they like in order to make claims about the propriety procedures they use to introduce singles to one another. It is impossible for independent scholars to evaluate the validity of a given matching algorithm because the matching sites refuse to share the algorithm with members of the scientific community. Such open sharing is standard in science.

A related issue is that online dating sites rarely publish their empirical findings in peer-reviewed reports. Indeed, we found no published, peer-reviewed papers—or Internet postings, for that matter—that explained in sufficient detail (that is, sufficient to allow determination of whether the data are free from artifact or sufficient to permit replication) the criteria used by dating sites for matching or for selecting which profiles a user gets to peruse.[7] Scientific journals generally require this kind of information to evaluate a paper for publication. For example, the *Publication Manual of the American Psychological Association* (American Psychological Association, 2001, p. 17) informs researchers that the Method section must describe "in detail how the study was conducted," as "such a description enables the reader to evaluate the appropriateness of your methods and the reliability and the validity of your results" and "permits experienced investigators to replicate the study if they so desire."

Since at least 2004, scholars have repeatedly noted the necessity of dating sites providing fully documented scientific studies to support their various claims (e.g., Houran, Lange, Rentfrow, & Bruckner, 2004; King, Austin-Oden, & Lohr, 2009; M. Thompson, Zimbardo, & Hutchinson, 2005), but the sites have not adhered to these standards. Until the science underlying the purported effectiveness of online dating protocols is subjected to the standard scrutiny, scientific claims regarding the construction or effectiveness of such protocols should be given little credence.

Failure to collect data that are free from artifact. Regarding the second criterion—adherence to consensually accepted standards for interpreting data as free from artifact—the empirical reports from online dating sites fall well short of accepted standards for establishing that any effects they might

find are due to the mechanisms they claim. For example, even if a dating site shared sufficient information for scholars to be confident that couples formed through that site were more satisfied than were couples formed through other means, the site would also have to show that any such differences were due to the sites' procedures rather than to a broad range of potential confounds in the research. All dating sites function as dating interventions, and there is a long tradition in the behavioral and medical sciences of evaluating the impact of interventions. We discuss three issues in the online dating literature—selection bias, expectancy effects, and the need for randomized experiments—that converge upon the conclusion that the evidence dating sites have reported to date is susceptible to troubling artifacts.

i. Selection bias. Published research comparing couples who met through a given dating site to those who met through some other means are compromised by *selection bias*, which refers to a statistical artifact in which conclusions are distorted by the existence of systematic differences between groups that are unrelated to any variable the researchers are investigating. For example, when eHarmony scholars reported that couples who had met through eHarmony exhibited stronger marital adjustment than couples who had met through "unfettered selection" (Carter & Buckwalter, 2009), they failed to rule out a broad range of plausible differences between the people in these two groups that caused half of them to join eHarmony in the first place. People who seek to establish a romantic relationship online are not a random sample of single people who are unattached and interested in a relationship; instead, and minimally, they tend to be people who are highly motivated to establish a romantic relationship. Such motivation may cause these people to evaluate with favoritism any company that offers access to a large pool of potential partners or to be more likely to commit to a relationship. In addition, people with the financial resources and social-psychological skills to join a dating site (especially eHarmony) and to pass the background screening implemented by some sites (especially eHarmony) may be better candidates for successful relationships than other people.

ii. Expectancy effects. A second issue plaguing research comparing couples who met through a given dating site to those who met through some other means pertains to the possibility of *expectancy effects*, which refer to the myriad ways that research participants' expectancies can bias a study's results. In particular, it seems plausible that users of a given matching site have some degree of faith in the matching algorithm's validity, and we suggest that this faith can cause them to experience positive romantic outcomes, at least in the short-term, that are entirely unrelated to the content of the algorithm. Scholars have identified at least three interrelated processes that may lend indirect support for this proposition.

One process, which resides at the intersection of research on *outcome dependency* (Berscheid, Graziano, Monson, & Dermer, 1976) and research on the *endowment effect* and the *status quo bias* (Kahneman, Knetsch, & Thaler, 1990; Kahneman, Knetsch,

& Thaler, 1991; Samuelson & Zeckhauser, 1988; Thaler, 1980), begins with the recognition that assigning users an algorithm-selected match causes them to perceive that they have progressed through several early stages of the dating process, including narrowing the field of potential partners and finding somebody with whom they might be especially compatible. Given various pieces of evidence that the perception that one has progressed through the early stages of a given process increases one's motivation to continue with that process (J. E. Heyman, Orhun, & Ariely, 2004; Nunes & Dreze, 2006), a user of a dating site may be especially motivated to pursue a relationship with an algorithm-identified match.

A second process that may emerge as a result of users' faith in the validity of a site's algorithm is the *placebo effect*, which refers to improvements in one's psychological or physical well-being, or in one's satisfaction with a particular experience, that result from the erroneous belief that one has received an efficacious intervention (e.g., Plassman, O'Doherty, Shiv, & Rangel, 2008). A user's belief in the validity of the algorithm used by a dating site may cause him or her to view a match as compatible. That is, having a purportedly authoritative source claim to use science to select putatively ideal or highly compatible matches could predispose people to be more accepting of these matches, at least initially, than they might otherwise be. Such a belief may increase their likelihood of contacting, and perhaps experiencing initial attraction toward, him or her.

The third process is the *confirmation bias*, which refers to tendency for people to seek or interpret evidence in ways that are likely to support their existing beliefs or expectations (Nickerson, 1998; Snyder & Swann, 1978). Whereas the placebo effect may cause users of matching sites to behave in accord with the belief that selected potential partners are in fact compatible with them, the confirmation bias may help sustain this belief, at least in the short-term, by inspiring hypothesis tests that are systematically biased toward confirming it. For example, a user might pursue certain lines of conversation with a selected potential partner that are especially likely to provide evidence of compatibility (e.g., discussing known common interests rather than more ambiguous topics).

iii. The need for randomized experiments. Selection bias and expectancy effects are troubling methodological artifacts, but scholars can overcome them by employing optimal research designs. Most researchers believe that randomized trials, in which participants are randomly assigned either to an intervention condition or to one or more suitable control conditions, are the gold standard for evaluating the effectiveness of an intervention (Campbell & Stanley, 1963; Nezu & Nezu, 2008). Random assignment is crucial because it rules out various threats to internal validity (Campbell & Stanley, 1963; Cook & Campbell, 1979). Unfortunately, our extensive literature review revealed no randomized experiments evaluating the effectiveness of dating sites or of the matching procedures that these sites use.

How could researchers at eHarmony or some other matching site design scientifically valid research to determine whether their company's algorithm does what they purport it does? The optimal randomized experiment would include at least three control conditions to pit against the *algorithm condition*, in which participants are matched with potential partners according to the site's current algorithm. The first control condition would be a so-called *wait-list control condition* (sometimes called a no-intervention control condition), in which participants who are interested in registering for the matching site are only allowed to register after the study has concluded. The second control condition would be a *placebo control condition*, in which the information about the matching algorithm provided to participants is identical to the information provided to participants in the algorithm condition (e.g., that it is based on scientific evidence and that it is likely to introduce you to your soulmate), but participants are in fact assigned to be matched with partners at random (within certain constraints, including sexual orientation, age and education ranges, etc.). The third control condition would be a *matchability-only control condition*, in which the information about the matching algorithm provided to participants is once again identical to the information provided to participants in the algorithm condition, but only those aspects of the algorithm relevant to participants' general relationship potential—and not any aspects associated with dyadic compatibility per se—are used in the matching process. The inclusion of these control conditions could potentially allow the researchers to establish that any possible benefits that may emerge in the algorithm condition are due to the algorithm itself rather than to certain artifacts. In particular, the wait-list control condition could help them rule out self-selection processes, the placebo control condition could help them rule out expectancy effects, and the matchability-only control condition could help them rule out the possibility that the algorithm is effective for reasons that are entirely unrelated to dyadic compatibility (i.e., that any possible benefits of the algorithm are due exclusively to the exclusion of certain people from the dating pool).

If the researchers can demonstrate—in an experiment employing both random assignment to condition and longitudinal procedures and in a report that fully discloses the research methods and statistics—that participants assigned to the algorithm condition experienced better romantic outcomes than participants in all three control groups, that will likely constitute convincing evidence for the validity of the site's algorithm. Of course, demonstrating that a given compatibility algorithm is more effective than an alternative compatibility algorithm (e.g., that eHarmony's algorithm is more effective than, say, PerfectMatch's or Chemistry's) would require one or more additional control conditions, which could either be added to the four-condition experiment described above or included in a separate experiment pitting various matching algorithms against one another.

Claims of superiority—conclusion. In sum, online dating sites frequently claim that people will achieve better romantic outcomes when seeking partners through their site than through conventional offline dating (or through other dating sites). Such claims have been trumpeted by news organizations that frequently celebrate dating sites' services without providing sufficient critical analysis, and regulatory agencies have, it seems, adopted a laissez-faire attitude toward these claims. Our investigation suggests, however, that dating sites have failed to provide any compelling evidence for these claims. As such, the claims simply cannot be accepted as valid.

The severe limitations of dating sites' scientific reports are especially disconcerting when they are compared to the rigorous scientific standards for reporting research in other areas that have immediate relevance to the public welfare. For example, according to the author guidelines of the *Journal of the American Medical Association* (JAMA), all articles must include at least one named author who is independent of any commercial funder or sponsor and who indicates that she or he "had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis" (JAMA, 2011, para. 22). Furthermore,

> for industry-sponsored studies, an analysis of the data (based on the entire raw data set and evaluation of the study protocol and a prespecified plan for data analysis) must be conducted by an independent statistician at an academic institution rather than by statisticians employed by the sponsor or by a commercial contract research organization . . . The results of this independent statistical analysis should be the results reported in the manuscript.

Given the potentially serious consequences of intervening in people's romantic lives, one could argue that the standards required of online dating sites' scientific investigations should be especially high. It is unfortunate that they have been, to date, especially low.

With this skepticism of dating sites' claims as the backdrop, we now review a broad range of scientific literatures to examine whether the presence or form of access, communication, and matching offered by online dating sites is likely to yield superior romantic outcomes. In the absence of studies directly investigating the superiority question, we draw on the rapidly expanding empirical literatures on the implications of access, communication, and matching for subsequent relationship outcomes to make informed evaluations of these services.

Service #1—access: Does the access offered via online dating yield superior outcomes?

The first service that dating sites offer is access, which refers to users' exposure to and opportunity to evaluate potential romantic partners whom they are otherwise unlikely to encounter (Step 4 in Fig. 1). As noted previously, the access that users acquire through dating sites does not necessarily yield access to a relationship partner (Step 9); indeed, it does not necessarily yield any face-to-face encounters (Step 8) or even any mutual mediated communication (Step 7). Rather, it simply alerts users to the existence of specific potential partners—and, reciprocally, allows such potential partners to become aware of users' existence. Several factors influence the amount of users' access on a given dating site, including the number of people who have posted profiles on that site in their geographical area, users' search criteria (e.g., age range, geographic proximity, income), and whether the dating site allows them to view only the handful of potential partners whom the dating site's mathematical algorithm determines to be matches for them.

All else being equal, the access to potential partners offered by online dating can be a major boon to singles looking for partners. Accessing partners through online dating helps to address many problems that can plague conventional approaches to dating. Perhaps the most significant problem it solves is the actual or perceived lack of access to potential partners offline. It also addresses the interrelated problems of having to (a) confront uncertainty about whether a given potential partner is in fact romantically available and (b) muster the courage to approach strangers face-to-face. To be sure, the access that online dating sites provide has its own limitations, not least of which is the consumption of time and other resources that singles might otherwise spend seeking partners through more traditional means. However, access through online dating is much more convenient than access through conventional offline dating; users have access while drinking their morning cup of coffee with their hair rollers in, when lying in bed for 10 minutes before turning off the light to sleep, and during meetings at work. The degree to which the access provided by online dating sites ultimately yields positive romantic outcomes, especially relative to conventional offline dating, depends in part on how effective the access is at facilitating face-to-face contact with potentially compatible partners.

In this section, we evaluate whether the ways dating sites offer access to potential partners are likely to yield superior romantic outcomes. In particular, we examine the likely romantic consequences of, and the assumptions underlying, three ways access through online dating differs from access through conventional offline dating. First, online dating sites typically offer initial access to potential partners through profiles rather than through face-to-face encounters (profiles vs. face-to-face). Second, they typically present users with near-simultaneous access to profiles of more than one potential partner rather than with one specific potential partner (joint vs. separate evaluation context). Third, and related to the second point, they frequently present users with large choice sets of potential partners, often hundreds or thousands of them (large vs. small choice sets). Although these procedures characterize some dating sites more accurately than others, they remain more the rule than the exception.

It is easy to understand why the online dating industry altered access in these three ways, right from Match's launch

in 1995. After all, it is efficient for users to browse many profiles side-by-side as a first step toward the goal of identifying potential compatible partners. Users can browse many profiles quickly, allowing them to whittle down the options to a manageable number of potential partners who meet or exceed their desirability threshold. However, critical implicit assumptions lurk in this approach, and several lines of scientific work suggest that these assumptions, although intuitively appealing, might be flawed. The first assumption is that people tend to have good insight into what partner qualities presented in a profile will actually appeal to them when they meet the person represented in that profile. The second assumption is that side-by-side comparisons among multiple potential partners provide an effective means of evaluating one's potential attraction to (or relationship satisfaction with) a given partner once a relationship starts to develop. The third assumption is that people make better decisions when they can choose from a large rather than a small choice set. Next, we review a broad range of scientific findings to evaluate the validity of these three assumptions.

Can users glean accurate compatibility information from profiles? Self-selection and algorithm-selection sites make different assumptions regarding who is best suited to identify compatible matches for users—the users themselves or a particular matching algorithm. We postpone discussion of the validity of matching algorithms until the "Service #3—Matching" section below; for now, we examine the degree to which users are well served by trusting their intuitions regarding their own idiosyncratic preferences for a romantic partner. People typically *believe* they know what they desire in a potential partner—what partner characteristics, as assessed through a profile, are especially compatible with them. Indeed, after conducting in-depth interviews with online daters, Long (2010, p. 209) concluded that all of them "knew what they were looking for . . . and searched through several people and profiles to find it." Is users' confidence in their introspective accuracy justified?

There are actually two ways of posing this question, and they yield different answers. First, can people glean sufficient information from profiles to assess which potential partners are *generally more appealing* than others? Second, can people glean sufficient information from profiles to assess which partners are *uniquely compatible* with them? The answer to the first question (assessing which partners are appealing in general) appears to be yes. When browsing profiles, users can glean accurate information not only regarding obvious traits such as physical attractiveness but also regarding subtler traits, such as warmth and competence. Indeed, research on "thin slices" of social behavior demonstrates that individuals can accurately assess a broad range of trait-relevant information about other people based on brief exposure to their photographs (Ambady, Bernieri, & Richeson, 2000; Wills & Todorov, 2006). For example, participants' independent ratings of the power and leadership ability exhibited in facial photographs of chief executive officers from Fortune 1,000 companies exhibited moderately strong correlations with the companies' profits (Rule & Ambady, 2008), which is consistent with the conclusion that powerful chief executive officers with strong leadership ability both exhibit these qualities in facial photographs and use these skills to generate profits. Such effects, which emerge even though the participants do not recognize the people depicted in the photographs, suggest that people can glean accurate trait information from photographs and, by extension, from online dating profiles.

However, the answer to the second question (assessing which partners are uniquely compatible with a given user) appears to be no. Indeed, the ability to glean general desirability information might not be especially beneficial because the ease of contacting extremely desirable people in online dating may undermine the pairing process. Users contact some potential partners at massively higher rates than others (Hitsch et al., 2010a), a tendency that is typically mitigated in more conventional approaches to dating. In the words of Christian Rudder, one of the founders of OkCupid (quoted in Paumgarten, 2011, p. 43),

> You've got to make sure certain people don't get all the attention. In a bar, it's self-correcting. You see ten guys standing around one woman, maybe you don't walk over and try to introduce yourself. Online, people have no idea how "surrounded" a person is.

Rudder observes that this lack of knowledge can create an unfortunate dynamic in which women become overwhelmed and become increasingly unlikely to reply to the messages men send to them. In short, although people appear to be able to judge which potential partners are more appealing than others based on the sorts of information that typically appear in profiles, the ease with which any online dater can contact the most appealing potential partners implies that such judgments, by themselves, cannot provide an efficient pairing process. Not only are users at risk for contacting potential partners who are out of their league, but the most desirable partners, especially the most desirable women, are likely to find the process of sifting through so many first-contact e-mails aversive, perhaps causing them to disengage from the process altogether.

Even leaving aside this deluge problem, users' ability to detect from a profile which partners are consensually appealing falls short of the goal of enabling users to identify potential partners who are uniquely compatible with them. This observation links to the second way of posing the question of whether users' confidence in their introspective accuracy is justified: Does the ability to judge which partners are more appealing than others suggest that people can glean sufficient information from profiles to assess which partners are uniquely compatible with them? For example, if John prioritizes a particular trait (e.g., competence) more than James does when browsing profiles, will a potential partner who possesses that trait inspire John's romantic interest more than James's once

the men have met the potential partner in person? A recent program of research, which examined the extent to which people tend to be attracted to potential partners who match versus mismatch their stated ideal partner preferences, suggests that the answer is no (Eastwick & Finkel, 2008a). People often lack insight into why they like things (Nisbett & Wilson, 1977), perhaps including which characteristics available on a potential partner's profile will inspire their attraction to him or her following a face-to-face encounter (Eastwick & Finkel, 2008a; Sprecher, 1989).

In support of this lack-of-insight idea, people's idiosyncratic self-reported preferences for certain characteristics in hypothetical romantic partners appear to be irrelevant to their romantic outcomes with specific potential partners they have actually met in person. In one study, for example, undergraduate participants reported the degree to which they desired potential romantic partners who possessed three characteristics that are frequently assessable in profiles: physical attractiveness, earning prospects, and personality (Eastwick & Finkel, 2008a). Approximately 10 days later, they attended a speed-dating event where they met 12 potential partners, evaluating every one of them on these same three traits. Not surprisingly, participants experienced greater attraction to the extent that potential partners possessed these desirable characteristics—everybody prefers attractive, friendly partners with good earning prospects to ugly, unfriendly partners perpetually freeloading off of their parents. However, these associations were irrelevant to individual differences in stated preferences for these characteristics (Eastwick & Finkel, 2008a; also see Finkel & Eastwick, 2008). For example, physical attractiveness inspired romantic interest, but physical attractiveness did not have a stronger association with romantic interest for those participants who had reported that they strongly (vs. weakly) desired this trait in an ideal partner.

This disconnect between a priori stated preferences and invivo revealed preferences (those preferences that people exhibit after actually meeting potential partners) has emerged not only in undergraduate samples but also in speed-dating samples ranging from graduate students at an elite university in the United States (Iyengar, Simonson, Fisman, & Mogilner, 2005) to clients of a professional speed-dating company in Germany (Todd, Penke, Fasolo, & Lenton, 2007). It has also emerged in studies using experimental and longitudinal designs. For example, of particular relevance to the present analysis, when research participants evaluated a potential romantic partner's written profile (no photograph included), they expressed more romantic interest in a partner whose traits were rigged to match (vs. mismatch) their idiosyncratic preferences (Eastwick, Finkel, & Eagly, 2011). After a brief live interaction with the potential partner, however, the extent to which the partner matched their ideals no longer predicted romantic interest. In other words, participants exhibited a disconnect between (a) their idiographic self-reports of the traits that they desired in a romantic partner and (b) the traits that

actually predicted their romantic attraction to and relationship well-being with real-life potential partners. This effect is not limited to initial attraction contexts: A longitudinal study of middle-aged adults demonstrated that people with particularly strong preferences for a specific partner characteristic did not experience greater desire for their current partner to the degree that he or she possessed that characteristic (Eastwick, Finkel, & Eagly, 2011).

Taken together, these studies suggest two conclusions. First, people's idiosyncratic stated preferences predict who appeals to them in a profile but not necessarily who appeals to them in person. Second, although people can accurately discern from profiles which potential partners are more appealing than others, they may not be especially good at discerning which characteristics will uniquely inspire their attraction and relationship well-being after meeting the potential partner in person, and this disconnect may cause certain potential partners to receive huge numbers of first-contact e-mails. As a result, such consensually desired partners are likely to become decreasingly likely to reply to these emails and perhaps increasingly likely to opt out of the process. As a whole, the online dating system would function more effectively if there were some mechanism by which users could discern which potential partners are more compatible with them than with other users. Browsing profiles does not appear to be such a mechanism.

Are side-by-side comparisons a good way to evaluate potential romantic partners? Even if browsing profiles were an effective means of evaluating one's compatibility with a potential partner, the access function is frequently implemented by dating sites in a manner that further undermines the usefulness of that access. For example, one major problem may emerge from the disconnect between the characteristics of potential partners that users are likely to prioritize when browsing profiles and those that matter when pursuing a relationship with a specific potential partner. Browsing profiles places people into a *joint evaluation* mode in which they compare multiple potential partners nearly simultaneously, whereas pursuing a relationship with a particular partner places people into a *separate evaluation* mode in which they evaluate one specific partner in isolation.[8]

Frequently, people make choices in a joint evaluation mode but experience the consequences of those choices in a separate evaluation mode. For example, "when buying a sofa, we usually compare multiple options, whereas when using the sofa we have eventually bought, we face that sofa alone" (Hsee & Zhang, 2010, p. 349). Similarly, when browsing profiles, a user compares multiple options with one another (even if it is just a handful of options selected by an algorithm), whereas when he or she initiates and pursues a relationship with a potential partner met through a dating site, that relationship is frequently evaluated on its own. Rather than comparing multiple potential partners, the user is evaluating whether a

specific potential partner is or is not a good fit for him or her. This distinction might seem subtle, but an impressive program of research suggests that it is consequential.

Do users prioritize the wrong characteristics when browsing profiles? Many studies in nonromantic domains have demonstrated that people frequently prioritize different qualities when in a joint evaluation mode than they do when in a separate evaluation mode (Hsee, Loewenstein, Blount, & Bazerman, 1999). Of particular relevance to online dating, people in a joint evaluation mode (e.g., when browsing profiles) frequently overemphasize certain attributes that are relatively unimportant in a separate evaluation mode (e.g., when pursuing a relationship with a potential partner initially encountered when browsing profiles). For example, before learning to which of 12 dormitories they would be randomly assigned, incoming college freshmen predicted that the physical features of the dormitories (e.g., location, room size) would strongly influence their future happiness once they lived in a given dormitory; however, after they had been living in their assigned dormitory, these physical features did not predict their happiness (Dunn, Wilson, & Gilbert, 2003). One explanation for this disconnect is that the freshmen (a) were in a joint evaluation mode when making the predictions and in a separate evaluation mode when living in the assigned dorm and (b) were more sensitive to physical variations, which were ultimately unimportant, in a joint evaluation mode than in a separate evaluation mode because such variations were easy to evaluate (Hsee & Zhang, 2010). By analogy, the joint evaluation model triggered by browsing profiles of potential romantic partners is likely to cause users to focus on certain qualities they *think* are important in a potential partner, perhaps to the neglect of qualities that actually *are* important.

Such processes might be especially problematic in online dating because the sorts of easy-to-evaluate, searchable characteristics available through profiles tend to be largely irrelevant to the sorts of hard-to-evaluate, experiential characteristics that promote positive outcomes in an emerging or an established relationship (Frost et al., 2008). Experiential attributes are those that are best evaluated face-to-face (e.g., rapport, sense of humor), whereas searchable attributes can be evaluated through a simple informational presentation, such as an online dating profile (e.g., income, physical attractiveness). It is difficult for an online dater to know whether he or she will like a potential partner based on knowledge of the partner's searchable traits and interests, just as it is difficult for someone to know whether or not he or she will like a meal based on knowledge of the ingredients and nutritional content (Frost et al., 2008; Kaplan, 2008). When browsing profiles, a user conducts a side-by-side comparison, selecting or dismissing potential partners based upon searchable characteristics that facilitate judgment in a joint evaluation mode but that frequently turn out to be unimportant once the user has started a relationship with a specific potential partner and, consequently, is in a separate evaluation mode. Indeed, preference reversals from joint to separate evaluation modes tend to

"occur when a hard-to-evaluate attribute is more important than an easy-to-evaluate attribute" (Gonzalez-Vallejo & Moran, 2001, p. 220), as in online dating, where important qualities like sense of humor and rapport are difficult to evaluate from a profile.

Does the side-by-side comparison process elicit an assessment mindset that undermines romantic outcomes? A second consequence of having users engage in side-by-side comparisons of potential partners is that the joint evaluation mode that is triggered by this process is likely to strengthen *assessment mindsets* and undermine *locomotion mindsets* (Kruglanski et al., 2000). An assessment mindset stresses critical evaluation of entities, states, or goals in comparison to available alternatives, whereas a locomotion mindset emphasizes committing psychological resources toward the effective and pleasurable attainment of desired goals (for a related distinction between deliberative and implemental mindsets, see Gollwitzer & Bayer, 1999). Of course, all dating, especially when first getting to know a potential partner, involves some degree of assessment. We suggest, however, that online dating—in which users frequently make mating decisions after browsing a profile for a matter of seconds and in which the next potential partner is a mere mouse-click away—may place an unusually high priority on this mindset, especially relative to the priority placed on a locomotion mindset.

What are the likely consequences of adopting a strong assessment mindset and a weak locomotion mindset? On one hand, adopting an assessment mindset likely facilitates certain aspects of the online dating process. For example, an assessment (or a deliberative) mindset is associated with (a) pursuing the optimal choice among an array of options (Kruglanski et al., 2000), (b) less biased consideration of the pros and cons of alternatives (Taylor & Gollwitzer, 1995), and (c) more accurate forecasts about the future of a romantic relationship (Gagné & Lydon, 2001). On the other hand, an assessment mindset may not promote satisfying social interaction. First encounters are often awkward, and an assessment mindset may channel the assessor's attention in ways that inhibit fluid, spontaneous interaction. Even in established relationships, people with strong assessment or weak locomotion mindsets tend to be especially critical and unsupportive of their partners (Kumashiro, Rusbult, Finkenauer, & Stocker, 2007) and pessimistic about both the future of their relationships (Gagné & Lydon, 2001) and their ability to complete goal-relevant tasks (Armor & Taylor, 2003; Kruglanski et al., 2000)—all factors that predict unsuccessful, dissatisfying relationships over the long term (Kumashiro et al., 2007).

