



Acta de Investigación Psicológica -
Psychological Research Records

ISSN: 2007-4832

actapsicologicaunam@gmail.com

Universidad Nacional Autónoma de
México
México

Sprecher, Susan

Relationship Compatibility, Compatible Matches, and Compatibility Matching

Acta de Investigación Psicológica - Psychological Research Records, vol. 1, núm. 2,
agosto, 2011, pp. 187-216

Universidad Nacional Autónoma de México
Distrito Federal, México

Available in: <http://www.redalyc.org/articulo.oa?id=358933579002>

- How to cite
- Complete issue
- More information about this article
- Journal's homepage in redalyc.org

redalyc.org

Scientific Information System

Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal

Non-profit academic project, developed under the open access initiative

Relationship Compatibility, Compatible Matches, and Compatibility Matching

Susan Sprecher¹
Illinois State University

Abstract

Many leading Internet dating sites claim to be able to find compatible matches for singles, and that they use principles from Relationship Science to generate their matching algorithms. In this article, I first discuss how “relationship compatibility” has been studied in Relationship Science. It is generally not directly studied, but inferred from related constructs, including satisfaction, commitment, and endurance of the relationship. Second, I discuss three principles that are referred to in Relationship Science as defining a pair being a “compatible match.” These principles are similarity, complementarity, and matching (on same level of socially desirable characteristics, regardless of whether they are the same or different between partners). In the final section, I discuss what aspects of science are being used at the Internet dating sites to create compatible matches.

Keywords: Relationship Compatibility, Matches, Compatibility Matching, Internet Dating Sites.

Compatibilidad de la Relación, Parejas Afines y Compatibilidad del Emparejamiento

Resumen

Muchos de los sitios líderes en “la búsqueda de pareja” se dicen capaces de lograr coincidencias compatibles para solteros, usando los principios de la Ciencia de las Relaciones para generar sus algoritmos de emparejamiento. En este artículo primero se discute cómo la “compatibilidad en las relaciones” ha sido estudiada en la Ciencia de las Relaciones. Generalmente no es directamente estudiada, pero sí inferida a partir de constructos relacionados, incluyendo satisfacción, compromiso y mantenimiento en la relación. En segundo lugar, se discuten los tres principios referidos por la Ciencia de las Relaciones que definen lo que es “el emparejamiento compatible. Estos principios son similitud, complementariedad, y emparejamiento (el mismo nivel de características socialmente deseables, relativas a si ellos son iguales o diferentes entre ambos miembros de la parejas). En la sección final, se discuten qué aspectos de la ciencia han sido usados en los sitios de internet de búsqueda de pareja para crear emparejamientos compatibles.

Palabras Clave: Compatibilidad, Emparejamiento, Emparejamiento compatible, Sitios de internet de búsqueda de pareja.

¹ Portions of this paper were given in a keynote address at the conference for the International Association for Relationship Research (IARR) at the Interdisciplinary Center at Herzliya, Israel, July 24, 2010; and in a Distinguished Professor Lecture at Illinois State University, November 2, 2010.

Please address correspondence to Susan Sprecher, Department of Sociology and Anthropology (also of Department of Psychology), Illinois State University, Normal, IL 61790-4660, sprecher@ilstu.edu

“Enter eHarmony and the new generation of dating sites, among them PerfectMatch.com and Chemistry.com. All have staked their success on the idea that long-term romantic compatibility can be predicted according to scientific principles – and that they can discover those principles and use them to help their members finding lasting love. To that end they’ve hired high-powered academics, devised special algorithms for relationship-matching, developed sophisticated personality questionnaires, and put into place mechanisms for the long-term tracking of data. Collectively, their efforts mark the early days of a social experiment of unprecedented proportions, involving millions of couples and possibly extending over the course of generations. The question at the heart of this grand trial is simple: In the subjective realm of love, can cold, hard science help?”

Lori Gottlieb – “How Do I Love Thee”, *Atlantic Monthly*, March 2006 (pp. 58-59).