In addition to undermining relationship dynamics in emerging and existing relationships, an assessment mindset can cause problems during the profile-browsing stage, despite potentially making the process more efficient. Specifically, as discussed previously, the browsing process can cause users to objectify potential partners, commoditizing them as options available in a marketplace of profiles (Heino et al., 2010;

Lawson & Leck, 2006). Perhaps more than in conventional offline dating, an online dater may immediately assess the likely rewards and costs associated with forming a relationship with a certain partner, relative to alternatives, and use these assessments to decide whether to pursue further contact (Sunnafrank, 1988). Ahuvia, Adelman, and Izberk-Bilgin (2009, p. 239) referred to this process as "a 'McDonaldizing' of romance that is systematizing, rationalizing, and rendering into a calculative mate quest" a process that perhaps functions better when people adopt a less deliberate approach. Indeed, close relationships are especially satisfying to the degree that they involve (a) relatively high levels of social exchanges that are low in concreteness and high in particularism, such as love and affection; and (b) relatively low levels of social exchanges that are high in concreteness and low in particularism, such as tangible goods and money (Foa, 1993). Similarly, close relationships are especially satisfying to the degree that they are characterized by a strong communal orientation, in which partners provide benefits according to each other's needs, and a weak exchange orientation, in which partners provide benefits according to reciprocity norms (Clark, 1984; Clark, Lemay, Graham, Pataki, & Finkel, 2010). It seems reasonable to assume, then, that the sort of marketplace-exchange orientation triggered by the profile-browsing process might interfere with the development of satisfying romantic relationships.

Does selecting potential partners from large choice sets improve romantic outcomes? Online dating sites, especially self-selection sites, frequently offer users more than just a handful of profiles for side-by-side comparison. Indeed, they often present users with nearly simultaneous access to (the profiles of) many potential partners, sometimes thousands of them, who vary in complex ways across a wide range of characteristics. As noted previously, this situation differs markedly from traditional dating, where singles rarely encounter a large array of potential partners at once, especially in a setting in which they can almost effortlessly initiate correspondence with many of them. Even at a party, it typically is not obvious which partygoers are open to starting a romantic relationship, and even if the party is explicitly designed for singles, the public setting and the presence of so many competitors for potential partners' affections means that people must recruit substantial courage to approach potential partners.

Do large choice sets yield choice overload, lazier decision-making strategies, and poorer decisions? Beyond triggering a joint evaluation mode and an assessment mindset, both of which can arise even with relatively small choice sets, how might providing large choice sets influence the manner in which users browse profiles and prioritize some potential partners over others? Certainly, people value choice (Leotti, Iyengar, & Ochsner, 2010), and the experience of choice causes elevated activation in brain regions associated with motivation and reward, such as the ventral striatum (Leotti

& Delgado, 2011). Furthermore, the perception that one has options (and the autonomy or responsibility to select among them) predicts psychological and physical health (Deci & Ryan, 1991; Langer & Rodin, 1976; Ryan & Deci, 2001). Indeed, people frequently strive to keep their options open even when doing so yields worse outcomes than would jettisoning clearly inferior options (Botti & Hsee, 2010; Botti & Iyengar, 2004; Botti, Orfali, & Iyengar, 2009; Bown, Read, & Summers, 2003; Chernev, 2006; Shin & Ariely, 2004; for review monographs, see Iyengar, 2010; B. Schwartz, 2004).

Despite the strength of people's motivation to keep their options open, however, many studies have demonstrated that a large degree of choice can overwhelm people, undermining their ability to make good decisions and sometimes producing a state of *choice overload*, in which people simply avoid making any decision rather than exerting the mental effort required to compare and contrast so many options (Iyengar, 2010; Keller & Staelin, 1987; Malhotra, 1982; Redelmeier & Shafir, 1995; B. Schwartz, 2004; Simonson & Tversky, 1992; for a recent debate regarding choice overload and paralysis, see Scheibehenne, Greifeneder, & Todd's, 2010, meta-analytic review and Chernev, Bockenholt, & Goodman's, 2010, commentary). In a famous illustration of this principle, supermarket shoppers encountered a tasting booth that displayed either 6 or 24 flavors of jam (Iyengar & Lepper, 2000). Although shoppers were 50% more likely to stop at the tasting booth with the larger array of jams than at the booth with the smaller array, they were *10 times* more likely to purchase one of the jams from the smaller array than to purchase a jam from the larger array (30% vs. 3%).

Recently, scholars have extended this line of research into the romantic domain, addressing three research questions about the influence of large versus small choice sets of potential partners. First, does choice set size influence people's subjective experience of the choice process? Second, do relatively large choice sets cause people to employ less cognitively taxing comparison strategies and, consequently, alter their mating decisions? Third, do relatively large choice sets cause people to make mating decisions that are less closely aligned with their idealized mating preferences, perhaps undermining their likelihood of experiencing positive romantic outcomes with potential partners they have met through the dating site?

Regarding the first question—whether choice set size influences participants' subjective experience of the choice process—two experiments suggest that the answer is no (Lenton, Fasolo, & Todd, 2008; Lenton & Stewart, 2008). Participants in these experiments were randomly assigned to view choice sets ranging from 4 to 64 online dating profiles, and they experienced comparable levels of satisfaction and enjoyment regarding the process across the choice set size conditions. It is plausible that online daters do indeed become less satisfied with the search process as the number of browsed profiles gets into the hundreds or thousands, but additional research is required to address this issue.

Regarding the second question—whether large choice sets cause participants to employ lazier comparison strategies and, consequently, alter their mating decisions—several studies suggest that participants become cognitively overwhelmed as choice sets of potential partners grow larger. For example, participants were more prone to memory confabulations, misremembering characteristics as present in a particular profile when they were in fact absent, when browsing 20 rather than 4 online dating profiles (Lenton et al., 2008). In addition, as choice set size increased from 4 to 24 to 64 profiles, users increasingly switched from time-consuming choice strategies that examine and combine multiple cues (e.g., weighted averaging; Payne, Bettman, & Johnson, 1993) to more frugal choice strategies that examine few cues and do not make trade-offs among conflicting ones (e.g., "elimination by aspects"; Tversky, 1972) (Lenton & Stewart, 2008).

Speed-dating studies tell a similar story. For example, relative to speed-daters at smaller events (15–23 speed-dates), the "yessing" decisions of speed-daters at larger events (24–31 speed-dates) were less strongly predicted by characteristics that are relatively hard to elicit and evaluate, such as occupational status and educational attainment, and more strongly predicted by characteristics that are relatively easy to evaluate, such as height and weight (Lenton & Francesconi, 2010). Consistent with this evidence, participants exhibit stronger consensus regarding which potential partners are most appealing at larger relative to smaller events (Lenton, Fasolo, & Todd, 2009). This effect could readily emerge if speed-daters increasingly prioritized characteristics that required minimal cognitive resources to assess (e.g., physical attractiveness) and if speed-daters exhibited some level of consensus regarding which partners possessed such characteristics.

Regarding the third question—whether large choice sets cause participants to make mating decisions that are less closely aligned with their idealized mating decisions, perhaps undermining their chances of establishing successful relationships with potential partners on the dating site—recent studies suggest that the answer may be yes. For example, relative to participants browsing smaller choice sets of online dating profiles, participants browsing larger choice sets (whether comparing sets of 30, 60, and 90 or sets of 40 and 80) choose partners who diverge more from participants' own stated preferences (Chiou & Yang, 2010; Wu & Chiou, 2009; Yang & Chiou, 2010). In addition, larger choice sets cause participants to allocate their time poorly, spending too much time studying profiles of potential partners who are poorly matched to their stated preferences and too little time studying profiles of potential partners who are well-matched (Wu & Chiou, 2009).

These studies suggest that users make mating decisions that are poorly aligned with their stated preferences when they browse large choice sets of potential partners, which is consistent with the finding that they employ relatively careless cognitive strategies under such circumstances. However, critiquing users' mating decisions based solely upon the convergence of such decisions with users' stated preferences provides an incomplete analysis of the quality of those decisions; after all, a priori stated preferences may not reliably align with in-vivo preferences following face-to-face interaction (e.g., Eastwick & Finkel, 2008a; Eastwick, Finkel, & Eagly, 2011). As such, it is important to bring additional evidence to bear, from both within and beyond the romantic domain, to address whether large choice sets are likely to cause users to experience choice overload or diminished satisfaction with the choices they have made.

Several such studies are relevant. For example, a recent speed-dating study provided two suggestive findings (Lenton & Francesconi, 2011). First, as the variability of potential partners increased (across attributes like age, height, occupation, and education), speed-daters became increasingly likely to say "no" to 100% of their partners, echoing the choice overload effect in which supermarket shoppers failed to make a purchase when encountering a large array of jams. Second, as the variability of potential partners increased, speed-daters became decreasingly likely to say "yes" to those potential partners who were consensually viewed as appealing, echoing the careless decision effects in which online daters' mating decisions converged poorly with their stated preferences when encountering a large array of profiles. Although this speed-dating study focused on the variability of the choice set rather than its absolute size, it is likely that the mechanism underlying the effects in both contexts (large and variable choice sets) involves the complexity of the information the decision maker confronts.

Another speed-dating study addressed choice set size more directly (Fisman, Iyengar, Kamenica, & Simonson, 2006). Graduate students attended speed-dating events that varied in size from 18 participants (9 of each sex) to 42 participants (21 of each sex). As the size of the choice set increased—as speed-daters met a larger number of opposite-sex partners—they said "yes" to a smaller proportion of the potential partners, although the effect was limited to female speed-daters in this study. Specifically, women who attended speed-dating events at which they met a relatively small number of men (9–14) were over 40% more likely to agree to a follow-up meeting with any given potential partner than were women who attended events at which they met a larger number of men (15–21), an effect that is consistent with the choice overload effect.

No studies in the romantic domain have examined satisfaction with choices after selecting from larger versus small choice sets of potential partners, but research outside the romantic domain suggests that people are likely to be less satisfied when choosing from a larger choice set. For example, people who selected a chocolate from an array of 6 chocolates thought the chocolate tasted significantly better than did participants who selected their chocolate from an array of 30, and they chose to be compensated for their research participation in chocolate rather than in cash four times more frequently (48% vs. 12%; Iyengar & Lepper, 2000). Analogously, online daters choosing from relatively large (vs. small) choice sets may be less satisfied with the potential partners they select from those choice sets.

Of course, in the studies reviewed in this section, the large choice set condition was always operationalized with fewer than 100 choices, which is a far cry from the hundreds or thousands of potential partners that many online dating sites offer to users. We speculate that the effects reviewed in the preceding paragraphs would be, if anything, even stronger at such sites.

Do large choice sets make people less willing to commit to one person? A second possible consequence of offering users access to large rather than small choice sets is related to the first: Having immediate access to (the profiles of) so many potential partners might undermine users' willingness to commit to any one person. Indeed, a vast corpus of research demonstrates that the perception of and attention to potentially appealing alternatives to a current romantic partner is a strong predictor of both low commitment to that partner and eventual relationship breakup (Drigotas & Rusbult, 1992; Miller, 1997; Rusbult, 1983; for meta-analytic reviews, see Le & Agnew, 2003; Le, Dove, Agnew, Korn, & Mutso, 2010). Furthermore, people tend to exhibit stronger positive illusions regarding specific potential partners when they believe that access to alternative potential partners is scarce rather than plentiful (e.g., Gladue & Delaney, 1990; Pennebaker et al., 1979). As observed by Coren (2006), this tendency is likely to be accentuated by the constant availability of romantic alternatives through online dating sites: "And now, with globalisation, we actually have millions of partners to choose from. We end up frozen over the procedure, constantly refining and refining, certain that an even more congruent soul mate is waiting in the next personal column or on the next website" (para 13). These empirical findings and observations converge to suggest that the constant access to large numbers of potential partners might undermine users' willingness to commit, or to remain committed, to a particular partner.

Access—conclusion. Online dating sites offer a broad range of access that users would otherwise lack. In addition, they offer access in extremely convenient and flexible formats. These are two major benefits of online dating compared to conventional offline dating.

When shifting attention from the *presence* of the access provided by online dating to the specific *implementations* of this access, the degree to which dating sites benefit users becomes less clear. For example, providing access to potential partners via profiles artificially transforms three-dimensional people into two-dimensional displays of information, and it appears that something crucial is lost in the transformation. Although users are likely to detect which potential partners possess certain appealing qualities by browsing profiles, they may be incapable of determining which potential partners are uniquely suited to them. In combination, these factors can lead to a situation in which a small number of particularly appealing potential partners become deluged with first-contact requests, which can cause them to disengage from the process.

In addition, evaluating multiple potential partners nearly simultaneously, rather than evaluating one at a time, is likely to alter users' decision processes in a manner that could potentially undermine their romantic outcomes with a particular potential partner. People tend to prioritize different qualities when conducting joint evaluation (as in browsing) than when conducting separate evaluation (as in determining whether a specific potential partner is appealing). As such, they might prioritize attributes during the browsing process that are irrelevant to, or perhaps even contradictory to, the attributes that will actually make them happy once a face-to-face relationship starts to form.

Finally, online dating sites frequently offer users a whole lot more than simply "more than one" potential partner; they frequently offer hundreds or thousands of them. Indeed, and perhaps ironically, one of the most prominently advertised features self-selection sites use to lure singles is immense numbers of available partners. Online daters are likely to find the process of browsing through so many profiles cognitively laborious, which may decrease their level of interest in any specific potential partner during the browsing process—and it might ultimately undermine their levels of happiness with and commitment to a potential partner once a relationship moves offline.

In short, online dating sites offer extensive and convenient access in ways that were virtually nonexistent in conventional offline dating. These considerable advantages are mitigated somewhat by the widespread emphasis on introducing users to potential partners through profiles, which fail to capture the essence of a person. Fortunately, dating sites provide more than access to new potential partners; they also provide a convenient means of communicating with those partners via CMC—as a means toward the goals of learning more about potential partners and perhaps ultimately setting up a face-to-face meeting.

Service #2—communication: Does the communication offered via online dating yield superior outcomes?

Outside of online dating, it is possible but rare that people would have a chance to communicate with each other before meeting in person; for example, two people who have agreed to a blind date might need to correspond to determine an initial meeting location. However, users of dating sites are certain to correspond via CMC before meeting in person. Is CMC simply a logistical necessity in the early phases of an online dating relationship, or might engaging in CMC before meeting face-to-face have implications for the initiation and development of relationships as the users move offline? Research that spans the fields of communication, social psychology, and relationship science suggests that the widespread use of CMC in online dating may have significant, if not always intended, implications for the character and success of offline relationships that may follow.

This section on the communication service of online dating addresses two questions. First, can CMC foster intimacy and liking between strangers? Second, can CMC substitute for face-to-face interaction? Throughout this section, we compare CMC to face-to-face interaction within the context of the get-acquainted process, and we review research from both romantic and nonromantic contexts. We place less emphasis on the differences between alternative forms of CMC (e.g., e-mail vs. instant messaging), as these comparisons remain "considerably undertheorized and understudied" (Walther, 2010, p. 495).

Can CMC foster intimacy and liking between strangers?

Today, many people are comfortable with the idea that actual social relationships can form and persist online (Madden & Lenhart, 2006). But when CMC first became widely available with the advent of networked computer systems in the 1970s and the proliferation of dialup bulletin board systems in the 1980s, scholars and laypeople alike were dubious that CMC could foster a meaningful social connection, let alone that actual relationships could emerge without some face-to-face contact. Early research tackled this topic by examining the ability of workgroups to achieve consensus and to make decisions effectively when meeting over a computer network versus via traditional face-to-face interaction (e.g., Kiesler, Siegel, & McGuire, 1984; for a review, see Baym, 2006). Confirming skepticism about the relationship-building potential of CMC were the findings that, in computer-mediated compared to face-to-face settings, people (a) were more likely to behave in a task-oriented, impersonal manner and also (b) exhibited more disinhibited and counternormative behaviors, such as flaming (i.e., the expression of strong and inflammatory opinions; Hiltz, Johnson, & Turoff, 1986; Siegel, Dubrovsky, Kiesler, & McGuire, 1986). These findings suggested multiple possibilities: Relative to face-to-face interaction, CMC might not foster relationship formation because of the reduced informational feedback and/or because a sense of depersonalization freed people from adhering to standard social norms (Kiesler et al., 1984).

Cues-filtered-out is an umbrella term that describes these early findings (Culnan & Markus, 1987). Building on earlier telecommunications research (e.g., Daft & Lengel, 1984; Short, Williams, & Christie, 1976), the cues-filtered-out perspective suggested that because CMC possesses fewer nonverbal (e.g., dress, facial expression, posture, mimicry), contextual, and auditory cues than face-to-face interaction does, it offers a reduced experience of social presence. Furthermore, because these reduced cues cause CMC to feel unlike "real" interaction to the user, people are more likely to engage in impersonal, asocial forms of communication and may even exhibit more uninhibited, antisocial tendencies than they would in face-to-face settings. In short, cues-filtered-out suggests a three-step process: (a) Reductions in the number of available nonverbal and contextual cues will (b) diminish people's experience of social presence and use of intimate, social communication, thus (c) hindering people's ability and desire to form social connections

(see also Rice & Love, 1987). Thus, the cues-filtered-out perspective generated little confidence that CMC could foster real relationships, much less deeply intimate romances.

New theories that emerged in the 1990s challenged the cues-filtered-out perspective, taking specific aim at the presumed link between the number of available cues and the use of social forms of communication—link (a) to (b) in the previous paragraph. Especially noteworthy was a meta-analysis of this early research by Walther, Anderson, and Park (1994), which found that users assigned to have a discussion using CMC were less likely to engage in friendly, social forms of communication than face-to-face discussants *only* when the discussions were time-limited. When discussions had unrestricted time frames (as would a fledgling relationship), CMC and face-to-face communication formats did not differ in the relative amount of social communication elicited. Walther and colleagues (1994) interpreted these findings in the context of social-information-processing theory (Walther, 1992; Walther, 1995), which suggests that people communicate social information within the limitations of the medium. In other words, because humans are naturally social creatures, they will use the communicative tools they have at their disposal to connect with one another even in the absence of nonverbal and other socially relevant cues. For example, CMC users consider the social information inherent in the timing of responses (Walther & Tidwell, 1995): Fast (vs. slow) e-mail responses communicate greater warmth and social support (Ledbetter, 2008). Social information can also be conveyed through emoticons (Derks, Bos, & von Grumbkow, 2007) as well as language style and word choice (Walther, Loh, & Granka, 2005). Even though many early influential theories of relational development more or less assumed that at least some amount of face-to-face contact was required for intimacy to emerge (e.g., Altman & Taylor, 1973), modern communications perspectives recognize that CMC permits the exchange of a great deal of social information and that intimate relationships can indeed be forged through CMC (A. Cooper & Sportolari, 1997; Lea & Spears, 1995; Merkle & Richardson, 2000).

In fact, as research paradigms have shifted away from the study of workgroups and toward dyadic interactions, the emerging consensus is that CMC may foster *more* social presence, and hence more intimacy and desire for social connection, than face-to-face settings (Antheunis, Valkenburg, & Peter, 2007; Joinson, 2001; Schouten, Valkenburg, & Peter, 2009; L. C. Tidwell & Walther, 2002; Valkenburg & Peter, 2009a; Valkenburg & Peter, 2009b). These findings are consistent with the *hyperpersonal* perspective (Walther, 1996), a special case of social-information-processing theory that highlights several features specific to CMC that can increase the likelihood that people will form positive online impressions relative to face-to-face interactions. On the part of the message sender, many forms of CMC provide enhanced control over the communication process; because people can edit and revise text-based messages, they have more opportunities to present themselves in a strategic manner to convey a highly

socially desirable image (Goffman, 1959; Walther, 1996, 1997). Such strategic self-presentation might entail contextualizing negative information in a positive light, selectively revealing negative information over time, actively suppressing negative information, or presenting an impression that reflects one's ideal self or true self rather than one's actual self (Ellison et al., 2006; McKenna, Green, & Gleason, 2002). Also, the absence of nonverbal channels of communication in CMC might cause people to compensate (Argyle & Dean, 1965) by making more intimate disclosures in CMC than face-to-face and, consequently, accelerating intimacy (Altman & Taylor, 1973; Reis & Shaver, 1988).

Hyperpersonalization processes may also take place in the mind of the message recipient: Text formats are frequently limited in the amount of information they convey, and perceivers are likely to elaborate on or fill in the gaps using their own mental schemas or other known information about the sender, such as shared category membership (Spears & Lea, 1992). Although schemas, such as attachment representations (Baldwin, 1992, Bowlby, 1969), can cause people to interpret interpersonal information to be more negative than reality (Walther, 1997), in the context of initial communication with a potential romantic partner, people on average will tend to confirm their hopes and positive expectations. For example, a sender might mention "loving the outdoors," and the receiver interprets this disclosure to mean "I love 'roughing it' in the wilderness" as opposed to the sender's intention of "I love ski weekends in Aspen." Thus, when a liked other sends an ambiguous text-based message, the perceiver may interpret that ambiguity in a desired light, and ultimately this may lead the perceiver to have an exaggeratedly favorable view of the sender. In fact, manipulations of the extent of a partner's self-disclosure have a larger effect on a perceiver's feelings of intimacy in CMC than they do in face-to-face interactions (Jiang, Bazarova, & Hancock, 2011). Furthermore, mediational analyses have suggested that this effect is due to the perceiver's optimistic over-interpretation of the limited CMC cues: Perceivers in CMC (relative to face-to-face) contexts are more likely to believe that the self-disclosures are due to unique qualities of the dyadic relationship (Jiang et al., 2011).

In summary, CMC encourages message senders to engage in strategic self-presentation and to make intimate disclosures, and it also encourages message recipients to form positive impressions of the senders. Taken together, these features cause many dyads to experience greater attraction and intimacy after interacting via computer compared to dyads meeting and interacting face-to-face (Jiang et al., 2011; McKenna et al., 2002; L. C. Tidwell & Walther, 2002; Walther, 1996; but see Okdie, Guadagno, Bernieri, Geers, & Mclarney-Vesotski, 2011).

However, even if online dating CMC services permit users to engage in more self-disclosure and to form more positive impressions than would occur in face-to-face communication among their offline counterparts, ultimately, the goal of most online daters is to meet in person to assess the potential for forming an offline relationship. Although the communication

process at some sites, particularly eHarmony, can prolong the initial CMC period, most online daters try to move the relationship offline quickly—65% of participants in one sample typically did so within a week of initial CMC contact (Whitty & Carr, 2006). Therefore, the research on differences between CMC and face-to-face impression formation that would be most relevant to online dating involves procedures that examine participants' impressions when they first meet through CMC and then later transition to face-to-face interaction (sometimes called a "mixed-mode relationship"; Walther & Parks, 2002). Thus, the (small) literature on *modality switching* is especially relevant to the communication service offered by online dating sites. This literature addresses how people's impressions change when an initial CMC interaction is followed by a face-to-face interaction.

Conceivably, the modality switch from CMC to face-to-face could be associated with increases in impression positivity on average (an "enhancing" hypothesis). Some scholars have suggested that even a brief CMC interaction (e.g., 40 minutes) fosters the ability to express one's true self better than a similarly brief face-to-face interaction (Bargh, McKenna, & Fitzsimons, 2002), and CMC may be especially likely to have this true-self-revealing effect for socially anxious and lonely individuals (McKenna et al., 2002). It is therefore plausible that online dating communication services could build a substantive foundation for a relationship: People's CMC-revealed inner beauty could outshine social deficits or unappealing physical qualities, thus permitting subsequent face-to-face interaction to promote relationship growth (A. Cooper & Sportolari, 1997). Alternatively, a user could form an exaggeratedly positive or overly specific impression of a potential partner through CMC, perhaps because the potential partner engages in deception or because the user overinterprets CMC-limited cues in a favorable or overly definitive light. In this case, an initial face-to-face interaction may provide discouraging disconfirmation of an idealized or overly particular image (D. Jacobson, 1999; see also Aronson & Linder, 1965; Thibaut & Kelley, 1959). According to this perspective, people's impressions might become more negative with the switch from CMC to face-to-face interactions (a "devaluing" hypothesis).

Recent research has supported the enhancing hypothesis and partially supported the devaluing hypotheses, with one key moderating variable being the length of time between the initial CMC encounter and the initial face-to-face encounter. McKenna and colleagues (2002) found support for the enhancing hypothesis: Participants' impressions of an opposite-sex individual improved between an initial online chat session and a subsequent face-to-face interaction, and these improvements were not found for participants who met face-to-face continuously. However, the time frame of this study was short: Each interaction lasted for 20 minutes, and the entire study was concluded in one laboratory visit. A series of studies by Ramirez and colleagues has replicated this enhancement pattern when the switch between CMC and

face-to-face interaction (regarding a set of collaborative tasks) took place after participants had initially communicated by e-mail for 3 weeks (Ramirez & Wang, 2008; Ramirez & Zhang, 2007). However, when the switch took place at 6 weeks, the devaluing pattern started to emerge: Participants' attraction to their partners after a face-to-face interaction was lower than in the 3-week condition, and it was about equal to the no-CMC condition. In other words, face-to-face interactions may produce increases in impression positivity following a brief period of CMC communication, but these benefits disappear following a longer period of CMC communication (cf. Brym & Lenton, 2003).

Both of these effects are consistent with the hyperpersonal perspective (Walther, 1996). CMC affords intimate disclosures and perhaps even the expression of the true self (Bargh et al., 2002; McKenna et al., 2002), and these benefits of CMC can provide the foundation for subsequent relationship development as long as the face-to-face reality check follows somewhat quickly. However, additional time spent using CMC without a reality check may allow strategic self-presentation (on the part of the message sender) and idealization or particularization (on the part of the perceiver) to continue unabated, and the subsequent face-to-face interaction could produce unpleasant disconfirmation of the perceiver's overly particular expectations. Indeed, Ramirez and Wang (2008) provided some evidence that participants' sense of expectancy violation (e.g., "my partner's behavior was not at all expected") was associated with the devaluing pattern observed when the face-to-face switch happened after 6 weeks of CMC rather than after 3 weeks. However, it is important to note that in no condition were participants' impressions worse when face-to-face interaction followed CMC than when participants met face-to-face without first meeting through CMC (McKenna et al., 2002; Ramirez & Zhang, 2007). Thus, for the benefits of CMC to translate to an offline relationship, the modality switch should take place fairly quickly; with a late modality switch, the benefits of CMC can be offset by unpleasant expectancy disconfirmation.