Relationship compatibility and compatible matches have come to the media’s and public’s attention because of the popularity of Internet matching sites which state that they can find compatible matches for their members and that their compatibility matching is based on principles from Relationship Science. Recent estimates are that hundreds of millions of singles, worldwide, have gone to a dating website to seek a partner (Shtatfeld & Barak, 2009)^{II}. Even those who would have no interest or need for “logging on for love” but who view media are exposed to the claims about compatibility made by the various dating sites. For example, U.S. based eHarmony advertises that that they match singles based on a Compatibility Matching System that “narrows the field from thousands of single men or single women to match with a highly select group of compatible singles.”^{III} Perfectmatch.com (also U.S. based) uses a Duet Total Compatibility System to “find highly compatible matches.”^{IV} Thus, “compatibility” is the industry buzz word *and* several of the major matching sites claim that they use Relationship Science to identify compatible matches for their members.

This chapter focuses on relationship compatibility, compatible matches, and compatibility matching, three distinct but inter-related topics. In the first section of this article, I discuss how *relationship compatibility* is presented in relationship science. The second section focuses more specifically on *compatible matches*, also from the perspective of relationship science. The final section discusses the *compatibility matching procedures* used at the Internet matching sites. Although the focus of Internet matching services is on compatibility in *romantic relationships*, compatibility is a concept relevant to all types of relationships, including friendships, parent-child relationships, and co-workers. Compatibility is also a

^{II} http://www.comscore.com/Press_Events/Press_Releases/2007/02/Top_Dating_Sites
<http://www.thedatingjournal.com/2010/02/20/the-emergence-of-romantic-relationships-online-main-findings/>
http://findarticles.com/p/articles/mi_m0EIN/is_2007_Feb_12/ai_n17218532/
http://www.businesswire.com/portal/site/home/permalink/?ndmViewId=news_view&newsId=20080211005037&newsLang=en

^{III} <http://www.eharmony.com/why>

^{IV} <http://www.perfectmatch.com/>

relationship state that is good and desirable (Berscheid, 1985; Berscheid & Regan, 2005).

Relationship Compatibility in Relationship Science

Although compatibility may be the buzz word at Internet matching services, it is not a central construct in the scientific field of personal relationships. The subject indices for recent handbooks and textbooks in the field of close relationships have either no entries for compatibility (e.g., Bradbury & Karney, 2010; Hendrick & Hendrick, 2000; Miller & Perlman, 2009) or only a few (e.g., Berscheid & Regan, 2005; Vangelisti & Perlman, 2006). For example, in Vangelisti and Perlman's (2006) almost 800-page *Cambridge Handbook on Personal Relationships* "compatibility" is referenced on only three pages.

As noted by Berscheid (1985), however, "compatibility seems to be known largely by the company it keeps; that is, it appears to acquire much of its meaning from its assumed cohorts; those *other* properties of relationships that appear to be the traveling companions of compatibility." (p. 144). Traveling companions of compatibility include satisfaction, commitment, and stability, relationship outcome variables that *are* frequently examined in the close relationships field (Berscheid, 1985).

The Concept of Compatibility

The exception to the lack of focus on compatibility in the relationship field is an edited volume published by Ickes (1985), entitled *Compatible and Incompatible Relationships*. Because there has not been a scholarly book or chapter published on the topic of relationship compatibility since 1985, the Ickes volume (also summarized recently by Ickes & Charania [2009] in an entry in the *Encyclopedia of Human Relationships*) remains the major published source of scientific discussion of compatibility per se, as well as its opposite – incompatibility. (For an empirical article on compatibility, however, see Houts, Robins, & Huston, 1996).

In the opening chapter to this book, Ickes (1985) distinguished between compatibility and incompatibility by referring to two sets of gears:

Consider the relationships within two sets of gears; In the first set, the two gears are precisely matched to each other; in the second set, the two gears are badly mismatched. When the two gears are compatible (i.e., precisely matched), their relationship "works," and they operate together in a smooth, synchronized manner. On the other hand, when the two gears are incompatible (i.e., badly mismatched), their relationship does not "work," and instead of meshing together and integrating their respective movements without unnecessary friction, they grind and grate against each other, producing heat, discordant noise, mutual wear and tear, and – in some cases – complete mutual inhibition of movement." (p. 3).

Ickes also noted, however, the limitation of this metaphor because it depicts primarily behavioral interdependence, whereas compatibility is likely to also include

feelings and cognitions. The Ickes (1985) volume presented 14 chapters that focused on relationship compatibility and incompatibility in various behavioral, emotional, and cognitive contexts, and across a variety of relationships, ranging from parent-infant relationships to long-term marriage. Because of the generosity of my mentor (Elaine Hatfield) in offering publication opportunities to her graduate students, I was a co-author of Chapter 4 (Hatfield, Traupmann, Sprecher, Utne, & Hay, 1985), which focused on reviewing evidence that equitable relationships are compatible relationships. Equity is defined as existing when the person evaluating the relationship perceives one partner's ratio of outcomes to inputs is equal to his or her partner's (e.g., Hatfield et al., 1985).