In short, the nascent literature on modality switching suggests that the CMC services offered by online dating sites may encourage the development of intimacy and attraction better than conventional offline dating avenues. However, users might benefit from making the transition to face-to-face interaction relatively quickly, as any benefits of CMC seem to disappear if interactants rely on CMC for too long as a substitute for face-to-face interaction.

Why is CMC not a substitute for face-to-face interaction?

Even though CMC can foster intimacy and liking, it does not necessarily follow that CMC can substitute for face-to-face interaction. Indeed, the research reviewed above demonstrated theoretically meaningful differences between face-to-face interactions and text-based information presentations, including CMC (Eastwick, Finkel, & Eagly, 2011; Ramirez & Zhang, 2007). In other words, there seems to be some face-to-face reality that is inaccurately or incompletely communicated

over CMC. One likely consequence of this disconnect is that few people would be willing to start a romantic relationship without having had a face-to-face interaction (Whitty & Carr, 2006). Why would some information about a person be especially important or apparent in face-to-face interactions?

For one thing, it is easier to misrepresent oneself when interacting over CMC than it is when interacting face-to-face. That is, it may be relatively easy to be deceptive about certain topics using CMC, and, as noted previously, users of dating sites could be motivated to deceive in the service of impression management. Although people will sometimes misrepresent their occupations, education, or interests online (Caspi & Gorsky, 2006; Whitty, 2002), visible characteristics like age and appearance are easier to misrepresent over CMC than in face-to-face interactions (Cornwell & Lundgren, 2001). Finally, although users may engage in deception for a variety of reasons (e.g., protecting one's identity; Utz, 2005), people report that they are more likely to tell self-serving lies over e-mail than over the phone and in face-to-face interaction (Whitty & Carville, 2008; but see Hancock, Thom-Santelli, & Ritchie, 2004). Partially due to this heightened potential for deception online, most users seek face-to-face verification before forming an offline relationship.

Deliberate deception is unlikely, however, to account for the entire difference between online and offline impression formation. Even when deception is not an issue, face-to-face interaction still conveys information that cannot be gleaned readily from CMC. In particular, CMC is unlikely to convey experiential attributes as effectively as face-to-face interactions (Frost et al., 2008). Although CMC can provide greater depth and texture than online profiles can, even the most information-rich versions of CMC are unlikely to achieve the richness of face-to-face interaction. In a face-to-face interaction, people make gut-level evaluations—momentary, affective reactions to each other—that derive from their own holistic integration of a potential partner's innumerable experiential parts (Eastwick, Finkel, & Eagly, 2011). As one online dater artfully put it: "The whole warm complex animal gestalt of her was unlike anything I could've gleaned from e-mails or jpegs. The difficult love in her voice when she talked about her father contained a compressed terabyte of information" (Kreider, 2011, para. 16).

Consistent with Asch's (1946) Gestalt theory of person perception, participants in the Eastwick, Finkel, and Eagly (2011) research tended to reinterpret the potential partner's searchable traits to be consistent with their experiential impressions after the face-to-face interaction. For example, a participant who did not desire an "outspoken" romantic partner might have interpreted outspoken to mean "tactless" when examining a potential partner's profile, but after a positive experience with this partner, outspoken might be reconstrued as "frank." The experiential information provided by the live interaction caused participants to reinterpret the meaning of the information contained on the profile. In this way, experiential information may drive the relationship-initiation process; in fact, most

people in Western cultures consider gut-level, emotional evaluations of partners to be an essential component of the decision to initiate and pursue a romantic relationship (Levine, Sato, Hashimoto, & Verma, 1995; Simpson, Campbell, & Berscheid, 1986).

We hasten to note, however, that the virtual-date paradigm (Frost et al., 2008) may narrow the gap between traditional forms of CMC and face-to-face interaction by combining chat features, avatars, and a navigable visual environment. Some dating sites (e.g., Weopia) feature virtual dates, and other sites (e.g., SpeedDate) seek to approximate live face-to-face interactions through the use of webcam chats. These newer CMC methods may offer online daters the best possible opportunity to assess experiential information about potential romantic partners over the Internet, even though they are unlikely to achieve the level of nuance and texture emerging from face-to-face interaction.

Another reason why CMC is likely to differ from face-to-face interaction is that people may evaluate the same attribute, even a searchable trait like physical attractiveness, differently in CMC than in face-to-face contexts. For example, people differ in the extent to which the physical attractiveness of a potential partner's photograph inspires their romantic desire for that partner, and this individual difference is associated with their explicitly reported preference for physical attractiveness. That is, someone with a strong explicit preference for physical attractiveness is more likely than someone with a weak preference to be romantically inspired by the physical attractiveness of a potential partner's profile photo (Wood & Brumbaugh, 2009). However, people also have spontaneous, affectively based preferences (i.e., implicit preferences), and these implicit preferences tend to be uncorrelated with their explicit preferences (Eastwick, Eagly, Finkel, & Johnson, 2011). That is, participants' spontaneous affective associations regarding physically attractive partners do not necessarily correspond to whether they say they ideally want a physically attractive partner (an explicit preference). Furthermore, implicit (but not explicit) preferences for physical attractiveness predict the extent to which participants find physical attractiveness appealing in face-to-face interaction partners (Eastwick, Eagly, et al., 2011). Implicit preferences are more likely to be associated with momentary feelings or gut reactions (Gawronski & Bodenhausen, 2011; Ranganath, Smith, & Nosek, 2008), and thus this research suggests that gut-level feelings about a potential partner take on increased importance in face-to-face interaction relative to CMC contexts.

Thus, the task of an online dater is more difficult than simply assessing searchable traits online, assessing experiential traits face-to-face, and then summing up the two impressions to form a romantic judgment. Instead, aspects of a potential partner that seem promising on a profile or over CMC can leave negative impressions in person, and vice versa. Furthermore, some aspects of one's romantic impressions are largely unknowable until a face-to-face interaction has occurred; gut-level evaluations are crucial and are more likely to be relevant in face-to-face than in CMC contexts (Eastwick, Eagly, et al., 2011). Until CMC procedures can effectively approximate live interaction, communication services offered by dating sites are unlikely to replace face-to-face interactions as a complete source of romantic impressions.

Communication—conclusion. Taken as a whole, what does the scholarly literature say about the potential of communication to yield success in the online dating realm? People can convey a substantial amount of social information using CMC, and so online profiles, e-mail, and chatting features are all likely to aid users in the romantic-impression-formation process. There are two important caveats, however. The first is that the time frame between the initial CMC interaction and the initial face-to-face interaction is likely to be important. When this time frame is short, users' face-to-face impressions may be more positive than they would be if no CMC had taken place, perhaps because CMC facilitates sharing of the true inner self and provides a strong foundation for a relationship (McKenna et al., 2002; Ramirez & Zhang, 2007). Thus, communication services offered by dating sites have the potential to produce superior romantic outcomes relative to conventional offline dating avenues. However, if the time between the initial CMC interaction and the initial face-to-face interaction is too long (e.g., 6 weeks in the research of Ramirez & Zhang, 2007), CMC fails to provide this additional boost, perhaps because the face-to-face reality fails to live up to people's exaggerated or overly particular expectations.

The second caveat is that, despite the ability of CMC to convey social information, there is *something* that people must assess face-to-face before a romantic relationship can begin. Scholars are still working to identify exactly what that something is, but it appears to reside at the intersection of experiential attributes, chemistry, and gut-level evaluations—the myriad verbal and nonverbal factors such as sense of humor, rapport, interaction style, holistic impressions, and nonconscious mimicry that determine how comfortably two people interact and that are better conveyed face-to-face. Part of people's face-to-face emotional reactions could even be based on sensual experiences, like olfaction, that cannot be gleaned via CMC (e.g., Gangestad & Thornhill, 1998; Zhou & Chen, 2009). Also, people are less likely to misrepresent their observable, physical attributes in face-to-face interactions relative to CMC, so there is some wisdom in verifying these attributes face-to-face before an online romantic relationship becomes intimate.

On the surface, these modern perspectives on relationship initiation may seem to echo the cues-filtered-out perspective, but this similarity is largely cosmetic. Cues-filtered-out proposed that the missing cues in CMC would lead to less social presence and a reduced ability to form social connections, but that hypothesis has not held up to empirical scrutiny. But CMC does indeed "filter out" nonverbal and other cues, and these other cues affect people's desire to form a relationship. Thus, the best conclusion is not that face-to-face interactions offer

better (or worse) potential for forming social connections relative to CMC, but rather that the two forms of communication offer overlapping yet complementary sets of information, and a person must integrate both into a coherent impression of a potential partner before establishing a romantic relationship. As the great social psychologist Stanley Milgram (1984, p. 411) put it with astonishing prescience:

> But there is a vital limitation to computer-network affairs: the participants can only go so far on a computer screen. . . . Eventually the involved parties must go beyond the computer, meet face-to-face, and deal with their full complexity as human beings.

Service #3—matching: Does the matching offered via online dating yield superior outcomes?

As noted previously, dating sites vary in the degree to which they market themselves in terms of the access to potential partners versus in terms of the quality of the matches they provide. Sites that emphasize access position themselves as relationship supermarkets, where they advertise the range of their wares. In contrast, sites that emphasize matching services position themselves as real estate agents of love, where they advertise their experience and expertise. For those in the market for a new home, the enormous investment, the wide range of available properties, and the complexities of evaluating a home drive many to seek the services of real estate agents, whose knowledge of the inner workings of the market and developed powers of discernment are presumed to offer them insight that most home buyers lack. For those in the market for a new relationship, a similar dynamic presumably attracts users to matching sites. Initiating a new relationship, like buying a home, is a major investment, and the complexities of evaluating a potential partner are great. Those who sign onto matching sites are trusting in the expertise of the site to navigate those complexities more effectively than they could on their own. Sites offering matching frequently encourage this trust by featuring experts and invoking scientific research prominently in their marketing materials. In the present section, we compare the procedures employed by matching sites with the existing literature on predicting and understanding romantic outcomes to evaluate whether there is a strong empirical basis for believing that these procedures are likely to be successful in matching partners who are especially compatible.

Is there a solid empirical or theoretical basis for matching? As observed previously, dating sites, especially matching sites, frequently make bold claims about the effectiveness of their procedures for helping users find relationship partners with whom they will experience positive romantic outcomes, but the evidence supporting these claims is insufficient to evaluate their validity. In this section, we review the relationships literature to evaluate whether it is possible, in principle, to collect information about two people who have never met and establish whether they are uniquely compatible, not only initially but also over the long run—as marriage partners or even soulmates. Our approach enables us to circumvent the challenges arising from the proprietary nature of most matching sites' algorithms. Our goal is not to critique any specific algorithm but rather to evaluate whether even an optimal algorithm can account for more than a very small amount of the variance in predicting positive romantic outcomes, especially over the long run.

What are the possible outcomes of successful matching? Collectively, matching sites promise to facilitate two different outcomes, and in so doing, they set themselves a high bar for success. First, they promise to identify partners with whom users are likely to experience a romantic spark. Second, they promise that those same partners are individuals with whom users are likely to experience a satisfying and lasting long-term relationship. The sites themselves rarely distinguish between these outcomes, accepting the implicit assumption that the more one is attracted to someone initially, the more likely a long-term relationship with that person is to succeed. This is not a position that requires much defending, as it expresses what most laypeople already believe (Simpson et al., 1986), and, indeed, it is consistent with our definition of "positive romantic outcomes." However, these two outcomes, although correlated, are distinguishable, which means that matching for initial attraction (e.g., a sexual spark on a first date) and matching for long-term relationships (e.g., a long-term, satisfying marriage) may be very different endeavors.

How compelling is the empirical and theoretical basis to support successful matching? Among the online dating sites that use proprietary algorithms to identify suitable partners, some explicitly promote their ability to match users for their potential to experience an initial romantic attraction to each other, regardless of whether that initial spark is likely to lead to a successful long-term relationship. For example, Chemistry.com (2011, para. 3) makes plain that:

> We know some of our competitors want you to believe they hold the formula for who you're compatible with and who is right for you. We at Chemistry.com know that only you know who is right for you. So we make it fun and easy for you to take the first steps in figuring out who that is before you meet in person.

In other words, they are promising that their algorithms will facilitate an easy first step, not a lifetime of happiness. Nevertheless, as we have highlighted earlier, the existing empirical literature raises serious questions about whether the initial romantic attraction between two people can be predicted reliably on basis of their responses to online profiles. Indeed,

what people say they are attracted to imperfectly represents what they are actually attracted to, and what attracts people to a written profile differs from what attracts them to an individual in person (Eastwick & Finkel, 2008a; Eastwick, Finkel, & Eagly, 2011). Both of these issues contribute to the long-standing difficulty of predicting romantic attraction between strangers (Lykken & Tellegen, 1993).

What we have not yet discussed is research relevant to the second possible goal of matching sites: arranging successful long-term relationships. Whereas Chemistry says to its users "You want to go on great dates" and makes no explicit promise beyond that, sites like eHarmony announce, "We deliver more than just dates" (eHarmony.com, 2011e, para. 1). The eHarmony homepage claims that "We've conducted years of extensive research and know what makes relationships last" (eHarmony.com, 2011a, para. 1 under the "Why Join eHarmony" tab). A lasting relationship, not just great dates, is the outcome that eHarmony promises and is the measure of the success of its algorithm. This promise is more in keeping with matchmaking services prior to the Internet era, when couples were expected not necessarily to love each other at first sight but rather to live together successfully for the rest of their lives.

Is there an empirical basis for predicting the long-term success of intimate relationships? If so, how well does that literature map onto the factors being used as the basis for Internet matching?

i. How predictable are long-term romantic outcomes? Before discussing the specifics of what predicts long-term romantic outcomes, we must first consider the extent to which long-term romantic outcomes are predictable at all. Matching sites like eHarmony strongly imply that the likelihood of any two people having a successful intimate relationship is knowable in advance. In their pursuit of this goal, matching sites are standing on the shoulders of giants. Predicting the long-term success or failure of intimate relationships, and marriages in particular, has been called the "Holy Grail" of scientific research on relationships (R. E. Heyman & Slep, 2001, p. 473) and has been an explicit goal of this research since the first studies of marriage were conducted in the 1930s and 1940s (Adams, 1946; Burgess & Cottrell, 1939; Terman, 1938, Terman, 1948). Only in the past few decades, however, have researchers claimed to have made substantial progress toward this goal.

In research that received widespread media attention, Buehlman, Gottman, and Katz (1992) reported that they could, on the basis of interviewing a married couple and observing a relatively brief interaction, predict with 94% accuracy whether or not that couple would divorce over the subsequent 3 years. Later work with newlyweds reported comparable levels of accuracy (greater than 80%) predicting divorce over the first 6 years of the marriage (Gottman, Coan, Carrere, & Swanson, 1998). Longitudinal studies by other research teams have reported comparably high levels of accuracy in predicting marital outcomes (e.g., Rogge, Bradbury, Hahlweg, Engl, & Thurmaier, 2006).

Such findings might be taken as encouragement for the developers of matching algorithms, as they suggest the existence of a set of variables that, if they could be measured in advance, might distinguish between couples more or less likely to form successful long-term relationships. However, there are two important reasons that the results of longitudinal prediction studies of married couples may not provide a strong basis for attempts to match unacquainted strangers.

First, in a trenchant critique of this literature, R. E. Heyman and Slep (2001) explained that none of the marriage prediction studies actually predicts anything. All of these studies use the same general approach: They assess couples on a wide range of variables, follow them for a period of time, determine who divorces and who does not, and then use a computer program to identify the combination of variables assessed at baseline that best accounts for group membership at follow-up. This is not prediction but postdiction, and it is a perfectly valid way of identifying variables that might be important for understanding how relationships develop over time. The true accuracy of the prediction, however, can only be established by cross-validating the results—that is, taking the estimates obtained from postdiction in one sample and using them to predict outcomes in an independent sample. Longitudinal studies of marriage never do this, but R. E. Heyman and Slep (2001) drew from cross-sectional survey data to illustrate how cross-validation affects the accuracy of a predictive algorithm. In their data, their ability to account for whether or not an individual had experienced a divorce dropped substantially (from 65% to 21%) when estimates derived from one half of their sample were applied to the other half. This analysis raises concerns about the extent to which analyses of known outcomes from any one sample can support specific predictions about unknown outcomes in a separate sample, yet this is precisely what any legitimate matching algorithm would have to do.

A second reason that even the best longitudinal marital research may not offer much support for the validity of matching algorithms is that, even in a study in which the ability to predict where most relationships end up is relatively high, the ability to account for specific outcomes can be far lower. The problem, as R. E. Heyman and Slep (2001, p. 474) point out, is that "the predictive value of any measuring device will be low whenever prevalence itself is low." In the samples examined in research on married couples, divorce tends to have a low prevalence, and this can result in a highly accurate overall model that still does not identify the divorcing couples well. To illustrate this point, consider research attempting to account for divorce in a population in which the divorce rate is 7% per year. In a random sample of 100 couples from this population, 7 of them are expected to divorce annually. If, at the beginning of the year, a researcher simply predicts that all 100 of those couples will remain intact, the researcher will be correct for 93% of the sample—a highly accurate prediction even though the researcher has not the slightest ability to identify the specific couples who divorce. For dating sites, however, the situation is reversed; that is, most matched couples will fail to

connect. A dating site could therefore develop a highly predictive algorithm if it did no more than prevent pairings that are unlikely to succeed, as these constitute the majority of possible pairings. What matching sites care about most, however, is the outcome that is least likely to happen—successfully developing a relationship—and this is the outcome that is most difficult to predict. The existing literature does not inspire confidence in the ability of even the most accurate predictive algorithms to account for low-prevalence events.

Questioning the predictability of romantic outcomes does not undercut the considerable advances that relationship science has made in understanding the forces that contribute to the success or failure of relationships. As we will elaborate shortly, many of the important forces that contribute to romantic outcomes are well-established. The point of the preceding analysis, however, is to emphasize that understanding and predicting are two different goals, and success at one does not necessarily imply success at the other. By analogy, we might compare the understanding and prediction of romantic outcomes to attempts to understand and predict the stock market. Although economists know a great deal about how the stock market behaves and why, attempts to predict the behavior of the market at a specific point in the future have limited accuracy. Relationship scientists, like economists, have made great strides in identifying the determinants of their outcome of interest: relationship success or failure. Matching sites, however, are in the business of predicting the future success or failure of a particular couple, and there may be inherent limits to the ability of available scientific research to support that goal.

ii. On what basis can we predict romantic outcomes? To the extent that romantic outcomes are at all predictable in advance, on what basis might those predictions be made? Theories of intimate relationships and marriage have generally highlighted three broad classes of variables as reasons why these relationships succeed or fail (e.g., Huston, 2000; Karney & Bradbury, 1995). First, relationships are naturally affected by the *individual characteristics* of the partners (e.g., Kelly & Conley, 1987; Robins, Caspi, & Moffitt, 2000). These include all of the relatively stable aspects of two people, including not only their personalities but also their personal histories, attitudes, values, and backgrounds. Second, relationships develop as a function of the *quality of the interactions* between the partners (e.g., Gottman, 1994; Johnson et al., 2005). These include all of the ways that couples communicate, resolve problems, and support each other, as well as their emotional reactions to and interpretations of these behaviors. Third, relationships can be constrained or facilitated by the *circumstances* surrounding the couple (e.g., Conger, Rueter, & Elder, 1999; A. Thompson & Bolger, 1999). These include chronic and acute sources of stress and support, as well as the neighborhoods, cultures, and social networks within which couples are embedded.

These three broad classes of variables are not equally assessable by the methods adopted by matching sites. For example, whereas dyadic interactions play a central and explicitly causal role in several of the most influential theories of relationship development and treatment (e.g., social learning theories; N. S. Jacobson & Christensen, 1996; Weiss, 1978), and whereas the longitudinal studies of Gottman and his colleagues (e.g., Buehlman et al., 1992; Gottman et al., 1998) based their predictions primarily on observations of couples' interactions and behaviors, this entire class of variables is necessarily excluded from consideration by the algorithms used by extant matching sites. Matching algorithms are designed to predict romantic outcomes between individuals who have not yet met. Having never interacted, these potential couples therefore cannot provide interaction data on which to base a prediction about their future success or failure, despite the central importance of these variables in all contemporary models of relationships.

In contrast to their interactions, some aspects of the circumstances of a couple can be assessed before the partners have met. Socioeconomic status, for example, is a powerful predictor of romantic outcomes, such that divorce rates are nearly twice as high in low-income neighborhoods as in affluent neighborhoods (Bramlett & Mosher, 2002). Similarly, couples under financial stress have more trouble resolving conflicts effectively and, as a consequence, experience lower relationship satisfaction, compared to couples who are more financially stable (Conger & Conger, 2008). These concrete aspects of individuals' environments may be measured in advance of two people meeting and could be incorporated into an algorithm to predict, for example, that users from poorer neighborhoods, or users experiencing greater economic stress, will have a more difficult time forming and maintaining a lasting intimate relationship. Matchmaking sites do not appear to emphasize these sorts of economic issues in their algorithms (see our previous review of major sites' key matching principles), and, even if they did, it is not clear how they would do so. Moreover, because matching sites frequently charge substantial membership fees, it seems likely that the clientele for these sites draws disproportionately from among the more affluent, for whom financial stress is less acute and therefore may be less predictive.

An element of individuals' circumstances that matching sites surely do account for is geography. One of the earliest and most reliable findings in research on relationships is that lasting relationships are more likely to form between people who live near each other—people for whom it is relatively easy to meet in person and interact (Festinger, Schachter, & Back, 1950). Matching sites have integrated this finding into their designs, and all allow users to specify the geographic region within which they would be willing to search for a partner.

Yet, from the perspective of predicting romantic outcomes, data on many of the most important elements of a potential couple's circumstances are inaccessible in light of matching sites' data collection procedures. Classic and still-influential models of functioning in relationships and families (e.g., crisis

theory; Hill, 1949) emphasize that romantic outcomes are strongly determined by the extent to which couples experience chronic and acute stress and by the way couples cope with stressors when they arise. Although it is possible for couples to cope effectively with stress and thus grow closer, stress generally increases opportunities for conflict even as it decreases a couple's capacity to resolve conflict effectively (Neff & Karney, 2009). As a consequence, the experience of stress is a reliable and significant predictor of negative romantic outcomes across a wide range of domains. For example, couples coping with unemployment (Charles & Stephens, 2004), infertility (Monga, Alexandrescu, Katz, Stein, & Ganiats, 2004), chronic illness (Teachman, 2010), incarceration (Lopoo & Western, 2005), or natural disasters (Cohan & Cole, 2002) are all at higher risk of experiencing declines in the quality and longevity of their relationships.

For a matching Web site attempting to predict the outcome of an intimate relationship in advance, anticipating the role that stress will play in the development of that relationship is limited for two reasons. First, many of the stressors that will affect the success or failure of a relationship arise from factors entirely outside of the partners' control and are unknowable in advance. A flood or a hurricane, an economic downturn or the closing of a factory, a sudden illness in a child or family member—all of these events may tax a couple's resources in ways that change the relationship, but their occurrence cannot be predicted. The presence of such events in couples' lives places an upper limit on the predictability of their romantic outcomes. Second, matching sites tend not to ask their users to report on the stressors they already or will likely experience. Generally absent from the assessments we reviewed, for example, were any questions about chronic illnesses or risk factors for developing chronic disease in the future (e.g., a history of substance abuse or clinical depression). Similarly absent were questions directly assessing financial stability, employment stability, or the likelihood of career advancement. Thus, even those aspects of stress that might be knowable are being overlooked, despite the presence of an extensive literature pointing to their importance for understanding relationship success and failure.

So, within the broad landscape of variables known to affect long-term romantic outcomes, on what information can matching sites assess and base their predictions? Only qualities of the individual, and this of course is where the assessments of matching sites focus most of their attention. Indeed, matching sites necessarily focus on qualities of individuals, because these qualities are what the sites are in the best position to assess before a couple's relationship begins.

To illustrate the contrast between what matching sites can assess and what they cannot, Figure 3 assembles the major themes of models predicting initial romantic attraction and long-term romantic outcomes into a single model, an extension of the vulnerability-stress-adaptation model of marriage (Karney & Bradbury, 1995). The model begins with two unacquainted individuals, Partner A and Partner B. Matching sites assume that, with adequate knowledge about these two

individuals, an algorithm can be developed to predict whether these individuals are likely to enjoy long-term relationship quality (i.e., fulfillment in the relationship) and, consequently, long-term relationship longevity (i.e., a relationship that persists over time). This assumption is depicted by the dotted paths in the figure. All the other paths in the figure, however, represent themes and paths of influence that matching algorithms necessarily overlook—that is, all of the processes and experiences that begin only after two unacquainted individuals have interacted for the first time. The figure thus makes clear that the qualities of two individuals are likely to account for only a small fraction of the variance in the long-term outcomes of a relationship. Even if the initial attraction between two people could be predicted accurately before they met, the course of their relationship would still be shaped by elements (i.e., external or uncontrollable events and individual change and maturity) that emerge over time and cannot be predicted in advance. To the extent that these paths of the model account for important variance in relationship success or failure—and decades of empirical research indicate that they do—then the neglect of those factors imposes another limit on the ability of any matching site to predict in advance which relationships will form and which will last.

iii. How well do partners' individual qualities predict their romantic outcomes? Given the inherent limitations of an approach to matching that excludes many of the elements most strongly associated with romantic outcomes, we may nevertheless ask how effectively long-term romantic outcomes can be predicted by the individual characteristics that matching sites do assess. Models to explain how the qualities of two individuals may account for the outcomes of a relationship between them generally adopt one of two perspectives, which we will call the *relationship aptitude* perspective and the *compatibility* perspective.