Compatibility was conceptualized in various ways by the authors in the Ickes (1985) volume. One theme to the definitions of compatibility throughout the chapters was a positive affective state or emotional tenor to the relationship. Phrases and words used to describe this emotional state included "feelings of affection or interpersonal attraction" (Furman, p. 6), "getting along with another in a congenial, harmonious fashion" (Clark, p. 119), "emotional serenity and tranquility" (Berscheid, p. 145) and "whether two people like each other, and whether they like the way they spend time together" (Reis, p. 227). Likewise, reference was made to the absence of negative emotions. In addition, many authors in the book, in defining compatibility, referred to the behaviors of the two people in the dyad, including frequent rewarding or positive interaction (Furman, p. 6), equitable and fair exchanges of resources (Hatfield et al.), synchronous behaviors (Lamb & Gilbride; Furman), "the behavior of the two individuals are well meshed, and therefore [they are] able to communicate efficiently and accurately" (Lamb & Gilbride, p. 36), and "the ability to co-act with another person in creating social events that are satisfying to both partners" (Reis, p. 210). Ickes, in his opening chapter, acknowledged that Berscheid's analysis of compatibility, which focused on behavioral patterns, may be the "definitive one." Berscheid, drawing from Kelley et al.'s (1983) behavioral interdependence model, defined compatibility as "the ratio of facilitating to interfering and conflictual events in partners' interactions" (Berscheid, 1985, p. 153). As noted by Berscheid, this facilitation is associated with having positive feelings for each other (Levinger & Rands, in the same volume, provided a similar definition).

Variation in Perspectives on Compatibility Across Perceivers and Time

Regardless of whether compatibility is assessed directly or is assessed indirectly through its traveling companions, different observers and actors may vary in their perceptions of a relationship's compatibility. For example, one person may view the relationship to be very compatible, whereas his or her partner may view it as less compatible, differences that occur because the two may come to the relationship with different comparison levels or general expectations (Rusbult, 1983). In addition, outside observers (family and friends) may have different opinions of the compatibility of a relationship than do the insiders. For example, research by Chris Agnew and his colleagues suggests that social networks'

opinions of the compatibility of relationships may be more realistic, predictive, and negative than that of the insiders (Agnew, Loving, & Drigotas, 2001; Etcheverry, Le, & Charania, 2008; Loving, 2006; MacDonald & Ross, 1999).

In addition, perceived relationship compatibility is likely to change over time. A relationship may be compatible in early interaction, but the pair may later discover that they are not compatible for a long-term relationship. This is an obvious truism. In fact, one use of the concept compatibility in the relationship literature is in the context of compatibility testing for mate selection. According to “compatibility testing models,” such as Murstein’s (1987) Stimulus-Value-Role theory, partners gain new information about each other as they go through stages of increasing relationship development which involves becoming interdependent in new contexts. Compatibility can continue to change over time in long-term relationships. The major longitudinal research studies on married couples, including Huston’s PAIR project (e.g., Huston, Niehuis, & Smith, 2001) and Orbuch’s (e.g., Orbuch, Veroff, Hassan, & Horrocks, 2002) Early Years of Marriage Project, have found that compatibility – or at least its traveling companions – change over years of marriage. Some couples who begin in marital bliss find themselves several years later divorced, or, if still together, in unhappy/incompatible relationships. Such marriages have been described in various ways, including empty-shell, conflict-habituated, and mixed-blessing marriages. A recent study of 1,000 married couples across the U.S. (e.g., Whisman, Beach, & Snyder, 2008) found that 31% of marriages can be classified as “unhappy.”

Furthermore, the assessment of compatibility at any point in time may include both a present focus and a future focus. As noted by Berscheid (1985), people are likely to use the word compatibility not only to refer to whether a pair is presently in harmony, but “are also making some prediction about how likely this state is to endure into the foreseeable future” (p. 145). When insiders and outsiders have different views of the compatibility of a relationship, it may be because they are focused, to different degrees, on the current state versus the predicted state.