The premise of the relationship aptitude perspective is that, due to their traits, preferences, and personal history, some people are likely to have better relationships than others. The earliest research on marriage adopted this perspective and was explicitly designed to identify specific personality traits, values, and personal experiences that made people more or less likely to have successful marriages (e.g., Burgess & Cottrell, 1939; Terman, 1938). Research on adult attachment orientations (e.g., Fraley & Waller, 1998; Hazan & Shaver, 1987) continues in this tradition by suggesting that individuals possess relatively stable mental models of intimacy that they develop through interactions with their primary caregivers in early childhood. Attachment theory (Bowlby, 1969, 1973, 1980) suggests that those with sensitive, responsive caregivers are likely to develop secure models of attachment, which facilitate closeness with others in adulthood. In contrast, those with absent or unresponsive caregivers are likely to develop insecure models of attachment, which lead to anxiety about depending on others or avoidance of intimacy altogether in adulthood. What this perspective and all relationship aptitude models have in common is the idea that the capacity for
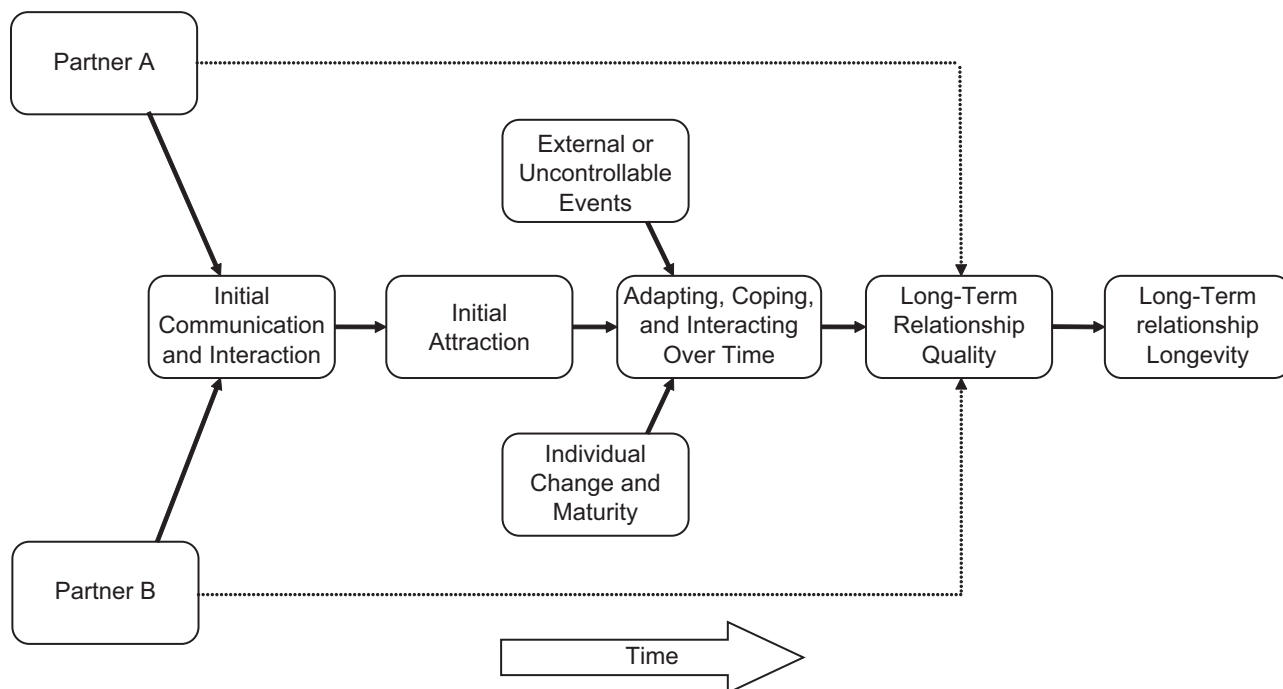
Fig. 3. A model of long-term romantic outcomes. The dotted paths represent the models implicit in matchmaking algorithms, which suggest that characteristics of two individuals measured prior to their meeting can directly predict the long-term outcomes of their relationship. The solid paths represent all of the intermediate steps and external sources of influence known to predict long-term relationship outcomes in addition to the characteristics of the two partners. To the extent that any of the constructs absent from matchmaking models are imperfectly related to or are independent of partners' individual qualities, then qualities of two individuals that can be measured before they meet are likely to account for only a small fraction of the variance in the long-term outcomes of a relationship.

successful intimate relationships is a relatively stable quality of an individual, regardless of who that individual's partner is.

An enormous body of research supports this view. For example, those early marriage studies successfully identified personality traits that were associated with more or less satisfying or enduring marriages over time (e.g., Adams, 1946; Terman, 1938). Over the subsequent decades, as theories of personality crystallized around the five-factor model (McCrae & Costa, 1997), research has examined each of the five factors for its cross-sectional and longitudinal associations with relationship processes and outcomes and has confirmed that most of them are associated with romantic outcomes in some way (Malouff, Thorsteinsson, Schutte, Bhullar, & Rooke, 2010; McNulty, in press). By far, the most consistent and extensive evidence has accumulated for neuroticism, defined as the stable tendency to experience negative emotions (Watson & Clark, 1984). In all of these studies, higher levels of neuroticism in either partner are associated with lower relationship satisfaction cross-sectionally (e.g., Bouchard, Lussier, & Sabourin, 1999) and declining satisfaction and greater risk of dissolution over time (e.g., Karney & Bradbury, 1997). Moreover, personality traits account for people's tendency to experience similar outcomes across different relationships (Robins, Caspi, & Moffitt, 2002), strong support for the idea that some traits are associated with less success in relationships regardless of the specific relationship partner. In a compelling

demonstration of this effect, the neuroticism of husbands and wives not only predicted their marital outcomes over 45 years later, but this effect swamped the effects of almost all other individual characteristics that they had measured (Kelly & Conley, 1987).

Aside from personality traits, other individual differences have also been identified as significant predictors of romantic outcomes. The predictions of attachment theory have been borne out in hundreds of studies showing that relatively stable orientations toward closeness and intimacy are reliably associated with outcomes in adult relationships (e.g., Holland, Fraley, & Roisman, 2011), even when attachment orientations are measured far in advance of the formation of a relationship (Roisman, Collins, Sroufe, & Egeland, 2005). Specific childhood experiences have been linked to adult romantic outcomes as well. For example, children whose parents were unhappily married or divorced are at greater risk for growing up to have unhappy relationships themselves (Amato & Booth, 2001; Feng, Giarrusso, Bengtson, & Frye, 1999). A history of psychopathology (Gotlib, Lewinsohn, & Seeley, 1998) and childhood experiences of abuse (Cherlin, Burton, Hurt, & Purvin, 2004) are also powerfully associated with greater difficulties forming and maintaining relationships in adulthood.

As a whole, research linking relatively stable individual differences to the long-term success or failure of relationships has several important implications for the prospects of

matching over the Internet. First, although the effects of individual differences are reliable and significant, they are generally small to moderate in size. In this literature, parental divorce, for example, has proven to be one of the variables with the highest impact, roughly doubling a child's risk for relationship difficulties in adulthood (McLanahan & Sandefur, 1994; Simons, 1996). Still, this leaves most of the variance in adult romantic outcomes unexplained. Similarly, as reliable as personality traits have been as predictors of romantic outcomes, a meta-analysis found that, across several longitudinal studies, even neuroticism, the personality trait with the largest effects on relationships, generally accounts for less than 5% of the variance in relationship satisfaction over time (Karney & Bradbury, 1995). Thus, although the characteristics of individuals matter to their relationships, history is not destiny, and for similar reasons neither is personality.

Second, this research nevertheless offers some empirical basis for making predictions about long-term romantic outcomes based on qualities of two individuals who have not yet met. Many of the individual differences that have been identified as predictors of romantic outcomes are easily and accurately assessed through self-reports. This ability to measure personality and personal history suggests a concrete, empirically based strategy for improving the likelihood of successful matching: Eliminate from the pool of potential partners those individuals most at risk for experiencing distressing or unstable relationships. By setting a high threshold for membership, subscribers to a site might be guaranteed a certain minimum level of quality in those they meet on the site and thereby an acceptable level of risk for relationships formed between any two individuals in the pool. Meeting potential partners through such a site would be analogous to joining an exclusive club, something that people have historically paid considerable sums to do.

Some online dating and matching sites are explicitly doing something like this already, turning away some of those who wish to subscribe because they fail to meet minimum criteria. For example, as we noted earlier, eHarmony rejects relationship seekers who are not judged to be "emotionally healthy" according to their criteria (eHarmony.com, 2011e). In response to a lawsuit, Match began screening out users who appear on registries of sex offenders (Stone, 2011). To the extent that screening in these ways eliminates users most likely to have relationship problems, these sites may be performing a valuable service, as most people cannot administer similar screens to the people they meet offline. However, this service also has several costs. First, because the individual-level markers of risk are far from perfect, such screens may eliminate some people unfairly and certainly may let through others who have risk factors that were not measured. Second, making this strategy public may motivate potential users to misrepresent themselves on the matching survey. Third, whereas elevating the quality of the dating pool may reduce the likelihood of grossly inappropriate matches, by itself this strategy falls short of the promise to match people who are uniquely suited to one

another. Fourth, this strategy may be harmful to those users whom the matching site rejects as unmatchable.

iv. How well does similarity between partners' individual qualities predict their romantic outcomes? The second group of models that link qualities of individuals to the outcomes of their relationships adopts the compatibility perspective. The compatibility perspective assumes that success in a relationship is a function of the unique combination of two individuals' qualities. Whereas the relationship aptitude perspective assumes that some people are more versus less equipped for successful relationships regardless of their partner, the compatibility perspective assumes that there is a suitable partner for almost everyone but that the same partner who is right for one person might be wrong for another. The relationship aptitude perspective and the compatibility perspective are not mutually exclusive. There can be traits that make a person more versus less likely to succeed at relationships generally, and at the same time there can be combinations of individual characteristics that uniquely predict the likelihood that two people will have a successful relationship. Indeed, widely available statistical techniques allow researchers to tease apart these effects within the same data (Kenny, Kashy, & Cook, 2006). Nevertheless, it is the compatibility perspective that most directly expresses what contemporary matching sites promise their users. For example, eHarmony famously promises that "every match is prescreened for deep compatibility with you across 29 dimensions" (eHarmony.com, 2011a). The implication is that the matches provided by the site are not just people who are likely to have good relationships but are those people who are likely to have a good relationship *with you*.

On what basis might the specific compatibility of two individuals be determined? As discussed previously and summarized in Table 2, by far the most frequently cited basis for compatibility is *similarity*. If birds of a feather are indeed happier when they flock together, one of the simplest things a matching site can do to create happy relationships is pair together partners who are like each other. The attractiveness of similarity was one of the first hypotheses studied in research on interpersonal relationships (Newcomb, 1956), and it has since received consistent support from research showing that matched strangers do in fact like each other more to the extent that they have (or at least *believe* that they have) more things in common (e.g., Byrne, 1961; Byrne, Ervin, & Lamberth, 1970). The widespread evidence for homogamy—the frequently observed tendency of spouses and relationship partners to be more similar to each other than to randomly matched strangers from the same population—has been taken as further support for the benefits of similarity (Blossfeld, 2009; Luo & Klohnen, 2005; Mare, 1991; Watson et al., 2004).

The relevant question for matching sites, however, goes beyond homogamy. For a matching algorithm based on similarity to predict long-term romantic outcomes, it must be demonstrated not merely that people are attracted to and tend to match up with similar others but that a greater degree of

similarity between two people predicts more satisfying and longer-lasting relationships over time. This is not an easy question to answer, for several reasons.

First, measuring similarity is surprisingly complicated. The perception of being similar to a partner is easy to measure, and indeed that perception is strongly associated with initial attraction and relationship satisfaction (e.g., Lutz-Zois, Bradley, Mihalik, & Moorman-Eavers, 2006; Montoya, Horton, & Kirchner, 2008). But perceptions of similarity are an imperfect proxy for actual similarity, and indeed may reflect relationship satisfaction rather than contribute to it (Morry, Kito, & Ortiz, 2011). In any case, perceived similarity cannot exist between two individuals who have yet to meet. Instead, to evaluate similarity, matchmakers must rely on either the difference approach or the profile approach. The difference approach is more straightforward: To estimate the similarity between two people on some dimension, researchers compare their scores on that dimension and consider smaller absolute differences to be signs of greater similarity (e.g., Luo & Klohnen, 2005). Among the limits of this approach, however, is the fact that, across multiple dimensions of comparison, positive and negative differences between individuals on different dimensions can cancel each other out, producing misleading results. To avoid this problem, researchers interested in comparing individuals on multiple dimensions at once typically rely on the profile approach, which calculates the correlation between the scores of two individuals across all of the dimensions assessed and treats a strong correlation as a sign of greater similarity (e.g., Glicksohn & Golan, 2001). The profile approach also has its limitations: The estimated similarity between two individuals will be inflated when their responses resemble the responses that most people typically give (Kenny & Acitelli, 1994). There are multiple ways to correct for this problem (Furr, 2008), but these corrections have been used sporadically in published studies. Perhaps as a result of the general inconsistency in the way that similarity has been operationalized, the results of research on the implications of similarity for romantic outcomes are "inconsistent and difficult to interpret" (Watson et al., 2004, p. 1035).

The second major problem for research on similarity and relationships is a lack of consensus on what dimensions of similarity are likely to matter most. Because human beings are complicated and multifaceted, two individuals who resemble each other in one way (e.g., they both love big parties) are unlikely to resemble each other in every way (political conservatism, a taste for Ethiopian food, ethnic background, openness to new experiences, etc.). The idea that similarity in general may facilitate successful relationships says nothing at all about which dimensions of similarity should be favored over others. In the absence of a clear theoretical direction, research on the implications of similarity has examined many possible ways that partners can be similar, obtaining varying results for different types of similarity.

Perhaps the clearest findings in this literature involve matching on demographic variables. For example, analyses of census data reveal that marriages between spouses of the same race or ethnicity have a lower divorce rate after 10 years than interracial or interethnic couples (31% risk vs. 41% risk; Bramlett & Mosher, 2002). In comparably large and representative samples, being of the same religious denomination has also been associated with longer-lasting marriages (Heaton & Pratt, 1990), and being similar in education, parental wealth, and earned income has been associated with happier marriages (Weisfeld, Russell, Weisfeld, & Wells, 1992). From the perspective of matching, however, such findings are not especially useful because (a) people who meet their spouse through more conventional approaches to dating tend to marry within their own demographic constellation in the first place and (b) matching on the basis of demographic similarity does little to narrow the range of potential partners for any one individual. That is, knowing that a person who is White, college educated, and Catholic is likely to be happier with another person who is White, college educated, and Catholic still leaves an unmanageable number of partners from which to choose. The rise of dating sites that cater specifically to a particular demographic niche (e.g., AveMariaSingles) only exacerbates this problem.

For this reason, discussions of matching tend to focus less on broad social groupings and more on psychological variables like personality. The underlying hypothesis is that individuals with similar styles of interacting with the world should find it easier to get along and so should experience more successful intimate relationships. Despite the appeal of this idea, however, the results of numerous studies examining it have been, on the whole, weak and contradictory. Several studies have reported positive associations between profile similarity, based upon multiple dimensions of personality, and concurrent or future relationship satisfaction (e.g., Decuyper, De Bolle, & De Fruyt, in press; G. C. Gonzaga, Campos, & Bradbury, 2007; G. C. Gonzaga, Carter, & Buckwalter, 2010). But other studies have found that, after controlling for the important main effects of each partner's personalities, the similarity between their personalities had only a negligible additional effect on their romantic outcomes (Glicksohn & Golan, 2001; Lewak, Wakefield, & Briggs, 1985; Luo et al., 2008; Luo & Klohnen, 2005; Robins et al., 2000; Russell & Wells, 1991; N. D. Tidwell, Eastwick, & Finkel, in press; Watson et al., 2004).

One of the most rigorous recent investigations of these effects puts the role of personality similarity into perspective (Dyrenforth, Kashy, Donnellan, & Lucas, 2010). In analyses of three large, nationally representative datasets from Australia, the United Kingdom, and Germany (total $N = 23,250$), each partner's personality accounted for approximately 6% of the variance in his or her own relationship satisfaction and between 1% and 3% of the variance in the other partner's relationship satisfaction. Controlling for these effects and using the most stringent methods for estimating similarity effects (i.e., profile matching of standardized scores), the similarity between partners' personalities accounted for an additional 0.5% of the variance in romantic outcomes, leading the authors to conclude that "actor and partner effects of personality are more robust and consistent than similarity effects when

predicting marital and life satisfaction" (Dyrenforth et al., 2010, p. 701). A meta-analysis of 313 studies that examined actual and perceived similarity in laboratory studies and studies of real couples reached a similar conclusion: Although similarity predicted attraction in the laboratory studies, the effect of actual similarity on satisfaction in existing relationships was not significantly different from zero (Montoya et al., 2008).

The inconsistent effects of personality similarity are not so surprising in light of the fact that some personality traits are distinctly negative. As noted earlier, the personality dimension with the strongest and most consistent direct effects on romantic outcomes is neuroticism. Given the abundant evidence that higher levels of neuroticism are associated with worse relationships, it is hard to imagine that similarity on this dimension (e.g., a couple in which both partners score high) would be preferable to a couple in which the total level of neuroticism across the partners was lower, regardless of similarity. In fact, with respect to negatively valenced personality traits, similarity between partners is clearly bad for relationships. For example, in research on dyadic interactions, similarity on introversion/extraversion predicts more effective communication, but similarity on disagreeableness predicts less effective communication, even after controlling for the main effects of each partner's personality (Cuperman & Ickes, 2009). In married couples, each spouse's depressive symptoms are consistently associated with lower marital satisfaction (e.g., Davila, Karney, Hall, & Bradbury, 2003), but after controlling for these effects, marriages in which both partners are depressed fare even worse (Whisman, Uebelacker, & Weinstock, 2004). On the flipside, the summed total of two partners' self-control, not their similarity on this dimension, predicts elevated relationship quality (Vohs, Finkenauer, & Baumeister, 2011). Thus, with respect to matching on personality, the relationship aptitude perspective seems to have more support than the compatibility perspective. The implication for relationship seekers and matchmakers is that finding a partner with a personality conducive to relationships is more likely to promote successful outcomes than is finding a partner with a personality similar to one's own.

The promise of similarity as a basis for successful relationships is clearer in research on attitudes and values. Whereas personality traits like neuroticism are "vertical attributes," in that partners with difficult personalities should be less attractive to everyone, many attitudes and values are "horizontal attributes," in that there is nothing inherently positive or negative about them. Most people would prefer partners high in vertical attributes like attractiveness, health, and wealth, but there is nothing universally attractive about horizontal attributes like voting Independent, loving foreign films, or reading science fiction (for a discussion of this distinction, see Hitsch et al., 2010a). We would therefore not expect each partner's endorsement of any specific attitudes or values to have any direct effects on the couple's romantic outcomes, but the similarity between partners on these dimensions could improve their relationship by reducing areas of potential conflict and opening domains of shared interest.

Although the tendency for partners within a couple to share their important attitudes and values (e.g., preferences, political views, spirituality) is strong and well-documented (e.g., D'Onofrio, Eaves, Murrelle, Maes, & Spilka, 1999; Nagoshi, Johnson, & Honbo, 1992), support for the idea that greater similarity on attitudes and values benefits relationships remains weak and inconsistent. Watson et al. (2004), for example, identified high levels of similarity in political orientation, religiosity, and life values among their sample of newlywed couples, but the degree of similarity on these dimensions was generally not associated with levels of marital satisfaction. An independent study of newlyweds found that similarity between spouses' preferences for how they spend their leisure time was associated with feelings of love among husbands but not among wives (Houts, Robins, & Huston, 1996). In a comparable study of longer-married couples, who presumably experience a wider range of romantic outcomes than newlyweds, similarity in life values was significantly associated with husbands' but not wives' marital satisfaction, and similarity on attitudes toward family issues was not associated with marital satisfaction for husbands or wives (Gaunt, 2006). A study of over 1,000 Chinese couples found stronger results, estimating that sharing intrinsic values (e.g., the importance of love, fairness, personal growth) accounted for 27% of the variance in wives' satisfaction and 28% of the variance in husbands' satisfaction (Luo et al., 2008), but no other study of these issues has obtained similarity effect sizes in this range.

One specific domain in which similar attitudes may be especially likely to facilitate successful long-term relationships is sex-role traditionalism. A long-term marriage between a man and a woman requires that they coordinate household chores, work outside the home, and childcare; all of these negotiations can be expected to go more smoothly for couples who share similar ideas about which partner should do what sort of work and how decisions within the home should be made. Indeed, spouses who share similar beliefs about gender roles do report higher satisfaction and lower levels of conflict in their marriages (Houts et al., 1996; Lye & Biblarz, 1993), and agreement on these issues is associated with more effective communication in observational studies as well (Overall, Sibley, & Tan, 2011).

In summary, what can we say about the empirical basis for matching based on similarity? The picture is mixed. On one hand, most people do end up paired with partners who strongly resemble themselves, at least in terms of demography and attitudes. On the other hand, once paired, it remains unclear whether the degree of similarity within the couple is associated with more versus less successful relationships over time. In the case of vertical attributes, the main effects of individual differences greatly outweigh any independent effects of similarity, and for negative attributes like depression, similarity is clearly detrimental. In the case of horizontal attributes like attitudes and values, similarity seems to be most powerful for

those values most directly associated with coordination within a family, including religion and attitudes toward sex roles. Thus, as a basis for compatibility in long-term relationships, similarity may be a beginning, but it is far from being the whole story or even a large part of the story.

From the perspective of evaluating matching sites, one limitation of this review is that it necessarily focuses on dimensions of similarity that have been examined in published empirical research. These dimensions may not map perfectly (if at all) onto the dimensions assessed by matching sites, such as the 29 dimensions advertised by eHarmony. Yet Lykken and Tellegen (1993) explained why research on additional dimensions is unlikely to improve the ability of similarity alone to account for the formation of successful long-term relationships. They observed that, even in a world where people benefit from similar partners, people are also likely to tolerate a range of difference in their partners, and indeed the average correlation between actual partners, although reliably significant, is rarely higher than .50 regardless of the dimension being assessed. Given that range of acceptable similarity, in an ideal case in which an individual had 10 completely independent dimensions along which to choose a similar partner, a search for partners who were within an acceptable range of similarity on all 10 dimensions would not go far in limiting the pool of available mates. In the real world, where the available dimensions that can be assessed are far from independent and in fact overlap highly within individuals, the ability of similarity matching to identify a uniquely suitable partner is even more limited. Describing the hypothetical case of a relationship seeker basing a search entirely on matching for similarity, the authors concluded as follows: "For our lonely bachelor . . . the entire literature on spousal similarity would eliminate not more than half the young women whom he encounters and will therefore leave him still unmated" (Lykken & Tellegen, 1993, p. 59). These authors, however, were writing before the current rise in the popularity of online dating. With the vastly wider range of potential mates that the Internet offers, the ability of similarity alone to narrow the field is even more limited.

To address this problem, matching sites could, and probably do, present users with access to only a handful of the possible options identified by their algorithms. Given the various adverse effects, discussed previously, of exposure to a large number of options, limiting the dating pool in this way is perhaps a wise decision. However, limiting the pool of compatible partners in a relatively arbitrary or random manner does not represent any great advance beyond the ways in which conventional offline dating has always limited the pool of potential partners.

v. How well does complementarity between partners' individual qualities predict their romantic outcomes? As noted earlier, similarity is by far the most frequently discussed and most thoroughly researched basis for compatibility in research on romantic relationships. But it is not the only basis. An alternative perspective on compatibility suggests that, at least

on some dimensions, couples benefit from their differences—from complementarity. In contrast to the idea that birds of a feather may flock together, the complementarity perspective suggests that, at least in some cases, opposites attract. More specifically, the sociologist Robert Winch (1958) proposed that, instead of being attracted to people like ourselves, we are actually attracted to people who possess valued personal qualities that we lack. Many people find this idea appealing, as it seems to describe successful couples in which one extravert partner is the life of the party while the introvert partner looks on, or in which one hard-headed, practical partner pays the bills while the free-spirited, nurturing partner cares for the children. Indeed, as discussed previously and in Table 2, complementarity has been explicitly named as informing at least part of the matching algorithms used by some matching sites (e.g., PerfectMatch, Chemistry), and it has been featured in recent popular books on romantic attraction and mate selection (Fisher, 2009).

Yet, despite decades of continued interest in complementary personalities, empirical evidence that differences between partners benefit relationships has been even harder to come by than evidence for the benefits of similarity (e.g., Klohnen & Luo, 2003; Markey & Markey, 2007). For example, there is no evidence that introverts are uniquely attracted to extroverts (Hendrick & Brown, 1971). More generally, there is no evidence that people are attracted to individuals with personality traits that they perceive to be lacking in themselves (Klohnen & Mendelsohn, 1998; Till & Freedman, 1978). Nor is there any evidence that couples are more satisfied when they have complementary attitudes (Aube & Koestner, 1995), interests (Houts et al., 1996), or spending habits (Rick, Small, & Finkel, 2011). Even research on sex roles fails to find that more psychologically masculine individuals benefit from more psychologically feminine partners (in fact, everyone benefits from more feminine partners; Antill, 1983). Research on complementarity has been reviewed repeatedly, and in every case the idea that complementary personalities might provide a basis for compatibility in romantic relationships has been dismissed as failing to describe the available data (e.g., White & Hatcher, 1984).

One reason that ideas about the benefits of complementarity for relationships persist despite decades of evidence to the contrary is that, within a relationship, two people who are basically similar to each other can adopt complementary roles (Levinger, 1986). For example, in randomly matched pairs of unacquainted females, those pairs in which one partner adopts a more dominant role than the other perform their assigned tasks more effectively (Dryer & Horowitz, 1997; Markey, Lowmaster, & Eichler, 2010). When the alternative is jockeying for position, it makes sense to accommodate our partners in this way. Indeed, when couples are experimentally placed in a situation that might invoke competition within the relationship, they tend to perceive more complementarity than when they are not in a competitive situation (Beach, Whitaker, Jones, & Tesser, 2001). Still, the complementarity in all of these studies is situational, not dispositional. None of this is of any use to matching

algorithms, which must evaluate compatibility between two people before they have entered a situation together.

Some scholars have drawn from research on the benefits of genetic diversity in other species (Bateson, 1983) to propose that a degree of genetic dissimilarity should be sought in a potential mate among humans as well (e.g., Penn, 2002). The argument is that, just as inbreeding increases the risk of off-spring born with severe recessive disorders, a preference for outbreeding, or selecting mates on the basis of their genetic diversity, should promote healthy offspring and should there-fore be selected for within a population. Within humans, this sort of argument has been applied specifically to research on a set of genes central to immune functioning called the major histocompatibility complex (MHC). MHC genes are more effective at producing antigens when they include more poly-morphisms—that is, when an individual receives different forms of the genes from each parent. If infants receiving dif-ferent copies of the genes therefore have healthier immune systems and are more likely to survive, then selection pres-sures should have led adults to identify and prefer to mate with individuals whose MHC genotype is different from their own (Grob, Knapp, Martin, & Anzenberger, 1998). In fact, several studies to test this idea have found that, when asked to smell t-shirts worn by possible partners who are MHC-similar or MHC-dissimilar, male and female research participants prefer the odor of the MHC-dissimilar partners (Thornhill et al., 2003; Wedekind, Seebeck, Bettens, & Paepke, 1995).

On the basis of these and related findings, the matching site ScientificMatch, which apparently shut down as we were making the final edits to this article, offered to test genetic material. This site promised that, after their algorithm identi-fied MHC-dissimilar mates, there would be an increased chance that users would "love the natural body fragrance of your matches" (ScientificMatch.com, 2011). It was an entic-ing promise, but recent reviews of the research on MHC in humans suggest that the benefits of MHC-dissimilarity are far from simple or clear. To date, evidence that real couples actu-ally choose each other on the basis of MHC-dissimilarity, which would be expected if humans have evolved to prefer for genetically dissimilar mates, has been inconsistent (Havlicek & Roberts, 2009), although one study found that MHC-dissimilarity is associated with greater sexual attraction between partners (Garver-Apgar, Gangestad, Thornhill, Miller, & Olp, 2006). Moreover, although men and women do prefer the odors of MHC-dissimilar others, it appears that they prefer the faces of MHC-similar others (Roberts & Little, 2008; Roberts et al., 2005). As will surprise no one, faces also play an enormous role in mate preferences (Little & Perrett, 2002). Thus, the current state of research on genetics and mate selection suggests that matching based on MHC-dissimilarity is, at best, premature.

Matching—conclusion. A review of the empirical literature on relationship functioning suggests that it is virtually impossible to succeed at the task many matching sites have set for themselves. On one hand, they can probably discern which people are likely to be relatively poor companions in most relationships by assessing stable individual differences like neuroticism and a history of substance abuse. Evidence that some people are better at sustaining intimacy than others, regardless of their partner, is strong and unequivocal. Assessing these characteristics can potentially act as a screening device, and this is a service that online dating sites are likely to perform far more efficiently and effectively than any individual can.

On the other hand, this screening service is far less than contemporary matching sites promise their users. Matching sites promise to identify potential mates who are uniquely compatible with their users, and this is a promise unlikely to have a great deal of empirical support, for multiple reasons. First, the promise assumes that compatibility effects on roman-tic outcomes are relatively large and that the bases of compat-ibility in relationships are well established. Neither of these assumptions is true. Second, and more troubling for the poten-tial of Internet matchmaking, research on intimate relation-ships suggests that there are inherent limits to how well the success of a relationship between two individuals can be pre-dicted in advance of their awareness of each other. Many of the strongest established predictors of romantic outcomes emerge only from the interactions between two people or from the way they respond to unpredictable and uncontrollable events that have not yet happened. Consequently, the best-established predictors of how a romantic relationship will develop can be known only after the relationship begins. The requirement that Internet matchmaking be based solely on qualities of individuals that can be known prior to their aware-ness of each other excludes these variables from consideration in matching algorithms and thus represents an upper bound to the ability of such algorithms to predict whether a relationship between two specific strangers is likely to succeed or fail.

Part II—conclusion: Online dating is superior in some ways but not in others

Part II examined whether online dating is superior to conven-tional offline dating. The answer is yes and no. On the positive side of the ledger, online dating offers access to partners for people who otherwise might lack it, which is a large benefit. In addition, the ability to engage in brief computer mediated communication (CMC) with potential partners has the poten-tial to foster greater attraction upon a first meeting. Finally, matching algorithms may be effective at omitting from the dating pool people who are likely to be poor relationship part-ners in general. These benefits are considerable.

On the negative side of the ledger, many aspects of online dating do not appear to improve romantic outcomes and might even undermine them. For example, the widespread emphasis on profiles as the first introduction to potential partners seems unfortunate in light of the disconnect between what people find attractive in a profile versus what they find attractive when

meeting another person face-to-face, a problem exacerbated by comparing multiple profiles side-by-side. In addition, browsing many profiles fosters judgmental, assessment-oriented evaluations and can cognitively overwhelm users, two processes that can ultimately undermine romantic outcomes. Furthermore, it seems that the CMC available through online dating sites only increases attraction toward a potential partner if the duration of CMC is brief (a few weeks or less), and it can potentially undermine attraction if it yields unrealistic or overly particular expectations that will be disconfirmed upon a face-to-face meeting. Finally, despite grand claims to the contrary, it is unlikely that any matching algorithm based upon data collected before people have encountered each other can be effective at identifying partners who are compatible for a long-term relationship.

Summary and Implications
Summary of the major findings

In a remarkably short time, online dating has revolutionized how people seek romantic partners and initiate relationships with them. Unlike other mate-seeking innovations that never achieved widespread appeal, such as printed personal advertisements and video-dating, online dating is enormously popular and expanding rapidly. It has fundamentally altered the dating landscape, restructuring the romantic acquaintance process and changing the nature of compatibility matching.

Overall, we view the emergence and popularity of online dating as positive developments. We concur with behavioral economist Dan Ariely's (2010, p. 215) recent observation that the dating market for single people (the coordination mechanism that helps them find partners efficiently) has long been "one of the most egregious market failures in Western society," and we believe that harnessing the power of the Internet is a promising means of improving societal levels of romantic well-being.

Although we see clear benefits in online dating for relationship seekers, especially those whose opportunities through more traditional dating channels are limited, we also see considerable limitations. For example, online dating sites have not been able to do some things likely to improve their effectiveness, such as minimizing deception or better regulating involvement by people with a history of substance abuse or violent crime. In addition, the incentive structure for most sites is inconsistent with their stated aims; because dating sites lose two paying customers (or potential advertising revenue) when they facilitate the formation of a romantic relationship, dating sites have a perverse incentive to keep users single (although they presumably also have an incentive for at least some of their users to develop romantic relationships, to foster positive word-of-mouth). Furthermore, whatever efficacy online dating possesses almost seems to occur in spite of how the particular sites implement the services of access, communication, and matching rather than because of how they do so. In our summary of the ways online dating sites implement these services, we focus on typical procedures of prototypical sites.

Regarding access, it can be difficult to learn much about potential partners from their profiles. Not only is modest misrepresentation widespread, but people seem to lack the ability to determine from a profile which potential partners will be especially compatible with them once they meet in person. In addition, the process of browsing profiles side-by-side is likely to cause users to overweight features of potential partners that are easy to evaluate via profiles but might be largely irrelevant once a relationship starts to develop. Side-by-side browsing is also likely to induce an assessment mindset, causing users to commoditize potential partners. Furthermore, many sites provide users with very large numbers of profiles, causing them to use time-efficient but minimally thoughtful strategies for choosing among them and potentially reducing their willingness to commit to any one partner. Moreover, many of these sites allow users to make unlimited selections, contacting hundreds of potential partners, which can cheapen the value of being contacted and overwhelm the most desirable potential partners. Thus, although offering users a chance to consider a great many potential partners in a simple, easy-to-use, and safe format may provide valuable opportunities at little cost, our analysis suggests that current practices are likely to reduce the value that users receive from their participation.

Regarding communication, the interactive nature of CMC can foster intimacy and liking between strangers, especially if the CMC lasts for short durations (e.g., 3 weeks rather than 6). Nevertheless, CMC falls short of the experiential richness of face-to-face interaction. The absence of face-to-face social cues may lead communicators to fill in the gaps in often inaccurate ways—for example, overly optimistic or overly particular views of the message sender, which can create expectations that are not confirmed when people subsequently meet face-to-face. In other words, live interaction is a complex, multifaceted process with an essence that cannot be fully captured by CMC. In online dating, users are probably wise to engage in CMC briefly to assess basic levels of romantic potential and then move rapidly to face-to-face interactions. Furthermore, the closer CMC comes to live interaction—for example, by offering more interactive channels for communication through the use of webcams or avatars—the more likely it is to be diagnostic of face-to-face compatibility and the more valuable users are likely to find it.

Regarding matching, online dating sites have published no research that is sufficiently rigorous or detailed to support the claim that they provide more compatible matches than traditional dating does. Moreover, the major assumption underlying these claims—that long-term romantic outcomes can be predicted substantially from individual qualities of the two partners assessed before they have even met—is weakly supported by many years of research showing that context and interaction have much more influence on romantic outcomes than personality and attitudes do. It is true that, compared to other types of sites, matching sites may benefit some of their users by ruling out poor candidates for a relationship (e.g., people with a criminal history or those disinterested in a long-term relationship) and highly incompatible matches (e.g., people with very different educational backgrounds or religious

beliefs, who presumably also would be unlikely to start dating offline or through self-selection sites). But this benefit, real as it may be, should not be conflated with the claim that a proprietary algorithm can determine whether two relationship seekers are soulmates or have chemistry with each other. Instead, and until data establish otherwise, we suggest that a significant portion of any perceived success of these sites may be attributable to (a) selection processes based upon branding (e.g., eHarmony might be especially successful at recruiting users who are interested in finding a marriage partner); (b) certain cognitive and social-psychological processes, such as the placebo effect, the endowment effect, and the confirmation bias; or (c) the inevitability that random pairings among highly motivated, prerequisite-meeting individuals would likely yield a certain number of successful relationships.

Implications of online dating

The prevalence of online dating may be exerting unexpected effects on romantic relationships. We speculate that online dating may affect not only the process of finding and forming romantic relationships but perhaps also something more fundamental about the organization of family life.

Does online dating change the way people think about and approach potential relationships? As discussed previously, online dating may encourage the adoption of an assessment mindset, in which people rapidly evaluate another person's potential as a romantic partner. This tendency is most pervasive on sites emphasizing access, although it is also evident on sites emphasizing matching, which also offer multiple potential partners. Assessment mindsets are most relevant to the evaluation of profiles, but they can also compromise live interactions.

Assessment mindsets may promote the tendency to commoditize other people. Jaron Lanier, a founder of the field of virtual reality, made a similar point about social networking sites, describing them as dehumanizing and fostering shallow interactions and a "fakey-fakey social life" (Kahn, 2011, p. 46). Relationships are most satisfying when partners adopt a communal orientation, responding mutually to each other's needs and preferences (Clark et al., 2010), rather than an exchange orientation, in which benefits and costs are assessed on an ongoing basis. To the extent that online dating induces a marketplace mentality, it is likely to interfere with a communal orientation and the formation of communal bonds.

The negative impact of processes associated with an evaluative mindset may be exacerbated by the idea, promoted at many online dating sites, that the goal of dating is to find and bond with one's soulmate. For example, eHarmony offers "Tips to Finding Your Soulmate Online," suggesting that even a free trial "allows you to connect to your potential soulmate within minutes" (eHarmony, 2011c, para. 3). This soulmate emphasis is consistent with the philosophy of eHarmony's founder (Warren, 2002), who at one point distributed to all

users of the site his book entitled *Date . . . or Soul Mate: How to Know if Someone Is Worth Pursuing in Two Dates or Less* (Orr, 2004, ellipses in original). Although one might expect that such claims about finding one's soulmate would be limited to algorithm-selection sites, they in fact pervade the online dating landscape. For example, one self-selection site, JDate (2011, para. 1), claims that, "Each week, hundreds of JDaters meet their soul mates." Another self-selection site, PlentyOfFish.com (2011, para. 5), makes strong soulmate claims and even suggests a rationale for why users are especially likely to find a soulmate on that site: "Do you want to find your soulmate? Think about it, where else are you going to find millions of singles all in one place looking for someone? If you are serious about finding a relationship you should Signup Now and find your soulmate!!"

One major problem with searching for one's soulmate is that the belief that a partner must be a soulmate for a romantic relationship to succeed is associated with relationship dysfunction (Eidelson & Epstein, 1982; Epstein & Eidelson, 1981). Indeed, people with strong beliefs in romantic *destiny* (sometimes called soulmate beliefs)—that a relationship between two people either is or is not "meant to be"—are especially likely to exit a romantic relationship when problems arise (Franiuk, Cohen, & Pomerantz, 2002; Franiuk, Pomerantz, & Cohen, 2004; Knee, 1998; Knee & Bush, 2008) and to become vengeful in response to partner transgressions when they feel insecure in the relationship (Finkel, Burnette, & Scissors, 2007). On the other hand, people with strong beliefs in romantic *growth* (sometimes called work-it-out beliefs)—that happy relationships emerge from overcoming challenges—are especially likely to persist and succeed when confronting problems.

Destiny/soulmate beliefs have long been encouraged by the media (Galician, 2004; Holmes, 2007), but the pervasiveness of online dating sites' soulmate-related claims may well be exacerbating this general trend. Consistent with this possibility, a January 2011 poll indicated that 73% of Americans believe in soulmates, up from 66% six months earlier (Marist Poll, 2011). To be sure, a destiny/soulmate mindset predicts better outcomes when people believe that they have found their soulmate and when relationships are going well (Finkel et al., 2007; Franiuk et al., 2002; Knee, 1998; Knee & Bush, 2008). However, almost all romantic relationships eventually encounter significant stresses and strains (for a review, see Bradbury & Karney, 2010), which suggests that this mindset is likely to undermine relationship well-being over the long-run.

Furthermore, soulmate beliefs may encourage daters to persist in their search for the perfect mate even when they have become involved in potentially rewarding (albeit imperfect) relationships. For example, in the words of Warren, eHarmony's founder, "I encourage people to figure out the kind of person they need to be really happy, and then to hold on to this set of criteria to the very end. Mismatchedness will always win out over hard work" (quoted in Orr, 2004, p. 54). In light of such pronouncements, perhaps it is not surprising when online

daters make assertions like this one: "I would prefer to be on my own rather than just fall into any relationship where I am not a hundred percent happy" (Leslie & Morgan, 2009, p. 13).

Online dating may be subtly influencing daters' approach to potential partners in another way. By suggesting that compatibility can be established from a relatively small bank of trait-based information about a person—whether by a matchmaker's algorithm or by the users' own glance at a profile—online dating sites may be supporting an ideology of compatibility that decades of scientific research suggests is false. That is, these sites imply, and in some instances explicitly assert, that the essential qualities of a relationship can be predicted from characteristics of the potential partners that exist before they have met. Standing in direct contrast to this suggestion is 75 years of scientific research, reviewed above, indicating that pre-existing personal qualities account for a very small percentage of the variance in relationship success.

Might online dating accentuate homogamy in marriage?
Similarity is a potent principle in online dating. As described previously, matching sites typically emphasize similarity on certain attributes in assigning compatible matches for their members. In terms of access, when people browse through the profiles of potential dating partners, similarity also plays an influential role. We speculate that the growing prevalence of such dating sites as a resource for pair-bonding might be leading to an increase in marriages based on similarity within our culture.

Homogamy has long been recognized as a selection factor in marriage, although scholars have argued that the observed similarities between spouses might be an artifact of three tendencies: (a) that people's everyday activities reflect their sociodemographic characteristics and attitudinal preferences; (b) that people therefore tend to come into contact with others whose sociodemographic characteristics and attitudinal preferences are like their own; and (c) that people tend to marry people with whom they have come into contact (Kerckhoff, 1964; Schellenberg, 1960; Winch, 1958). This field-of-eligibles hypothesis has long been one explanation for spousal correlations, in contrast to the possibility that there is a preference for similar others (Berscheid & Reis, 1998). Indeed, homogamous assortative mating—the tendency of sexually reproducing organisms to choose to mate with similar others—can occur in a population even when there is no individual preference for it (Burley, 1983).

Online dating redefines the field of eligibles. Sites that offer matching services generally rely on similarity algorithms (with some amount of complementarity sprinkled in), matching potential partners on the basis of numerous personality traits and values, some of which are unlikely to play much of a role in determining more traditional fields of eligibles. It is instructive to imagine a plausible hypothetical case in which a particular dating site matches people on the basis of similarity on the personality traits of self-esteem and conscientiousness. In everyday life, people likely come into contact with people whose self-esteem and conscientiousness are distributed across the full spectrum of this dimension. Thus, even if potential daters ignore self-esteem and conscientiousness in making their choices from the set of candidates provided by a matching site, we would expect a greater degree of homogamy in the pool of couples so formed, compared to couples formed from more traditional encounters. This occurs because, as a result of the matching algorithm, the field of eligibles is more homogenous with regard to self-esteem and conscientiousness in the former than in the latter case. In other words, and somewhat ironically, although users almost universally think of online dating as expanding their field of eligibles, it may actually be shrinking crucial aspects of the diversity of that field.

The consequences of this move toward homogamy may be considerable. For example, self-expansion theory suggests that people might actually prefer to associate with dissimilar others if they feel confident in the other's acceptance of them (Aron & Aron, 1997; Aron, Steele, Kashdan, & Perez, 2006). The reduced opportunity to date dissimilar others likely to be fostered by matching sites, however, seems unlikely to provide the sort of experiences that would promote feeling comfortable with dissimilar others. In the words of Coren (2006),

> I can't help suspecting that 'similarity' works best as a series of serendipitous realisations. You start by thinking that somebody looks quite nice, and seems quite nice. So you meet them again. And gradually, over time, you happily discover that they too enjoy Philip Roth novels, or safari parks, or latex handcuffs, and it feels like a sort of magic. But if you begin by demanding similarity, if you advertise to have your fetishes met, then surely all you can ever discover, over time, is difference? If you meet up with somebody because you know in advance that they share your love of Philip Roth, you'll end up disappointed that they prefer *Sabbath's Theater* to *American Pastoral*. . . . Your surprise is not the magical chime, but the jarring bell of discord.

Moreover, dating partners commonly become acquainted with, and often develop close ties to, each other's social networks (Sprecher, Felmlee, Orbuch, & Willetts, 2002). Contact with dissimilar others through social networks can help broaden one's perspective. For example, having a close friendship with a person who is close to a member of a different ethnic or racial group is associated with more positive intergroup attitudes and reduced prejudice (Wright, Aron, McLaughlin-Volpe, & Ropp, 1997). Similarly, partners often help each other develop new skills and perspectives by exposing each other to activities and viewpoints not previously attempted. To the extent that the pool of eligibles provided by an Internet matching site is less diverse (ethnically, attitudinally, or in any other respect relevant to its algorithm) than the pool of eligibles encountered in ordinary activity, then we would expect less self-expansion of this sort to occur.

One might even speculate about potential effects on the human gene pool if the number of couples having their origin through matching sites were to continue to increase. Biometric

genetic models counterintuitively indicate that assortative mating for a heritable trait will actually increase phenotypic variability, by increasing additive genetic variance, as first demonstrated by Sewall Wright in 1921 and elaborated by Jinks and Fulker (1970).[9] All human behavioral traits are at least somewhat heritable (Turkheimer, 2000)—a recent review of several meta-analyses reported a global heritability estimate (h^2) of 41% of phenotypic variance (Malouff, Rooke, & Schutte, 2008), and a qualitative synthesis by Pinker (2002) put this value at around 50%. Therefore, it follows that if the extent of assortative mating is greater for couples created through matching sites than for traditional couples, then the phenotypic variability of human traits, as well as the genetically determined component of those traits, will increase.

Implications of the present analysis for public policy

There are at least two broad areas in which public policy is relevant to online dating: (a) protecting the safety and privacy of users and (b) substantiating the advertised claims of online dating sites. Concerning safety and privacy, by and large, there has been little scrutiny of online dating sites by governmental regulatory authorities. No federal regulatory authority currently exists for online dating; in fact, as Bramble (2011) describes, the International Marriage Broker Act, passed in 2005, which some have suggested might be applied to online dating, pertains only to entities that offer foreign marriage partners to U.S. citizens (Internet Business Law Services, 2011). A few states have passed safety-oriented laws. For example, the first such law, New Jersey's Internet Safety Dating Act, enacted in 2008, begins with the premise that "there is a public safety need to disclose whether criminal history background screenings have been performed and to increase public awareness of the possible risks associated with online dating activities" (State.nj.us, 2011, para. 2a). This law requires online dating sites that charge membership fees and that operate in New Jersey to state clearly whether or not they conduct background checks and to educate members about safe dating practices (Bramble, 2011). A roughly similar New York law, enacted in 2009, "requires online dating services to provide safety awareness notification that includes, at minimum, a list and description of safety measures reasonably designed to increase awareness of safer dating practices" (open.nysenate. gov, 2011, para 1).

As for the second area, substantiating advertised claims, our impression is that policymakers and regulatory authorities have neglected this concern. In our view, regulatory authorities ought to subject the claims of online dating sites to the same degree of scrutiny as is applied to other advertised claims that are relevant to public well-being. As discussed previously, federal agencies such as the FTC and FDA are charged with ensuring that the advertised claims for a given product or service are substantiated, especially when those claims are

ascribed to the results of testing and "especially when [the claims] concern health, safety, or performance" (Bureau of Consumer Protection, 2011a, para. 4). That the consequences of online dating concern health and safety is uncontroversial; perhaps more than any other domain of human activity, relationships affect the emotional well-being, physical health, and productivity of partners, their children and families, and society as a whole. The need for regulatory scrutiny is particularly clear for matching sites, several of which assert that their algorithms are supported by scientific research. Even something as simple as disclaimers for consumer testimonials—that is, accompanying a glowing personal endorsement with the statement that such results are not typical, an official FTC guideline (Federal Trade Commission, 2011)—are rare, perhaps even nonexistent, in the marketing appeals of online dating sites. We are aware of no such scrutiny by federal or state regulatory agencies, despite dating sites' extensive and unsubstantiated claims.

Implications of the present analysis for relationship-seekers

The present review has identified a series of problems that can arise when people use online dating sites. Some of these problems might be ameliorated by informing consumers how to take advantage of the opportunities that online dating affords without succumbing to its pitfalls.

The most promising feature of online dating is probably the access it provides to large numbers of potential dating partners. Having choice is often a good thing, especially when access to dating partners through traditional means is limited. At the same time, too much choice can lead people to use ineffective screening strategies. We suggest that users limit themselves to a relatively manageable set of candidates within a specific time period and avoid an overemphasis on contacting those users who are most consensually desirable "on paper." They should try to avoid an assessment mindset and instead try to imagine what they might do to have an enjoyable interaction with a person. They should be open-minded to considering potential partners who may not fulfill all of their desired criteria, although they should avoid developing overly lofty or particular expectations regarding partners before meeting face-to-face. They should prioritize distinctive criteria in potential partners rather than criteria most other users are prioritizing. They should craft their profiles carefully, highlight qualities about themselves that differ from the standard profile fare, and log in to the dating site frequently.

The more channels for communication that a dating site provides, the more diagnostic users' early impressions are likely to be. At the same time, users should avoid overdoing online communications—the sooner two people meet face-to-face, the more likely they are to have benefited from the preceding CMC. Users may also want to view online communication as an opportunity to try interacting with potential partners who

may be outside of their comfort zone—that is, partners with whom one might not otherwise come into contact.

In light of the available data and the fact that many of the most important predictors of relationship success are simply unavailable prior to a relationship's beginning, we are not optimistic that mathematical matching algorithms can be especially effective at finding compatible partners for users. We encourage users to consider this limitation before investing the sometimes-considerable resources required to join certain matching sites. Matching algorithms may be effective at eliminating from the dating pool potential partners who are likely to have poor romantic outcomes in most of their romantic relationships. Eliminating such partners is potentially a valuable service, as long as the user in question does not fall into the eliminated category.

Conclusion

Romantic relationships can begin anywhere. When Cupid's arrow strikes, you might be at church or at school, playing chess or softball, searching for a partner at a party, or minding your own business on the train. But sometimes Cupid goes on vacation, or takes a long nap, or kicks back for a marathon of Lifetime original movies. As a result, people go through stretches of time when desirable potential partners seem out of reach. Instead of waiting for Cupid to get back to work, people sometimes join dating sites to take back some control of their romantic lives.

Indeed, online dating has enormous potential to ameliorate what is for many people a time-consuming and often frustrating activity: the pursuit of a committed, emotionally satisfying romantic relationship. For millennia, cultures have created diverse practices to fulfill the evolutionary imperatives of mating and reproduction (Coontz, 2005). In the modern Western world, people are largely expected to identify romantic partners on their own initiative, a process that typically entails significant effort, time, and ambiguity, as well as many, often painful, missteps. Thus, it comes as no surprise that people would be attracted to a new medium that offers to improve the efficiency and effectiveness of this process. We share this attraction and see much to like in the prospect of online dating. All other things being equal, having access to many potential partners is better than having access to few or none. Being able to communicate with potential partners safely and conveniently offers an attractive precursor to face-to-face encounters with complete strangers. Confidence that particularly poor relationship partners have been weeded out of the dating pool is an appealing prospect. In short, the potential of online dating to improve the process of finding and securing a satisfying, committed romantic relationship is great.

At the same time, we see substantial opportunities for improving the way online dating is practiced. Some of this improvement can come from closer collaboration between scholars and service providers. Relationship scientists have much to offer those who operate on the frontlines of romantic relationship formation. Complementarily, online dating offers an unprecedented opportunity for researchers to test their theories and develop new ones with large samples of participants who are highly motivated to establish romantic relationships. This sort of collaboration has produced important advances and applications in many other disciplines, and the time is ripe for a similar collaboration in this arena.

Another key source of improvement can come from advances in Internet technology. Mostly, the models currently in use represent relatively early stages in Internet methods. We envision many other possibilities, some of which are already available. For example, knowledge networks might be created on the basis of postdate ratings, much as Netflix currently does with films. This approach would encourage honesty (because dishonest self-descriptions would quickly be reported by other users) and provide more information about potential partners. Other possibilities involve enhancing opportunities for interaction through the use of video, avatars, virtual environments, and social networks. The closer the approximation to live interaction, the more useful CMC-based impressions will be.

In the final analysis, is online dating unique from, and does it yield superior romantic outcomes to, conventional offline dating? The answer to the uniqueness question is an unqualified yes: Online dating is pervasive, and it has fundamentally altered both the romantic acquaintance process and the process of compatibility matching. The answer to the superiority question is more qualified. Online dating offers access to potential partners whom people would be unlikely to meet through other avenues, and this access yields new romantic possibilities. On the other hand, the heavy emphasis on profile browsing at most dating sites has considerable downsides, and there is little reason to believe that current compatibility algorithms are especially effective. Online dating functions best to the degree that it introduces people to potential partners they would have been unlikely to encounter otherwise and facilitates a rapid transition to face-to-face interaction, where the two people can get a clearer sense of their romantic potential. As online dating evolves and matures, it seems likely that more and more of us will first encounter romantic partners online. Cupid's aim will be most precise to the extent that online dating sites are informed by rigorous psychological science.

Notes

1. For example, during the final revisions of this article in late 2011, PlentyOfFish officially changed its name to POF. We did not alter the text to reflect this 11th-hour change.

2. "Online dating" is a misnomer because the dating that is facilitated by these sites does not typically take place online. Rather, users make initial contact online toward the goal of forming a face-to-face relationship. A more apt term for "dating sites" might be "Internet relationship initiation sites," and a more apt term for "online dating" might be "the Internet relationship initiation process," but we adopted the more felicitous, familiar terms for ease of presentation.

3. As noted previously and in Table 1, examining how romantic relationships can emerge via general social networking sites like Facebook is beyond the scope of this article. Such initiation frequently involves turning acquaintances or friends-of-friends into lovers, which means that it involves different sorts of issues from the ones that initiation through online dating sites involves.

4. It is possible that certain processes could promote short-term success but undermine long-term success, or vice versa. However, our review of the empirical literature suggests that such disconnects are rare. As such, we do not address them in this article. In no case do we discuss an effect relevant to initial attraction that has been demonstrated to reverse in predicting long-term relationship well-being or vice versa.

5. Technically, mutual mediated communication involves two substeps—communicating through the dating site and communicating without mediation by the dating site—but the processes are similar, so we discuss them as a single step. The communication in the second substep is still mediated in the sense it is not face-to-face; it generally transpires via e-mail, texts, or phone.

6. Gays and Lesbians are also rejected from the site, although after a settlement in response to a discrimination complaint, eHarmony created a new site, CompatibleMatches, for them.

7. One apparent exception is an article by Carter and Buckwalter (2009), both employees of eHarmony, who reported findings suggesting that eHarmony couples are more similar and more satisfied than couples who met without the help of a matchmaking service. This article was published in *Interpersona*, an online, open access, peer-reviewed journal published by the Brazilian Association for Interpersonal Relationship Research. It provides no information about how eHarmony couples were formed, stating that its algorithms "must remain proprietary" (p. 119). As noted earlier, this lack of information makes it impossible for independent researchers to try to replicate the findings or to evaluate possible alternative explanations to the authors' desired conclusions, thereby undermining essential tenets of good science.

8. Joint versus separate evaluation modes exist as endpoints of a continuum rather than as a strict dichotomy; for ease of presentation, we adopt the convention of discussing them as a dichotomy.

9. In a single generation, positive assortative mating increases phenotypic variance on a given trait by a factor of $.5rh^4$ of the phenotypic variance in a population that mates randomly, where r is the correlation between the parents' phenotypic values on that trait and h^4 is heritability (h^2) squared (Falconer, 1981; also see Hohenboken, 1985).

References

Adams, C. R. (1946). The prediction of adjustment in marriage. *Educational and Psychological Measurement, 6*, 185–193.

Adelman, M. B., & Ahuvia, A. C. (1991). Mediated channels for mate seeking: A solution to involuntary singlehood? *Critical Studies in Mass Communication, 8*, 273–289.

Ahuvia, A. C., & Adelman, M. B. (1992). Formal intermediaries in the marriage market: A typology and review. *Journal of Marriage and the Family, 54*, 452–463.

Ahuvia, A. C., Adelman, M. B., & Izberk-Bilgin, E. (2009). Commercial channels for mate seeking. In H. Reis & S. Sprecher (Eds.), *Encyclopedia of human relationships* (Vol. 1, pp. 45–48). Newbury Park, CA: Sage.

Altman, I., & Taylor, D. A. (1973). *Social penetration: The development of interpersonal relationships*. New York, NY: Holt, Rinehart and Winston.

Amato, P. R., & Booth, A. (2001). The legacy of parents' marital discord: Consequences for children's marital quality. *Journal of Personality and Social Psychology, 81*, 627–638.

Amato, P. R., & DeBoer, D. D. (2001). The transmission of marital instability across generations: Relationship skills or commitment to marriage? *Journal of Marriage and the Family, 63*, 1038–1051.

Ambady, N., Bernieri, F. J., & Richeson, J. A. (2000). Toward a histology of social behavior: Judgmental accuracy from thin slices of the behavioral stream. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 32, pp. 201–271). San Diego, CA: Academic Press.

American Psychological Association. (2001). *Publication manual of the American psychological association* (5th ed.). Washington, DC: Author.

Anderson, T. L. (2005). Relationships among Internet attitudes, internet use, romantic beliefs, and perceptions of online romantic relationships. *CyberPsychology & Behavior, 8*, 521–531.

Antheunis, M. L., Valkenburg, P. M., & Peter, J. (2007). Computer-mediated communication and interpersonal attraction: An experimental test of two explanatory hypotheses. *CyberPsychology & Behavior, 10*, 831–836.

Antill, J. K. (1983). Sex role complementarity versus similarity in married couples. *Journal of Personality and Social Psychology, 45*, 145–155.

Aretz, W., Demuth, I., Schmidt, K., & Vierlein, J. (2010). Partner search in the digital age. Psychological characteristics of online-dating-service-users and its contribution to the explanation of different patterns of utilization. *Journal of Business and Media Psychology, 1*, 8–16. Available from www.journal-bmp.de/

Argyle, M., & Dean, J. (1965). Eye-contact, distance and affiliation. *Sociometry, 28*, 289–304.

Ariely, D. (2010). *The upside of irrationality*. New York, NY: Harper Collins.

Armor, D. A., & Taylor, S. E. (2003). The effects of mindset on behavior: Self-regulation in deliberative and implemental frames of mind. *Personality and Social Psychology Bulletin, 29*, 86–95.

Aron, A., & Aron, E. N. (1997). Self-expansion motivation and including other in the self. In S. Duck (Ed.), *Handbook of personal relationships: Theory, research, and interventions* (2nd ed., pp. 251–270). Chichester, UK: John Wiley.

Aron, A., Steele, J., Kashdan, T. B., & Perez, M. (2006). When similars don't attract: Tests of a prediction from the self-expansion model. *Personal Relationships, 13*, 387–396.

Aronson, E., & Linder, D. (1965). Gain and loss of esteem as determinants of interpersonal attractiveness. *Journal of Experimental Social Psychology, 1*, 156–172.

Asch, S. E. (1946). Forming impressions of personality. *Journal of Abnormal and Social Psychology, 41*, 258–290.

Aube, J., & Koestner, R. (1995). Gender characteristics and relationship adjustment: Another look at similarity complementarity hypotheses. *Journal of Personality, 63*, 879–904.

Badoo.com. (2011, December 19). *Badoo corporate*. Retrieved from http://corp.badoo.com/

Baker, A. (2008). Down the rabbit hole: The role of place in the initiation and development of online relationships. In A. Barak (Ed.), *Psychological aspects of cyberspace: Theory, research, applications* (pp. 163–184). Cambridge, UK: Cambridge University Press.

Baldwin, M. R. (1992). Relational schemas and the processing of social information. *Psychological Bulletin, 112*, 461–484.

Bargh, J. A., McKenna, K. Y. A., & Fitzsimons, G. M. (2002). Can you see the real me? Activation and expression of the "true self" on the Internet. *Journal of Social Issues, 58*, 33–48.

Barraket, J., & Henry-Waring, M. S. (2008). Getting it on(line): Sociological perspectives on e-dating. *Journal of Sociology, 4*, 149–165.

Bateson, P. P. G. (1983). Optimal outbreeding. In P. P. G. Bateson (Ed.), *Mate choice* (pp. 257–277). Cambridge, UK: Cambridge University Press.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*, 497–529.

Baym, N. K. (2006). Interpersonal life online. In L. A. Lievrouw & S. Livingstone (Eds.), *Handbook of new media: Social shaping and social consequences of ICTs* (2nd ed., pp. 35–54). London, England: SAGE.

Beach, S. R. H., Whitaker, D. J., Jones, D. J., & Tesser, A. (2001). When does performance feedback prompt complementarity in romantic relationships? *Personal Relationships, 18*, 231–248.

Ben-Ze'ev, A. (2004). *Love online*: *Emotions on the Internet*. Cambridge, UK: Cambridge University Press.

Berscheid, E., Graziano, W., Monson, T., & Dermer, M. (1976). Outcome dependency: Attention, attribution, and attraction. *Journal of Personality and Social Psychology, 34*, 978–989.

Berscheid, E., & Reis, H. T. (1998). Attraction and close relationships. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., Vol. 2, pp. 193–281). New York, NY: McGraw-Hill.

Blossfeld, H. P. (2009). Educational assortative marriage in comparative perspective. *Annual Review of Sociology, 35*, 513–530.

Botti, S., & Hsee, C. K. (2010). Dazed and confused by choice: How the temporal costs of choice freedom lead to undesirable outcomes. *Organizational Behavior and Human Decision Processes, 112*, 161–171.

Botti, S., & Iyengar, S. S. (2004). The psychological pleasure and pain of choosing: When people prefer choosing at the cost of subsequent satisfaction. *Journal of Personality and Social Psychology, 87*, 312–326.

Botti, S., Orfali, K., & Iyengar, S. S. (2009). Tragic choices: Autonomy and emotional responses to medical decisions. *Journal of Consumer Research, 36*, 337–352.

Bouchard, G., Lussier, Y., & Sabourin, S. (1999). Personality and marital adjustment: Utility of the five-factor model of personality. *Journal of Marriage and the Family, 61*, 651–660.

Bowlby, J. (1969). *Attachment and loss: Volume I. Attachment*. New York, NY: Basic Books.

Bowlby, J. (1973). *Attachment and loss: Volume II. Separation: Anxiety and anger*. New York, NY: Basic Books.

Bowlby, J. (1980). *Attachment and loss: Volume III. Loss: Sadness and depression*. New York, NY: Basic Books.

Bown, N. F., Read, D., & Summers, B. (2003). The lure of choice. *Journal of Behavioral Decision Making, 16*, 297–308.

Bradbury, T. N., & Karney, B. R. (2010). *Intimate relationships*. New York, NY: W. W. Norton.

Bramble, E. (2011). *Communication law and online dating.* Unpublished manuscript, Columbus School of Law, The Catholic University of America, Washington, DC.

Bramlett, M. D., & Mosher, W. D. (2002). *Cohabitation, marriage, divorce, and remarriage in the United States* (Vital and Health Statistics No. Series 23, Number 22). Hyattsville, MD: National Center for Health Statistics.

Brooks, M. (2006, June 9). *Interviewing Plenty of Fish CEO, Markus Frind*. Retrieved from http://www.onlinepersonalswatch.com/news/2006/06/opw_interview_p.html

Brym, R. J., & Lenton, R. L. (2003). *Love at first byte: Internet dating in Canada*. Unpublished Manuscript, University of Toronto, Ontario, Canada.

Buckwalter, J. G., Carter, S. R., Forgatch, G. T., Parsons, T. D., & Warren, N. C. (2004). *Method and system for identifying people who are likely to have a successful relationship* (U.S. Patent 6,735,568). Washington, DC: U.S. Patent and Trademark Office

Buckwalter, J. G., Carter, S. R., Forgatch, G. T., Parsons, T. D., & Warren, N. C. (2008). *Method and system for identifying people who are likely to have a successful relationship* (U.S. Patent 7, 454,357B2). Washington, DC: U.S. Patent and Trademark Office

Buehlman, K. T., Gottman, J. M., & Katz, L. Y. (1992). How a couple views their past predicts their future: Predicting divorce from an oral history interview. *Journal of Family Psychology, 5*, 295–318.

Bureau of Consumer Protection. (2011a, June 14). *Advertising and marketing on the Internet: Rules of the road*. Retrieved from http://business.ftc.gov/documents/bus28-advertising-and-marketing-internet-rules-road

Bureau of Consumer Protection. (2011b, August 1). *Substantiation: The science of compliance*. Retrieved from http://business.ftc.gov/documents/substantiation-science-compliance

Burgess, E. W., & Cottrell, L. S. (1939). *Predicting success or failure in marriage*. New York, NY: Prentice Hall.

Burley, N. (1983). The meaning of assortative mating. *Ethology and Sociobiology, 4*, 191–203.

Byrne, D. (1961). Interpersonal attraction and attitude similarity. *Journal of Abnormal and Social Psychology, 62*, 713–715.

Byrne, D., Ervin, C. R., & Lamberth, J. (1970). Continuity between the experimental study of attraction and real-life computer dating. *Journal of Personality and Social Psychology, 16*, 175–165.

Cacioppo, J. T., Hawkley, L. C., Crawford, L. E., Ernst, J. M., Burleson, M. H., Kowalewski, R. B., . . . Berntson, G. G. (2002). Loneliness and health: Potential mechanisms. *Psychosomatic Medicine, 64*, 407.

Campbell, D., & Stanley, J. (1963). *Experimental and quasi-experimental designs for research*. Chicago, IL: Rand-McNally.

Carter, S. R., & Buckwalter, J. G. (2009). Enhancing mate selection through the Internet: A comparison of relationship quality between marriages arising from an online matchmaking system and marriages arising from unfettered selection. *Interpersona: An International Journal on Personal Relationships, 3*, 105–125.

Casewatch. (2011, May 24). Retrieved from http://www.casewatch.org/civil/enviga/complaint.shtml

Caspi, A., & Gorsky, P. (2006). Online deception: Prevalence, motivation, and emotion. *CyberPsychology & Behavior, 9*, 54–59.

Charles, K. K., & Stephens, M. (2004). Disability, job displacement and divorce. *Journal of Labor Economics, 22*, 489–522.

Chemistry.com. (2011, July 19). *Why choose chemistry?* Retrieved from http://www.chemistry.com/cp/whychemistry/

Cherlin, A. J., Burton, L. M., Hurt, T. R., & Purvin, D. M. (2004). The influence of physical and sexual abuse on marriage and cohabitation. *American Sociological Review, 69*, 768–789.

Chernev, A. (2006). Decision focus and consumer choice among assortments. *Journal of Consumer Research, 33*, 50–59.

Chernev, A., Bockenholt, U., & Goodman, J. (2010). Commentary on Scheibehenne, Greifeneder, and Todd-Choice overload: Is there anything to it? *Journal of Consumer Research, 37*, 426–428.

Chiou, W., & Yang, M. (2010). The moderating role of need for cognition on excessive searching bias: A case of finding romantic partners online. In B. K. Wiederhold, G. Riva, & S. I. Kim (Eds.), *Annual review of cybertherapy and telemedicine* (pp. 120–122). Amsterdam, Netherlands: IOS Press BV.

Christakis, N. A., & Fowler, J. H. (2009). *Connected: The surprising power of our social networks and how they shape our lives*. New York, NY: Little Brown.

Clark, M. S. (1984). Record keeping in two types of relationships. *Journal of Personality and Social Psychology, 47*, 549–557.

Clark, M. S., Lemay, E. P., Graham, S. M., Pataki, S. P., & Finkel, E. J. (2010). Ways of giving and receiving benefits in marriage: Norm use and attachment related variability. *Psychological Science, 21*, 944–951.

Cocks, H. G. (2009). *Classified: The history of the personal column*. London, England: Random House.

Cohan, C. L., & Cole, S. W. (2002). Life course transitions and natural disaster: Marriage, birth, and divorce following Hurricane Hugo. *Journal of Family Psychology, 16*, 14–25.

Cohen, S., Frank, E., Doyle, W. J., Skoner, D. P., Rabin, B. S., & Gwaltney, J. M., Jr. (1998). Types of stressors that increase susceptibility to the common cold in healthy adults. *Health Psychology, 17*, 214–223.

Conger, R. D., & Conger, K. J. (2008). Understanding the processes through which economic hardship influences families and children. In D. R. Crane & T. B. Heaton (Eds.), *Handbook of families and poverty* (pp. 64–81). Thousand Oaks, CA: SAGE.

Conger, R. D., Rueter, M. A., & Elder, G. H. (1999). Couple resilience to economic pressure. *Journal of Personality and Social Psychology, 76*, 54–71.

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues for field settings*. Chicago, IL: Rand-McNally.

Coontz, S. (2005). *Marriage, a history*. New York, NY: Viking.

Cooper, A., & Sportolari, L. (1997). Romance in cyberspace: Understanding online attraction. *Journal of Sex Education and Therapy, 22*, 7–14.

Coren, V. (2006, October 15). The curse of true love. *The Guardian.* Retrieved from http://www.guardian.co.uk/commentisfree/2006/oct/15/comment.victoriacoren

Cornwell, B., & Lundgren, D. C. (2001). Love on the Internet: Involvement and misrepresentation in romantic relationships in cyberspace vs. realspace. *Computers in Human Behavior, 17*, 197–211.

Culnan, M. J., & Markus, M. L. (1987). Information technologies. In F. M. Jablin, L. L. Putnam, K. H. Roberts, & L. W. Porter (Eds.), *Handbook of organizational communication: An interdisciplinary perspective* (pp. 420–443). Newbury Park, CA: SAGE.

Cuperman, R., & Ickes, W. (2009). Big Five predictors of behavior and perceptions in initial dyadic interactions: Personality similarity helps extraverts and introverts, but hurts "disagreeables." *Journal of Personality and Social Psychology, 97*, 667–684.

Daft, R. L., & Lengel, R. H. (1984). Information richness: A new approach to managerial behavior and organizational design. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 6, pp. 191–233). Greenwich, CT: JAI.

Darden, D., & Koski, P. R. (1988). Using the personals ads: A deviant activity? *Deviant Behavior, 9*, 383–400.

Davila, J., Karney, B. R., Hall, T. W., & Bradbury, T. N. (2003). Depressive symptoms and marital satisfaction: Within-subject associations and the moderating effects of gender and neuroticism. *Journal of Family Psychology, 17*, 557–570.

Day, M., Hamilton, A., Hutchins, J., Maher, J., & Vance, N. (2010). *Making the leap: Tracking the online dating process from computer mediated communication to face-to-face interaction*. Unpublished Manuscript, Pratt Institute, Brooklyn, New York.

Deci, E. L., & Ryan, R. M. (1991). A motivational approach to the self: Integration in personality. In R. Dienstbier (Ed.), *Nebraska symposium on motivation: Vol. 38. Perspectives on motivation* (pp. 237–288). Lincoln: University of Nebraska Press.

Decuyper, M., De Bolle, M., & De Fruyt, F. (in press). Personality similarity, perceptual accuracy, and relationship satisfaction in dating and married couples. *Personal Relationships.*

Derks, D., Bos, A. E. R., & von Grumbkow, J. (2007). Emoticons and social interaction on the Internet: The importance of social context. *Computers in Human Behavior, 23*, 842–849.

Diener, E., & Seligman, M. E. P. (2002). Very happy people. *Psychological Science, 13*, 81–84.

Doan, T. T., & Meyers, S. A. (2011, May). *Online dating: Determining the presence of a stigma*. Poster session presented at the meeting of Midwest Psychological Association, Chicago, IL.

Donn, J. E., & Sherman, R. C. (2002). Attitudes and practices regarding the formation of romantic relationships on the Internet. *CyberPsychology & Behavior, 5*, 107–123.

D'Onofrio, B. M., Eaves, L. J., Murrelle, L., Maes, H. H., & Spilka, B. (1999). Understanding biological and social influences on religious affiliation, attitudes, and behaviors: A behavior genetic perspective. *Journal of Personality, 67*, 953–984.

Drigotas, S. M., & Rusbult, C. E. (1992). Should I stay or should I go? A dependence model of breakups. *Journal of Personality and Social Psychology, 62*, 62–87.

Dryer, D. C., & Horowitz, L. M. (1997). When do opposites attract? Interpersonal complementarity versus similarity. *Journal of Personality and Social Psychology, 72*, 592–603.

Dunn, E. W., Wilson, T. D., & Gilbert, D. T. (2003). Location, location, location: The misprediction of satisfaction in housing lotteries. *Personality and Social Psychology Bulletin, 29*, 1421–1432.

Dyrenforth, P. S., Kashy, D. A., Donnellan, M. B., & Lucas, R. E. (2010). Predicting relationship and life satisfaction from personality in nationally representative samples from three countries: The relative importance of actor, partner, and similarity effects. *Journal of Personality and Social Psychology, 99*, 690–702.

Eastwick, P. W., Eagly, A. H., Finkel, E. J., & Johnson, S. E. (2011). Implicit and explicit preferences for physical attractiveness in a romantic partner: A double dissociation in predictive validity. *Journal of Personality and Social Psychology, 101*, 993–1011.

Eastwick, P. W., & Finkel, E. J. (2008a). Sex difference in mate preferences revisited: Do people know what they initially desire in a romantic partner? *Journal of Personality and Social Psychology, 94*, 245–264.

Eastwick, P. W., & Finkel, E. J. (2008b). Speed-dating: A powerful and flexible paradigm for studying romantic relationship initiation. In S. Sprecher, A. Wenzel, & J. Harvey (Eds.), *Handbook of relationship initiation* (pp. 217–234). New York, NY: Guilford.

Eastwick, P. W., Finkel, E. J., & Eagly, A. H. (2011). When and why do ideal partner preferences affect the process of initiating and maintaining romantic relationships? *Journal of Personality and Social Psychology, 101*, 1012–1032.

Eastwick, P. W., Finkel, E. J., Mochon, D., & Ariely, D. (2007). Selective versus unselective romantic desire: Not all reciprocity is created equal. *Psychological Science, 18*, 317–319.

The Economist. (2010, December 29). *Love at first byte*. Retrieved from http://www.economist.com/node/17797424.

eHarmony.com. (2011a, July 15). Retrieved from http://www.eharmony.com/

eHarmony.com. (2011b, July 15). *How we match*. Retrieved from http://www.eharmony.com/why

eHarmony.com. (2011c, July 15). *Tips to finding your soulmate online*. Retrieved from http://eharmonyfreetrial.com/2011/01/tips-to-finding-your-soulmate-online/

eHarmony Scientific Match Making. (2011). Retrieved from http://www.eharmony.com/why/science

Eidelson, R. J., & Epstein, N. (1982). Cognition and relationship maladjustment: Development of a measure of dysfunctional relationship beliefs. *Journal of Consulting and Clinical Psychology, 50*, 15–20.

Ellison, N., Heino, R., & Gibbs, J. (2006). Managing impressions online: Self presentation processes in the online dating environment. *Journal of Computer Mediated Communication, 11*, 415–441.

Epstein, N., & Eidelson, R. J. (1981). Unrealistic beliefs of clinical couples: Their relationship to expectations, goals and satisfaction. *American Journal of Family Therapy, 9*, 13–22.

Falconer, D. S. (1981). *Introduction to quantitative genetics* (2nd ed.). London, England: Longman.

Federal Trade Commission. (2011). *FTC publishes final guides governing endorsements, testimonials*. Retrieved from http://www.ftc.gov/opa/2009/10/endortest.shtm

Feng, D., Giarrusso, R., Bengtson, V. L., & Frye, N. (1999). Intergenerational transmission of marital quality and marital instability. *Journal of Marriage and the Family, 61*, 451–463.

Festinger, L., Schachter, S., & Back, K. (1950). *Social pressures in informal groups*. New York, NY: Harper.

Finkel, E. J., & Baumeister, R. F. (2010). Attraction and rejection. In R. F. Baumeister & E. J. Finkel (Eds.), *Advanced social psychology: The state of the science* (pp. 419–459). New York, NY: Oxford University Press.

Finkel, E. J., Burnette, J. L., & Scissors, L. E. (2007). Vengefully ever after: Destiny beliefs, state attachment anxiety, and forgiveness. *Journal of Personality and Social Psychology, 92*, 871–886.

Finkel, E. J., & Eastwick, P. W. (2008). Speed-dating. *Current Directions in Psychological Science, 17*, 193–197.

Finkel, E. J., & Eastwick, P. W. (in press). Interpersonal attraction. In J. A. Simpson & J. F. Dovidio (Eds.), *Handbook of personality and social psychology: Interpersonal relations and group processes*. Washington, DC: American Psychological Association.

Finkel, E. J., Eastwick, P. W., & Matthews, J. (2007). Speed-dating as an invaluable tool for studying romantic attraction: A methodological primer. *Personal Relationships, 14*, 149–166.

Fiore, A. T., & Donath, J. S. (2004). *Online personals: An overview*. Paper session presented at the meeting of ACM Computer-Human Interaction, Vienna, Austria.

Fiore, A. T., Taylor, L. S., Mendelsohn, G. A., & Hearst, M. (2008). Assessing attractiveness in online dating profiles. *Proceedings of Computer-Human Interaction* (pp. 797–806). New York, NY: ACM Press.

Fiore, A. T., Taylor, L. S., Zhong, X., Mendelsohn, G. A., & Cheshire, C. (2010). *Who's right and who writes: People, profiles, contacts, and replies in online dating*. Retrieved from http://www.computer.org/csdl/proceedings/hicss/2010/3869/00/index.html.

Fisher, H. (2008, June 8). *Q/A with Helen Fisher*. Retrieved from http://www.facebook.com/note.php?note_id=40673448583

Fisher, H. (2009). *Why him? Why her?* New York, NY: Henry Holt.

Fisher, H. (2011, February 14). *The chemistry of attraction: Understanding the science of your love personality to attract your soulmate*. Retrieved from http://www.soulmatesummit.net/upgrade/

Fisher, H. E., Rich, J., Island, H. D., & Marchalik, D. (2010). The second to fourth digit ratio: A measure of two hormonally-based temperament dimensions. *Personality and Individual Differences, 49*, 773–777.

Fisher, H. E., Rich, J., Island, H. D., Marchalik, L., Silver, R., & Zava, D. (2010, August). *Four primary temperament dimensions*

based on neurochemistry. Poster presented at the annual meeting of the American Psychological Association, San Diego, CA.

Fisman, R., Iyengar, S. S., Kamenica, E., & Simonson, I. (2006). Gender differences in mate selection: Evidence from a speed-dating experiment. *Quarterly Journal of Economics, 121*, 673–697.

Foa, U. G. (1993). Interpersonal and economic resources. In U. G. Foa, J. Converse, K. Y. Törnblom, & E. B. Foa (Eds.), *Resource theory: Explorations and applications* (pp. 13–30). San Diego, CA: Academic Press.

Forthofer, M. S., Markman, H. J., Cox, M., Stanley, S., & Kessler, R. C. (1996). Associations between marital distress and work loss in a national sample. *Journal of Marriage and the Family, 58*, 597–605.

Fraley, R. C., & Waller, N. G. (1998). Adult attachment patterns: A test of the typological model. In J. A. Simpson & W. S. Rholes (Eds.), *Attachment theory and close relationships* (pp. 77–114). New York, NY: Guilford.

Franiuk, R., Cohen, D., & Pomerantz, E. M. (2002). Implicit theories of relationships: Implications for relationship satisfaction and longevity. *Personal Relationships, 9*, 345–367.

Franiuk, R., Pomerantz, E. M., & Cohen, D. (2004). The causal role of theories of relationships: Consequences for satisfaction and cognitive strategies. *Personality and Social Psychology Bulletin, 30*, 1494–1507.

Frazzetto, G. (2010). The science of online dating. *EMBO Reports, 11*, 25–27.

Frost, J. H., Chance, Z., Norton, M. I., & Ariely, D. (2008). People are experience goods: Improving online dating with virtual dates. *Journal of Interactive Marketing, 22*, 51–61.

Furr, R. M. (2008). Framework for profile similarity: Integrating similarity, normativeness, and distinctiveness. *Journal of Personality, 76*, 1267–1316.

Gagné, F., & Lydon, J. (2001). Mindset and close relationships: When bias leads to inaccurate predictions. *Journal of Personality and Social Psychology, 81*, 85–96.

Galician, M. (2004). *Sex, love, and romance in the mass media*. Mahwah, NJ: Lawrence Erlbaum.

Gallo, L. C., Troxel, W. M., Matthews, K. A., & Kuller, L. H. (2003). Marital status and quality in middle-aged women: Associations with levels and trajectories of cardiovascular risk factors. *Health Psychology, 22*, 453–463.

Gangestad, S. W., & Thornhill, R. (1998). Menstrual cycle variation in women's preference for the scent of symmetrical men. *Proceedings of the Royal Society of London B, 262*, 727–733.

Garver-Apgar, C. E., Gangestad, S. W., Thornhill, R., Miller, R. D., & Olp, J. J. (2006). Major histocompatibility complex alleles, sexual responsivity, and unfaithfulness in romantic couples. *Psychological Science, 17*, 830–835.

Gaunt, R. (2006). Couple similarity and marital satisfaction: Are similar spouses happier? *Journal of Personality, 74*, 1401–1420.

Gawronski, B., & Bodenhausen, G. V. (2011). The associative-propositional evaluation model: Theory, evidence, and open questions. In M. P. Zanna & J. M. Olson (Eds.), *Advances in experimental social psychology* (Vol. 44, pp. 59–127). Amsterdam, The Netherlands: Elsevier.

Gelles, D. (2011, July 30). *Inside Match.com: It's all about the algorithm*. Retrieved from http://www.slate.com/id/2300430/

GenePartner.com (2011). *Homepage*. Available from http://genepartner.com/

Gibbs, J. L., Ellison, N. B., & Lai, C. (2011). First comes love, then comes Google: An investigation of uncertainty reduction strategies and self-disclosure in online dating. *Communication Research, 38*, 70–100.

Gigaom. (2011, June 14). *Match.com picks fight with competitor Plenty of Fish*. Retrieved from http://gigaom.com/2010/04/28/match-com-picks-fight-with-competitor-plenty-of-fish/

Gillmor, C. S. (2007). Stanford, the IBM 650, and the first trials of computer date matching. *IEEE Annals of the History of Computing, 29*, 74–80.

Gladue, B. A., & Delaney, H. (1990). Gender differences in perception of attractiveness of men and women in bars. *Personality and Social Psychology Bulletin, 16*, 378–391.

Glicksohn, J., & Golan, H. (2001). Personality, cognitive style, and assortative mating. *Personality and Individual Differences, 30*, 1199–1209.

Goffman, E. (1959). *The presentation of self in everyday life*. New York, NY: Doubleday.

Gollwitzer, P. M., & Bayer, U. (1999). Deliberative versus implemental mindsets in the control of action. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 403–422). New York, NY: Guilford.

Gonzaga, G. (2011). *How you meet your spouse matters*. Retrieved from http://advice.eharmony.com/blog/2011/02/10/how-you-meet-your-spouse-matters/

Gonzaga, G. C., Campos, B., & Bradbury, T. (2007). Similarity, convergence, and relationship satisfaction in dating and married couples. *Journal of Personality and Social Psychology, 93*, 34–48.

Gonzaga, G. C., Carter, S., & Buckwalter, G. J. (2010). Assortative mating, convergence, and satisfaction in married couples. *Personal Relationships, 17*, 634–644.

Gonzalez-Vallejo, C., & Moran, E. (2001). The evaluability hypothesis revisited: Joint and separate evaluation preference reversal as a function of attribute importance. *Organizational Behavior and Human Decision Processes, 86*, 216–233.

Goodwin, R. (1990). Dating agency members: Are they "different"? *Journal of Social and Personal Relationships, 7*, 423–430.

Gotlib, I. H., Lewinsohn, P. M., & Seeley, J. R. (1998). Consequences of depression during adolescence: Marital status and marital functioning in early adulthood. *Journal of Abnormal Psychology, 107*, 686–690.

Gottlieb, L. (2006, March). How do I love thee? *The Atlantic Monthly*, 58-70. Retrieved from http://www.theatlantic.com/doc/200603/online-love

Gottman, J. M. (1994). *What predicts divorce? The relationship between marital processes and marital outcomes*. Hillsdale, NJ: Erlbaum.

Gottman, J. M., Coan, J., Carrere, S., & Swanson, C. (1998). Predicting marital happiness and stability from newlywed interactions. *Journal of Marriage and the Family, 60*, 5–22.

Grob, B., Knapp, L. A., Martin, R. D., & Anzenberger, G. (1998). The major histocompatibility complex and mate choice: Inbreeding avoidance and selection of good genes. *Experimental and Clinical Immunogenetics, 15*, 119–129.

Gwinnell, E. (1998). *Online seductions: Falling in love with strangers on the Internet*. New York, NY: Kodansha America.

Hancock, J. T., Thom-Santelli, J., & Ritchie, T. (2004). Deception and design: The impact of communication technology on lying behavior. *Proceedings, Conference on Computer Human Interaction, 6*, 129–134.

Harmon, A. (2003). Online dating sheds its stigma as losers.com. *The New York Times*. Retrieved from http://www.nytimes.com/2003/06/29/us/online-dating-sheds-its-stigma-as-loserscom.html

Havlicek, J., & Roberts, S. C. (2009). MHC-correlated mate choice in humans: A review. *Psychoneuroendocrinology, 34*, 497–512.

Hazan, C., & Shaver, P. R. (1987). Romantic love conceptualized as an attachment process. *Journal of Personality and Social Psychology, 52*, 511–524.

Heaton, T. B., & Pratt, E. L. (1990). The effects of religious homogamy on marital satisfaction and stability. *Journal of Family Issues, 11*, 191–207.

Heino, R., Ellison, N., & Gibbs, J. (2010). Relationshopping: Investigating the market metaphor in online dating. *Journal of Social and Personal Relationships, 27*, 427–447.

Hendrick, C., & Brown, S. R. (1971). Introversion, extraversion, and interpersonal attraction. *Journal of Personality and Social Psychology, 20*, 31–36.

Henry-Waring, M., & Barraket, J. (2008). Dating & intimacy in the 21st century: The use of online dating sites in Australia. *International Journal of Emerging Technologies and Society, 6*, 14–33.

Heyman, J. E., Orhun, Y., & Ariely, D. (2004). Auction fever: The effect of opponents and quasi-endowment on product valuations. *Journal of Interactive Marketing, 18*, 7–21.

Heyman, R. E., & Slep, A. M. S. (2001). The hazards of predicting divorce without crossvalidation. *Journal of Marriage and the Family, 63*, 473–479.

Hill, R. (1949). *Families under stress*. New York, NY: Harper & Row.

Hiltz, S. R., Johnson, K., & Turoff, M. (1986). Experiments in group decision making communication process and outcome in face-to-face versus computerized conferences. *Human Communication Research, 13*, 225–252.

Hitsch, G. J., Hortaçsu, A., & Ariely, D. (2010a). Matching and sorting in online dating. *American Economic Review, 100*, 130–163.

Hitsch, G. J., Hortaçsu, A., & Ariely, D. (2010b). What makes you click? Mate preferences in online dating. *Quantitative Marketing and Economics, 8*, 393–427.

Hogan, B., Dutton, W., & Li, N. (2011). *A global shift in the social relationships of networked individuals: Meeting and dating online comes of age*. Retrieved from http://ssrn.com/abstract=176388

Hohenboken, W. D. (1985). The manipulation of variation in quantitative traits: A review of possible genetic strategies. *Journal of Animal Science, 60*, 101–110.

Holland, A. S., Fraley, R. C., & Roisman, G. I. (2011). Attachment styles in dating couples: Predicting relationship functioning over time. *Personal Relationships*. doi:10.1111/j.1475-6811.2011.01350.x

Holmes, B. M. (2007). In search of my "one and only": Romance-oriented media and beliefs in romantic relationships destiny. *Electronic Journal of Communication, 17*, 1–29.

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine, 7*, e1000316. doi:10.1371/journal.pmed.1000316

Houran, J., Lange, R., Rentfrow, J. P., & Bruckner, K. H. (2004). Do online matchmaking tests work? An assessment of preliminary evidence for a publicized "predictive model of marital success." *North American Journal of Psychology, 6*, 507–526.

Houts, R. M., Robins, E., & Huston, T. L. (1996). Compatibility and the development of premarital relationships. *Journal of Marriage and the Family, 58*, 7–20.

Hsee, C. K., Loewenstein, G. F., Blount, S., & Bazerman, M. H. (1999). Preference reversals between joint and separate evaluations of options: A review and theoretical analysis. *Psychological Bulletin, 125*, 576–590.

Hsee, C. K., & Zhang, J. (2010). General evaluability theory. *Perspectives on Psychological Science, 5*, 343–355.

Humphries, C. (2010). Dating sites try adaptive matchmaking. *Technology Review*. Retrieved from http:/www.technologyreview.com/printer_friendly_article.aspx?id=26805

Huston, T. L. (2000). The social ecology of marriage and other intimate unions. *Journal of Marriage and the Family, 62*, 298–320.

Internet Business Law Services. (2011, March 31). *Internet law: Does IMBRA exclusively regulate online dating sites and protect online-dating U.S. citizen brides?* Retrieved from http://www.ibls.com/internet_law_news_portal_view.aspx?id=2083&;s=latestnews

InternetWorldStats.com. (2011). *Internet world stats: Usage and population statistics*. Retrieved August 31 from http://internet-worldstats.com/stats.htm.

Iyengar, S. S. (2010). *The art of choosing*. New York, NY: Twelve Publishers, an imprint of Hachette Book Group.

Iyengar, S. S., & Lepper, M. R. (2000). When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology, 79*, 995–1006.

Iyengar, S. S., Simonson, I., Fisman, R., & Mogilner, C. (2005, January). *I know what I want but can I find it? Examining the dynamic relationship between stated and revealed preferences*. Paper session presented at the Society for Personality and Social Psychology Annual Meeting, New Orleans, LA.

Jacobson, D. (1999). Impression formation in cyberspace: Online expectations and offline experiences in text-based virtual communities. *Journal of Computer-Mediated Communication, 5*, 0.

Jacobson, N. S., & Christensen, A. (1996). *Integrative couple therapy: Promoting acceptance and change*. New York, NY: Norton.

JDate.com. (2011). *Homepage*. Available from www.jdate.com

Jiang, L., Bazarova, N. N., & Hancock, J. T. (2011). The disclosure–intimacy link in computer mediated communication: An attributional extension of the hyperpersonal model. *Human Communication Research, 37*, 58–77.

Jinks, J. L., & Fulker, D. W. (1970). A comparison of the biometrical-genetical, MAVA and classical approaches to the analysis of human behavior. *Psychological Bulletin, 73*, 311–349.

Johnson, M. D., Cohan, C. L., Davila, J., Lawrence, E., Rogge, R. D., Karney, B. R., . . . Bradbury, T. N. (2005). Problem-solving skills and affective expressions as predictors of change in marital satisfaction. *Journal of Consulting and Clinical Psychology, 73*, 15–27.

Joinson, A. N. (2001). Self-disclosure in computer mediated communication: The role of self-awareness and visual anonymity. *European Journal of Social Psychology, 31*, 177–192.

Journal of the American Medical Association. (2011, May 18). *JAMA instructions for authors*. Retrieved from http://jama.ama-assn.org/site/misc/ifora.xhtml

Kahn, J. (2011, July 11-18). The visionary. *The New Yorker, 87*, 46–53.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1990). Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy, 98*, 1325–1348.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1991). Anomalies: The endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives, 5*, 193–206.

Kaplan, M. (2008). You have 4 minutes to choose your perfect mate. *Nature, 451*, 760–762.

Karney, B. R., & Bradbury, T. N. (1995). The longitudinal course of marital quality and stability: A review of theory, methods, and research. *Psychological Bulletin, 118*, 3–34.

Karney, B. R., & Bradbury, T. N. (1997). Neuroticism, marital interaction, and the trajectory of marital satisfaction. *Journal of Personality and Social Psychology, 72*, 1075–1092.

Keller, K. L., & Staelin, R. (1987). Effects of quality and quantity of information on decision effectiveness. *Journal of Consumer Research, 14*, 200–213.

Kelly, E. L., & Conley, J. J. (1987). Personality and compatibility: A prospective analysis of marital stability and marital satisfaction. *Journal of Personality and Social Psychology, 52*, 27–40.

Kenny, D. A., & Acitelli, L. K. (1994). Measuring similarity in couples. *Journal of Family Psychology, 8*, 417–431.

Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY: Guilford.

Kerckhoff, A. C. (1964). Patterns of homogamy and the field of eligibles. *Social Forces, 42*, 289–297.

Kiecolt-Glaser, J. K., Loving, T. J., Stowell, J. R., Malarkey, W. B., Lemeshow, S., Dickinson, S. L., & Glaser, R. (2005). Hostile marital interactions, proinflammatory cytokine production, and wound healing. *Archives of General Psychiatry, 62*, 1377–1384.

Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist, 39*, 1123–1134.

Kim, M., Kwon, K., & Lee, M. (2009). Psychological characteristics of ODS user: The effect of self-esteem, involvement, and sociability on the use of ODSs. *CyberPsychology & Behavior, 12*, 445–449.

King, A. E., Austin-Oden, D., & Lohr, J. M. (2009). Browsing for love in all the wrong places: Does research show that Internet matchmaking is more successful than traditional dating? *Skeptic, 15*, 48–55.

Klohnen, E. C., & Luo, S. (2003). Interpersonal attraction and personality: What is attractive-Self similarity, ideal similarity, complementarity or attachment security? *Journal of Personality and Social Psychology, 85*, 709–722.

Klohnen, E. C., & Mendelsohn, G. A. (1998). Partner selection for personality characteristics: A couple-centered approach. *Personality and Social Psychology Bulletin, 24*, 268–278.

Knee, C. R. (1998). Implicit theories of relationships: Assessment and prediction of romantic relationship initiation, coping, and longevity. *Journal of Personality and Social Psychology, 74*, 360–370.

Knee, C. R., & Bush, A. (2008). Relationship beliefs and their role in relationship initiation. In S. Sprecher, A. Wenzel, & J. Harvey (Eds.), *The handbook of relationship initiation* (pp. 471–485). Hillsdale, NJ: Erlbaum.

Komblum, J. (May 18, 2005). *eHarmony: Heart and soul.* Retrieved from http://www.usatoday.com/life/people/2005-05-18-eharmony_x.htm

Kreider, T. (May 13, 2011). *True stories: Getting offline.* Retrieved from http://www.nerve.com/love-sex/true-stories/true-stories-getting-offline

Kruglanski, A. W., Thompson, E. P., Higgins, E. T., Atash, M. N., Pierro, A., Shah, J. Y., & Spiegel, S. (2000). To "do the right thing" or to "just do it": Locomotion and assessment as distinct self-regulatory imperatives. *Journal of Personality and Social Psychology, 79*, 793–815.

Kumashiro, M., Rusbult, C. E., Finkenauer, C., & Stocker, S. (2007). To think or to do: Assessment orientation, locomotion orientation, and the Michelangelo Phenomenon. *Journal of Social and Personal Relationships, 24*, 591–611.

Langer, E. J., & Rodin, J. (1976). The effects of choice and enhanced personal responsibility for the aged: A field experiment in an institutional setting. *Journal of Personality and Social Psychology, 34*, 191–198.

Laumann, E. O., Gagnon, J. H., Michael, R. T., & Michaels, S. (1994). *The social organization of sexuality: Sexual practices in the United States*. Chicago, IL: University of Chicago Press.

Lawrence, R. (2004). Guest editorial: Overcoming the stigma of online dating-What are we embarrassed for? *Online Dating Magazine*. Retrieved from http://www.onlinedatingmagazine.com/columns/editorials/editorial10.html

Lawson, H. M., & Leck, K. (2006). Dynamics of Internet dating. *Social Science Computer Review, 24*, 189–208.

Le, B., & Agnew, C. R. (2003). Commitment and its theorized determinants: A meta-analysis of the investment model. *Personal Relationships, 10*, 37–57.

Le, B., Dove, N. L., Agnew, C. R., Korn, M. S., & Mutso, A. A. (2010). Predicting non-marital romantic relationship dissolution: A meta-analytic synthesis. *Personal Relationships, 17*, 377–390.

Lea, M., & Spears, R. (1995). Love at first byte? Building personal relationships over computer networks. In J. T. Wood & S. W. Duck (Eds.), *Understudied relationships: Off the beaten track* (pp. 197–233). Newbury Park, CA: SAGE.

Ledbetter, A. M. (2008). Chronemic cues and sex differences in relational e-mail. *Social Science Computer Review, 26*, 466–482.

Lee, L., Loewenstein, G., Ariely, D., Hong, J., & Young, J. (2008). If I'm not hot, are you hot or not: Physical attractiveness evaluation and dating preferences as a function of one's own attractiveness. *Psychological Science, 19*, 669–677.

Lenton, A. P., Fasolo, B., & Todd, P. M. (2008). "Shopping" for a mate: Expected vs. experienced preferences in online mate choice. *IEEE Transactions on Professional Communication, 51*, 169–182.

Lenton, A. P., Fasolo, B., & Todd, P. M. (2009). The relationship between number of potential mates and mating skew in humans. *Animal Behaviour, 77*, 55–60.

Lenton, A. P., & Francesconi, M. (2010). How humans cognitively manage an abundance of mate options. *Psychological Science, 21*, 528–533.

Lenton, A. P., & Francesconi, M. (2011). Too much of a good thing? Variety is confusing in mate choice. *Biology Letters, 7*, 528–531.

Lenton, A. P., & Stewart, A. (2008). Changing her ways: Number of options and mate standard strength impact mate choice strategy and satisfaction. *Judgment and Decision Making, 3*, 501–511.

Leonhardt, D. (2006, March 28). The famous founder of operation match. *The New York Times.* Retrieved from http:/www.nytimes.com/2006/03/28/business/29leonside.html?_r=1

Leotti, L. A., & Delgado, M. R. (2011). The inherent reward of choice. *Psychological Science, 22*, 1310–1318.

Leotti, L. A., Iyengar, S. S., & Ochsner, K. N. (2010). Born to choose: The origins and value of the need for control. *Trends in Cognitive Science, 14*, 457–463.

Leslie, B., & Morgan, M. (2009). Soulmates, compatibility and intimacy: Allied discursive resources in the struggle for relationship satisfaction in the new millennium. *New Ideas in Psychology, 29*, 10–23.

Levine, R., Sato, S., Hashimoto, T., & Verma, J. (1995). Love and marriage in eleven cultures. *Journal of Cross-Cultural Psychology, 26*, 554–571.

Levinger, G. (1986). Compatibility in relationships. *Social Science, 71*, 173–177.

Lewak, R. W., Wakefield, J. A., Jr., & Briggs, P. F. (1985). Intelligence and personality in mate choice and marital satisfaction. *Personality and Individual Differences, 6*, 471–477.

Little, A. C., & Perrett, D. I. (2002). Putting beauty back in the eye of the beholder: Evolution and individual differences in face preference. *Psychologist, 15*, 28–32.

LittleRedRails.com. (2011a). *What is the cost of eHarmony subscriptions?* Retrieved from http://www.littleredrails.com/blog/what-is-the-price-of-eharmony-subscriptions/

LittleRedRails.com. (2011b). *What is the cost of Match.com subscriptions?* Retrieved from http://www.littleredrails.com/blog/2010/06/07/what-is-the-price-of-match-com-subscriptions/

Long, B. L. (2010). *Scripts for online dating: A model and theory of online romantic relationship initiation* (Unpublished doctoral dissertation). Bowling Green State University, OH.

Lopoo, L. M., & Western, B. (2005). Incarceration and the formation and stability of marital unions. *Journal of Marriage and Family, 67*, 721–734.

Luo, S., Chen, H., Yue, G., Zhang, G., Zhaoyang, R., & Xu, D. (2008). Predicting marital satisfaction from self, partner, and couple characteristics: Is it me, you, or us? *Journal of personality, 76*, 1231–1266.

Luo, S., & Klohnen, E. C. (2005). Assortative mating and marital quality in newlyweds: A couple-centered approach. *Journal of Personality and Social Psychology, 88*, 304.

Lutz-Zois, C. J., Bradley, A. C., Mihalik, J. L., & Moorman-Eavers, E. R. (2006). Perceived similarity and relationship success among dating couples: An idiographic approach. *Journal of Social and Personal Relationships, 23*, 865–880.

Lye, D. N., & Biblarz, T. J. (1993). The effects of attitudes toward family life and gender roles on marital satisfaction. *Journal of Family Issues, 14*, 157–188.

Lykken, D. T., & Tellegen, A. (1993). Is human mating adventitious or the result of lawful choice? A twin study of mate selection. *Journal of Personality and Social Psychology, 65*, 56–68.

Madden, M., & Lenhart, A. (2006). Online dating. *Pew Internet & American Life Project.* Retrieved from http://www.pewinternet.org/Reports/2006/Online-Dating.aspx

Malhotra, N. K. (1982). Information load and consumer decision making. *Journal of Consumer Research, 8*, 419–430.

Malouff, J. M., Rooke, S. E., & Schutte, N. S. (2008). The heritability of human behavior: Results of aggregating meta-analyses. *Current Psychology, 27*, 153–161.

Malouff, J. M., Thorsteinsson, E. B., Schutte, N. S., Bhullar, N., & Rooke, S. E. (2010). The five-factor model of personality and relationship satisfaction of intimate partners: A meta-analysis. *Journal of Research in Personality, 44*, 124–127.

Manning, J. T. (2002). *Digit ratio: A pointer to fertility, behaviour, and health*. New Brunswick, NJ: Rutgers University Press.

Mare, R. (1991). Five decades of educational assortative mating. *American Sociological Review, 56*, 15–32.

Marist Poll. (2011). Retrieved from http://maristpoll.marist.edu/210-its-destiny-most-americans-believe-in-soul-mates/

Markey, P. M., Lowmaster, S., & Eichler, W. (2010). A real time assessment of interpersonal complementarity. *Personal Relationships, 17*, 13–25.

Markey, P. M., & Markey, C. N. (2007). Romantic ideals, romantic obtainment, and relationship experiences. *Journal of Social and Personal Relationships, 24*, 517–533.

Match.com. (2011). Retrieved from http://www.match.com/index.aspx

Mathews, T. J. (1965). *Operation match. The Harvard Crimson.* Retrieved from http://www.thecrimson.com/article/1965/11/3/operation-match-pif-you-stop-to/

McCrae, R. R., & Costa, P. T. (1997). Personality trait structure as a human universal. *American Psychologist, 52*, 509–516.

McGrane, S. (2009, June 29). Can genetics help you find love? *Time Magazine.* Retrieved from http://www.time.com/time/magazine/article/0,9171,1905505,00.html

McKenna, K. Y. A., Green, A. S., & Gleason, M. E. J. (2002). Relationship formation on the Internet: What's the big attraction? *Journal of Social Issues, 58*, 9–31.

McLanahan, S., & Sandefur, G. (1994). *Growing up with a single parent: What hurts, what helps?* Cambridge, MA: Harvard University Press.

McNulty, J. K. (in press). Personality and relationships. In J. A. Simpson (Ed.), *Oxford handbook*. New York, NY: Oxford University Press.

Merkle, E. R., & Richardson, R. A. (2000). Digital dating and virtual relating: Conceptualizing computer mediated romantic relationships. *Family Relations, 49*, 187–192.

Merskin, D. L., & Huberlie, M. (1996). Companionship in the classifieds: The adoption of personal advertisements by daily newspapers. *Journalism & Mass Communication Quarterly, 77*, 219–229.

Milgram, S. (1984). Network love. *Omni, 7*(34), 410–413.

Miller, R. S. (1997). Inattentive and contented: Relationship commitment and attention to alternatives. *Journal of Personality and Social Psychology, 73*, 758–766.

Mitchell, R. L. (2009). Online dating: Analyzing the algorithms of attraction. *PCWorld.* Retrieved from http://www.pcworld.com/article/159884-2/online_dating_analyzing_the_algorithms_of_attraction.html

Monga, M., Alexandrescu, B., Katz, S. E., Stein, M., & Ganiats, T. (2004). Impact of infertility on quality of life, marital adjustment, and sexual function. *Urology, 63*, 126–130.

Montoya, R. M., Horton, R. S., & Kirchner, J. (2008). Is actual similarity necessary for attraction? A meta-analysis of actual and perceived similarity. *Journal of Social and Personal Relationships, 25*, 889–922.

Morry, M. M., Kito, M. I. E., & Ortiz, L. (2011). The attraction-similarity model and dating couples: Projection, perceived similarity, and psychological benefits. *Personal Relationships, 18*, 125–143.

Nagoshi, C. T., Johnson, R. C., & Honbo, K. A. M. (1992). Assortative mating for cognitive abilities, personality, and attitudes: Offspring from the Hawaii family study of cognition. *Personality and Individual Differences, 13*, 883–891.

National Advertising Review Council (NARC). (2011). *NARC online case reports*. Retrieved from http://www.narcpartners.org/reports/CaseReports.aspx

Neate, R. (2009, September 5). Appliance of science in finding love online. *The Telegraph*. Retrieved from http://www.telegraph.co.uk/finance/newsbysector/retailandconsumer/6142658/Appliance-of-science-in-finding-love-online.html.

Neff, L. A., & Karney, B. R. (2009). Stress and reactivity to daily relationship experiences: How stress hinders adaptive processes in marriage. *Journal of Personality and Social Psychology, 97*, 435–450.

Newcomb, T. M. (1956). The prediction of interpersonal attraction. *American Psychologist, 11*, 575.

Nezu, A. M., & Nezu, C. M. (2008). *Evidence-based outcome research: A practical guide to conducting randomized controlled trials for psychosocial interventions*. Oxford, UK: Oxford University Press.

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology, 2*, 175–220.

Nielsenwire.com. (2009, February 11). *Online dating and advertising prove to be a good match*. Retrieved from http://blog.nielsen.com/nielsenwire/consumer/online-dating-and-advertising-prove-to-be-a-good-match/

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84*, 231–259.

Nunes, J. C., & Dreze, X. (2006). The endowed progress effect: How artificial advancement increases effort. *Journal of Consumer Research, 32*, 504–512.

OkCupid.com. (2011). *About us.* Retrieved from http://www.okcupid.com/about/okcupid

Okdie, B. M., Guadagno, R. E., Bernieri, F. J., Geers, A. L., & Mclarney-Vesotski, A. R. (2011). Getting to know you: Face-to-face versus online interactions. *Computers in Human Behavior, 27*, 153–159.

Open.nystate.gov. (2011). S3618-2011: Enacts the "internet dating safety act of 2011." Retrieved January 19, 2012, from http://open.nystate.gov/legislation/bill/S3618-2011

Orenstein, S. (2003, August 1). *The love algorithm*. Retrieved from http://money.cnn.com/magazines/business2/business2_archive/2003/08/01/346313/index.htm.

Orr, A. (2004). *Meeting, mating, and cheating: Sex, love, and the new world of online dating*. Upper Saddle River, NJ: Reuters Prentice Hall.

Overall, N. C., Sibley, C. G., & Tan, R. (2011). The costs and benefits of sexism: Resistance to influence during relationship conflict. *Journal of Personality and Social Psychology, 101*, 271–290.

Parks, M. R., & Floyd, K. (1996). Making friends in cyberspace. *Journal of Communication, 46*, 80–97.

Parks, M. R., & Roberts, L. D. (1998). "Making MOOsic": The development of personal relationships online and a comparison to their off-line counterparts. *Journal of Social and Personal Relationships, 15*, 517–537.

Paumgarten, N. (2011, July 4). Looking for someone: Sex, love and loneliness on the Internet. *The New Yorker, 87*, pp. 36–49.

Payne, J. W., Bettman, J. R., & Johnson, E. J. (1993). *The adaptive decision maker*. Cambridge, England: Cambridge University Press.

Peel, L. (2008, Oct 6). *Matchmaker, Matchmaker, make me a match…if the algorithms agree*. Retrieved from http://business.timesonline.co.uk/tol/business/industry_sectors/technology/article4887501.ece

Penn, D. J. (2002). The scent of genetic compatibility: Sexual selection and the major histocompatibility complex. *Ethology and Sociobiology, 108*, 1–21.

Pennebaker, J. W., Dyer, M. A., Caulkins, R. S., Litowitz, D. L., Ackreman, P. L., Anderson, D. B., & McGraw, K. M. (1979). Don't the girls get prettier at closing time: A country and western application to psychology. *Personality and Social Psychology Bulletin, 5*, 122–125.

PerfectMatch.com. (2011a, June 15). Retrieved from http://www.perfectmatch.com/

PerfectMatch.com. (2011b, June 15). *Frequentlyaskedquestions*. Retrieved from http://www.perfectmatch.com/faq.asp

Pinker, S. (2002). *The blank slate: The modern denial of human nature*. New York, NY: Viking.

Plassman, H., O'Doherty, J., Shiv, B., & Rangel, A. (2008). Marketing actions can modulate neural representations of experienced pleasantness. *Proceedings of the National Academy of Sciences, 105*, 1050–1054.

PlentyOfFish.com. (2011, June 15). Retrieved from http://www.PlentyOfFish.com/

Ramirez, A., & Wang, Z. (2008). When online meets offline: An expectancy violations theory perspective on modality switching. *Journal of Communication, 58*, 20–39.

Ramirez, A., & Zhang, S. (2007). When online meets offline: The effect of modality switching on relational communication. *Communication Monographs, 74*, 287–310.

Ranganath, K. A., Smith, C. T., & Nosek, B. A. (2008). Distinguishing automatic and controlled components of attitudes from direct and indirect measurement methods. *Journal of Experimental Social Psychology, 44*, 386–396.

Redelmeier, D. A., & Shafir, E. (1995). Medical decision making in situations that offer multiple alternatives. *Journal of the American Medical Association, 273*, 302–305.

Reis, H. T. (2012). A brief history of relationship research in social psychology. In A. W. Kruglanski & W. Stroebe (Eds.), *Handbook*

of the history of social psychology (pp. 363–382). New York, NY: Psychology Press.

Reis, H. T., Maniaci, M. R., Caprariello, P. A., Eastwick, P. W., & Finkel, E. J. (2011a). Familiarity does indeed lead to attraction in live interaction. *Journal of Personality and Social Psychology, 101*, 557–570.

Reis, H. T., Maniaci, M. R., Caprariello, P. A., Eastwick, P. W., & Finkel, E. J. (2011b). In live interaction, does familiarity promote attraction or contempt? A reply to Norton, Frost, and Ariely (2011). *Journal of Personality and Social Psychology, 101*, 575–578.

Reis, H. T., & Shaver, P. (1988). Intimacy as an interpersonal process. In S. Duck (Ed.), *Handbook of personal relationships* (pp. 367–389). Chichester, UK: Wiley.

Rice, R. E., & Love, G. (1987). Electronic emotion: Socioemotional content in a computer-mediated communication network. *Communication Research, 14*, 85–108.

Rick, S., Small, D., & Finkel, E. (2011). Fatal (fiscal) attraction: Spendthrifts and tightwads in marriage. *Journal of Marketing Research, XLVIII*, 228–237.

Roberts, S. C., & Little, A. C. (2008). Good genes, complementary genes and human mate choice. *Genetica, 132*, 309–321.

Roberts, S. C., Little, A. C., Gosling, L. M., Jones, B. C., Perrett, D. I., Carter, V., & Petrie, M. (2005). MHC-assortative facial preferences in humans. *Biology Letters, 1*, 400–403.

Robins, R. W., Caspi, A., & Moffitt, T. E. (2000). Two personalities, one relationship: Both partners' personality traits shape the quality of their relationship. *Journal of Personality and Social Psychology, 79*, 251–259.

Robins, R. W., Caspi, A., & Moffitt, T. E. (2002). It's not just who you're with, it's who you are: Personality and relationship experiences across multiple relationships. *Journal of Personality, 70*, 925–964.

Rogge, R. D., Bradbury, T. N., Hahlweg, K., Engl, J., & Thurmaier, F. (2006). Predicting marital distress and dissolution refining the two-factor hypothesis. *Journal of Family Psychology, 20*, 156–159.

Roisman, G. I., Collins, W. A., Sroufe, L. A., & Egeland, B. (2005). Predictors of young adults' representations of and behavior in their current romantic relationship: Prospective tests of the prototype hypothesis. *Attachment & Human Development, 7*, 105–121.

Rosen, L. D., Cheever, N. A., Cummings, C., & Felt, J. (2008). The impact of emotionality and self-disclosure on online dating versus traditional dating. *Computers in Human Behavior, 24*, 2124–2157.

Rosenfeld, M. J. (2010, April). *Meeting online: The rise of the Internet as a social intermediary*. Paper session presented at the Population Association of America Meetings, Dallas, TX.

Rosenfeld, M. J., & Thomas, R. J. (2010, September). *Meeting online: The rise of the Internet as a social intermediary*. Unpublished manuscript, Department of Sociology, Stanford University, Stanford, CA

Rowan, D. (2011, April 25). How Badoo built a billion-pound social network … on sex. *Wired*. Retrieved from http://www.wired.co.uk/magazine/archive/2011/05/features/sexual-network?page=all

Rudder, C. (2010, April 7). Why you should never pay for online dating. Retrieved from http://interestingreads.posterous.com/why-you-should-never-pay-for-online-dating-ok

Rule, N. O., & Ambady, N. (2008). The face of success: Inferences from chief executives officers' appearance predict company profits. *Psychological Science, 19*, 109–111.

Rusbult, C. E. (1983). A longitudinal test of the investment model: The development (and deterioration) of satisfaction and commitment in heterosexual involvements. *Journal of Personality and Social Psychology, 45*, 101–117.

Russell, R. J. H., & Wells, P. A. (1991). Personality similarity and quality of marriage. *Personality and Individual Differences, 12*, 407–412.

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52*, 141–166.

Samuelson, W., & Zeckhauser, R. (1988). Status quo bias in decision making. *Journal of Risk and Uncertainty, 1*, 7–59.

Sautter, J., Tippett, R. M., & Morgan, S. P. (2010). The social demography of Internet dating in the United States. *Social Science Quarterly, 91*, 554–575.

Sbarra, D. A., Law, R. W., & Portley, R. M. (2011). Divorce and death: A meta-analysis and research agenda for clinical, social, and health psychology. *Perspectives on Psychological Science, 6*, 454–474.

Scheibehenne, B., Greifeneder, R., & Todd, P. M. (2010). Can there ever be too many options? A meta-analytic review of choice overload. *Journal of Consumer Research, 37*, 409–425.

Schellenberg, J. A. (1960). Homogamy in personal values and the "field of eligibles." *Social Forces, 39*, 157–162.

Schöndienst, V., & Dang-Xuan, L. (2011). The role of linguistic properties in online dating communication—A large-scale study of contact initiation messages. *Proceedings of the 15th Pacific Asia Conference on Information Systems, Paper 166*, Brisbane, Australia.

Schouten, A. P., Valkenburg, P. M., & Peter, J. (2009). An experimental test of processes underlying self-disclosure in computer-mediated communication. *Cyberpsychology, 3*, 1–15.

Schwartz, B. (2004). *The paradox of choice: Why more is less*. New York, NY: Eco/Harper-Collins Publishers.

Schwartz, P. (2006). *Finding your perfect match*. New York, NY: Penguin Group.

ScientificMatch.com. (2011, July 30). *Home Page*. Retrieved from https://scientificmatch.com/html/index.php

Shalit, G. (1966, February 22). Boy…girl…computer. New dating craze sweeps the campus. *Look Magazine*. Retrieved from http://blog.modernmechanix.com/2008/0/08/boy-girl-computer/

Shambora, J. (2010, September 23). *eHarmony's algorithm of love*. Retrieved from http://tech.fortune.cnn.com/2010/09/23/the-algorithm-of-love

Shin, J., & Ariely, D. (2004). Keeping doors open: The effect of unavailability on incentives to keep options viable. *Management Science, 50*, 575–586.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. London, England: John Wiley.

Siegel, J., Dubrovsky, V., Kiesler, S., & McGuire, T. W. (1986). Group processes in computer-mediated communication. *Organizational Behavior and Human Decision Processes, 37*, 157–187.

Simenauer, J., & Carroll, D. (1982). *Singles: The new Americans*. New York, NY: Simon & Schuster.

Simons, R. L. (1996). *Understanding differences between divorced and intact families: Stress, interaction, and child outcomes*. Thousand Oaks, CA: SAGE.

Simonson, I., & Tversky, A. (1992). Choice in context: Tradeoff contrast and extreme aversion. *Journal of Marketing Research, 29*, 281–295.

Simpson, J. A., Campbell, B., & Berscheid, E. (1986). The association between romantic love and marriage: Kephart (1967) twice revisited. *Personality and Social Psychology Bulletin, 12*, 363–372.

Skopek, J., Schulz, F., & Blossfeld, H. (2011). Who contacts whom? Educational homophily in online mate selection. *European Sociological Review, 27*, 180–195.

Smaill, B. (2004). Online personals and narratives of the self: Australia's RSVP. *Convergence: The Journal of Research into New Media Technologies, 10*, 93–107.

Snyder, M., & Swann, W. B. (1978). Hypothesis-testing processes in social interaction. *Journal of Personality and Social Psychology, 36*, 1202–1212.

Spears, R., & Lea, M. (1992). Social influence and the influence of the "social" in computer-mediated communication. In M. Lea (Ed.), *Contexts of computer-mediated communication* (pp. 30–65). Hemel Hempsted, UK: Wheatsheaf.

Sprecher, S. (1989). The importance to males and females of physical attractiveness, earning potential and expressiveness in initial attraction. *Sex Roles: A Journal of Research, 21*, 591–607.

Sprecher, S., & Duck, S. (1994). Sweet talk: The importance of perceived communication for romantic and friendship attraction experienced during a get-acquainted date. *Personality and Social Psychology Bulletin, 20*, 391–400.

Sprecher, S., Felmlee, D., Orbuch, T. L., & Willetts, M. C. (2002). Social networks and change in personal relationships. In A. L. Vangelisti, H. T. Reis, & M. A. Fitzpatrick (Eds.), *Stability and change in relationships* (pp. 257–284.). New York, NY: Cambridge University Press.

State.nj.us. (2011). *Internet dating safety act*. Retrieved from www.nj.gov/lps/ca/laws/InternetDatingAct.pdf

Steffek, L. M., & Loving, T. J. (2009). Contemporary methods of social introduction: Is the stigmatization justified? *Interpersona, 3*, 87–104.

Stephure, R. J., Boon, S. D., MacKinnon, S. L., & Deveau, V. L. (2009). Internet initiated relationships: Associations between age and involvement in online dating. *Journal of Computer-Mediated Communication, 14*, 658–681.

Stone, A. (2011). Match.com to begin checking users against sex offender database. *ABC News*. Retrieved from http://abcnews.go.com/US/match-begin-checking-users-sex-offender-database/story?id=13396930

Subscription Site Insider. (2011). *Dating and matchmaking site benchmark report*. Newport, RI: Anne Holland Ventures.

Sunnafrank, M. (1988). Predicted outcome value in initial conversations. *Communication Research Reports, 5*, 169–172.

Taylor, S. E., & Gollwitzer, P. M. (1995). Effects of mindset on positive illusions. *Journal of Personality and Social Psychology, 69*, 213–226.

Teachman, J. (2010). Work-related health limitations, education, and the risk of marital disruption. *Journal of Marriage and Family, 72*, 919–932.

Terman, L. M. (1938). *Psychological factors in marital happiness*. New York, NY: McGraw-Hill.

Terman, L. M. (1948). Marital adjustment and its prediction. In M. Fishbein & E. W. Burgess (Eds.), *Successful marriage* (pp. 117–131). Garden City, NY: Doubleday.

Thaler, R. H. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization, 1*, 39–60.

Thibaut, J. W., & Kelley, H. H. (1959). *The social psychology of groups*. New York, NY: Wiley.

Thompson, A., & Bolger, N. (1999). Emotional transmission in couples under stress. *Journal of Marriage and the Family, 61*, 38–48.

Thompson, M., Zimbardo, P., & Hutchinson, G. (2005). *Consumers are having second thoughts about online dating: Are the real benefits getting lost in over promises?* Unpublished manuscript. Available from http://weattract.com/

Thornhill, R., Gangestad, S. W., Miller, R., Scheyd, G., McCollough, J. K., & Franklin, M. (2003). Major histocompatibility complex genes, symmetry, and body scent attractiveness in men and women. *Behavioral Ecology, 14*, 668–678.

Tidwell, L. C., & Walther, J. B. (2002). Computer-mediated communication effects on disclosure, impressions, and interpersonal evaluations: Getting to know one another a bit at a time. *Human Communication Research, 28*, 317–348.

Tidwell, N. D., Eastwick, P. W., & Finkel, E. J. (in press). Perceived, not actual, similarity predicts initial attraction in a live romantic context: Evidence from the speed-dating paradigm. *Personal Relationships*.

Tierney, J. (2008). Hitting it off, thanks to the algorithms of love. *The New York Times*. Retrieved from http://www.nytimes.com/2008/01/29/science/29tier.html

Till, A., & Freedman, E. M. (1978). Complementarity versus similarity of traits operating in the choice of marriage and dating partners. *Journal of Social Psychology, 105*, 147–148.

Todd, P. M., Penke, L., Fasolo, B., & Lenton, A. P. (2007). Different cognitive processes underlie human mate choices and mate preferences. *Proceedings of the National Academy of Sciences of the United States of America, 104*, 15011–15016.

Toma, C. L., Hancock, J. T., & Ellison, N. B. (2008). Separating fact from fiction: An examination of deceptive self-presentation on online dating profiles. *Personality and Social Psychology Bulletin, 34*, 1023–1036.

Tong, S. T., & Walther, J. B. (2011). Just say "no thanks": Romantic rejection in computer-mediated communication. *Journal of Social and Personal Relationships, 28*, 488–506.

Tracy, J. (2006, January). Online dating stigma—Is the stigma gone? *Online Dating Magazine*. Retrieved from http://www.online-datingmagazine.com/columns/2006editorials/04-onlinedating-stigma.html

Turkheimer, E. (2000). Three laws of behavior genetics and what they mean. *Current Directions in Psychological Science, 9*, 160–164.

Tversky, A. (1972). Elimination by aspects: A theory of choice. *Psychological Review, 79*, 281–299.

Utz, S. (2000). Social information processing in MUDs: The development of friendships in virtual worlds. *Journal of Online Behavior, 1*, 1–23.

Utz, S. (2005). Types of deception and underlying motivation: What people think. *Social Science Computer Review, 23*, 49–56.

Valkenburg, P. M., & Peter, J. (2007). Who visits online dating sites? Exploring some characteristics of online dater. *CyberPsychology & Behavior, 10*, 849–852.

Valkenburg, P. M., & Peter, J. (2009a). The effects of instant messaging on the quality of adolescents' existing friendships: A longitudinal study. *Journal of Communication, 59*, 79–97.

Valkenburg, P. M., & Peter, J. (2009b). Social consequences of the internet for adolescents. *Current Directions in Psychological Science, 18*, 1–5.

Veroff, J., Kulka, R. A., & Douvan, E. (1981). *Mental health in America: Patterns of helpseeking from 1957 to 1976*. New York, NY: Basic Books.

Visualeconomics.com. (2011). *A business of love: Online dating by the numbers*. Retrieved from http://www.visualeconomics.com/a-business-of-love-online-dating-by-the-numbers/

Vohs, K. S., Finkenauer, C., & Baumeister, R. F. (2011). The sum of friends' and lovers' self-control scores predicts relationship quality. *Social Psychological and Personality Science, 2*, 138–145.

Walther, J. B. (1992). Interpersonal effects in computer-mediated interaction: A relational perspective. *Communication Research, 19*, 52–90.

Walther, J. B. (1995). Relational aspects of computer-mediated communication: Experimental observations over time. *Organization Science, 6*, 186–203.

Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research, 23*, 3–43.

Walther, J. B. (1997). Group and interpersonal effects in international computer mediated collaboration. *Human Communication Research, 23*, 342–369.

Walther, J. B. (2010). Computer-mediated communication. In C. R. Berger, M. E. Roloff, & D. R. Roskos-Ewoldsen (Eds.), *The handbook of communication science* (2nd ed., pp. 489–505). Thousand Oaks, CA: SAGE.

Walther, J. B., Anderson, J. F., & Park, D. W. (1994). Interpersonal effects in computer-mediated interaction. *Communication Research, 21*, 460–487.

Walther, J. B., Loh, T., & Granka, L. (2005). Let me count the ways: The interchange of verbal and nonverbal cues in computer-mediated and face-to-face affinity. *Journal of Language and Social Psychology, 24*, 36–65.

Walther, J. B., & Parks, M. R. (2002). Cues filtered out, cues filtered in: Computer-mediated communication and relationships. In M. L. Knapp & J. A. Daly (Eds.), *Handbook of interpersonal communication* (Vol. 3, pp. 529–563). Thousand Oaks, CA: SAGE.

Walther, J. B., & Tidwell, L. C. (1995). Nonverbal cues in computer-mediated communication, and the effect of chronemics on relational communication. *Journal of Organizational Computing and Electronic Commerce, 5*, 355–378.

Warren, N. C. (2002). *Date . . . or soul mate? How to know if someone is worth pursuing in two dates or less*. Nashville, TN: Nelson Books.

Watson, D., & Clark, L. A. (1984). Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin, 96*, 465–490.

Watson, D., Klohnen, E. C., Casillas, A., Nus Simms, E., Haig, J., & Berry, D. S. (2004). Match makers and deal breakers: Analyses of assortative mating in newlywed couples. *Journal of Personality, 72*, 1029–1068.

Wedekind, C., Seebeck, T., Bettens, F., & Paepke, A. J. (1995). MHC-dependent mate preferences in humans. *Proceedings: Biological Sciences, 260*, 245–249.

Weisfeld, G. E., Russell, R. J. H., Weisfeld, C. C., & Wells, P. A. (1992). Correlates of satisfaction in British marriages. *Ethology and sociobiology, 13*, 125–145.

Weiss, R. L. (1978). The conceptualization of marriage from a behavioral perspective. In T. J. Paolino & B. S. McCrady (Eds.), *Marriage and marital therapy: Psychoanalytic, behavioral and systems theory perspectives* (pp. 165–239). New York, NY: Brunner-Mazel.

Whisman, M. A., Uebelacker, L. A., & Weinstock, L. M. (2004). Psychopathology and marital satisfaction: The importance of evaluating both partners. *Journal of Consulting and Clinical Psychology, 72*, 830–838.

White, S. G., & Hatcher, C. (1984). Couple complementarity and similarity: A review of the literature. *American Journal of Family Therapy, 12*, 15–25.

Whitty, M. T. (2002). Liar, liar! An examination of how open, supportive and honest people are in chat rooms. *Computers in Human Behavior, 18*, 343–352.

Whitty, M. T. (2007). Introduction. In M. T. Whitty, A. J. Baker, & J. A. Inman (Eds.), *Online matchmaking*. New York, NY: Palgrave Macmillan.

Whitty, M. T. (2008). Revealing the "real" me, searching for the "actual" you: Presentations of self on an internet dating site. *Computers in Human Behavior, 24*, 1707–1723.

Whitty, M. T., & Buchanan, T. (2009). Looking for love in so many places: Characteristics of online daters and speed daters. *Interpersona: An International Journal of Personal Relationships, 3*, 63–86.

Whitty, M. T., & Carr, A. (2006). *Cyberspace romance: The psychology of online relationships*. New York, NY: Palgrave Macmillan.

Whitty, M. T., & Carville, S. E. (2008). Would I lie to you? Self-serving lies and other-oriented lies told across different media. *Computers in Human Behavior, 24*, 1021–1031.

Whitty, M. T., & Gavin, J. (2001). Age/sex/location: Uncovering the social cues in the development of online relationships. *CyberPsychology & Behavior, 4*, 623–630.

Wildermuth, S. M., & Vogl-Bauer, S. (2007). We met on the net: Exploring the perceptions of online romantic relationship participants. *Southern Communication Journal, 72*, 211–227.

Wills, J., & Todorov, A. (2006). First impressions: Making up your mind after a 100-ms exposure to a face. *Psychological Science, 17*, 592–598.

Winch, R. F. (1958). *Mate selection. A study of complementary needs*. New York, NY: Harper & Brothers.

Woll, S. B., & Cozby, C. P. (1987). Video-dating and other alternatives to traditional methods of relationship initiation. In W. H. Jones & D. Perlman (Eds.), *Advances in personal relationships* (Vol. 1, pp. 69–108). Greenwich, CT: JAI.

Wood, D., & Brumbaugh, C. C. (2009). Using revealed mate preferences to evaluate market force and differential preference explanations for mate selection. *Journal of Personality and Social Psychology, 96*, 1226–1244. doi:10.1037/a0015300

Wright, S. C., Aron, A., McLaughlin-Volpe, T., & Ropp, S. A. (1997). *Journal of Personality and Social Psychology, 73*, 73–90.

Wu, P., & Chiou, W. (2009). More options leads to more searching and worse choices in finding partners for romantic relationships online: An experimental study. *CyberPsychology & Behavior, 12*, 315–318.

Yang, M., & Chiou, W. (2010). Looking online for the best romantic partner reduces decision quality: The moderating role of choice-making strategies. *Cyberpsychology, Behavior, and Social Networking, 13*, 207–210.

Yurchisin, J., Watchravesringkan, K., & McCabe, D. B. (2005). An exploration of identity re-creation in the context of internet dating. *Social Behavior and Personality: An International Journal, 33*, 735–750.

Zhou, W., & Chen, D. (2009). Sociochemosensory and emotional functions: Behavioral evidence for shared mechanisms. *Psychological Science, 20*, 1118–1124.