Causal Conditions Affecting Relationship Compatibility

Gottlieb’s quote that opened this article referred to the stake that the Internet dating sites have in the idea that “long-term romantic compatibility can be predicted according to scientific principles (p. 58).” A primary goal of relationship science is, in fact, to make predictions and identify causal conditions that influence important relationship phenomena, such as attraction, satisfaction, and stability (e.g., Kelley et al., 1983). As is true of any complex relationship construct that is likely to have reciprocal associations with other relationship phenomena, there are no definitive models or statements that can be offered about which variables are causal conditions of compatibility versus are outcomes or indicators of compatibility. However, Figure 1 provides a summary of the types of variables likely to influence the interaction patterns in relationships that result in compatibility. These causal

factors can affect a pair's current compatibility as well as the likelihood that the relationship will be compatible in the long-run.

The causal conditions are divided into personal, relational, and environmental factors (Kelley et al., 1983). Personal causal conditions are the relatively stable characteristics of the partners in the relationship, who I will abbreviate as P (Person) and O (Other), following the notation used by Kelley et al. (1983). Individuals with a high level of certain personal characteristics are more likely than their counterparts who are characterized by a low level of these traits, to have compatible relationships with others. For example, personal characteristics that are found to be associated with relationship satisfaction and the other traveling companions of relationship compatibility include agreeableness, emotional stability, extraversion, high self-esteem, and secure attachment style (e.g., Barelds, 2005). Conversely, the personality characteristics, neuroticism and insecure attachment style, have been linked to lower quality relationships (Caughlin, Huston, & Houts, 2000; Karney & Bradbury, 1997; Kelly & Conley, 1987).

The second category of causal conditions is the combination or intersection of P's and O's characteristics (including their personality characteristics, attitudes and values, interests), which can refer specifically to being a *compatible match*. This causal factor is a focus on static personal characteristics of both partners and represents the crux of what is being considered by Internet matching sites in their efforts to create matches based on relationship science. The three "principles" from the close relationships field that refer to the intersection of partners' characteristics are: (1) similarity (or "birds of a feather flock together"), (2) complementary (or "opposites attract"); and 3) matching on socially desirable characteristics. As will be discussed further in the next section, considerable research indicates that similarity contributes to compatibility. In fact, some writers have equated similarity with compatibility. For example, Houts et al. (1996) wrote, "the standard paradigm for studying the role of compatibility in courtship focuses on whether people who marry are more similar than would be expected by chance" (pp. 7-8).

The third causal condition that can influence the compatibility of a relationship are processes that emerge out of P-O interactions. Certain norms (such as the norm of communality) communication patterns, and exchange patterns that emerge out of P x O interaction can contribute to relationship compatibility. Research by communication scholars (e.g., Sunnafrank & Miller, 1981) have indicated that these are the factors most likely to lead to attraction and early compatibility, and are more important than the joint consideration of static characteristics, i.e., the degree of similarity. It may be difficult, however, to distinguish causal P x O emergent variables (e.g., communication) conceptually from compatibility (the outcome variable) as defined by synchronous meshing of behaviors that result in a positive emotional state in the relationship. However, early P x O emergent conditions may predict later relationship compatibility. In addition, some P x O emergent variables may mediate the effects of other causal variables on compatibility.

The final causal conditions are environmental conditions, considered to be the neglected variables in the study of personal relationships (Berscheid, 1999;

Ridley & Avery, 1979). These are physical and social factors outside of the relationship that can impact the internal dynamics of the relationship. As a sociologist in the relationship field, one of my contributions has been to highlight the role of social networks in affecting relationships. When social network members approve of the couple, they are likely to facilitate experiences that help the couple's compatibility and satisfaction. Conversely, when network members are interfering or at least not supportive, this can have a negative effect on the outcome of the relationship (Sprecher & Felmlee, 1992; Sprecher & Felmlee, 2000; Sprecher, Felmlee, Orbuch, & Willetts, 2002). Other environmental influences on the compatibility of the relationship include stressful external events (e.g., loss of a job) and the erosive effect of one or both partners' attention directed toward alternative relationships (Karney & Bradbury, 1995, 2005). Compatibility is also likely to be affected by more distal factors – such as factors located within the social structure and culture.

Figure 1. Causal Factors Contributing to Relationship Compatibility

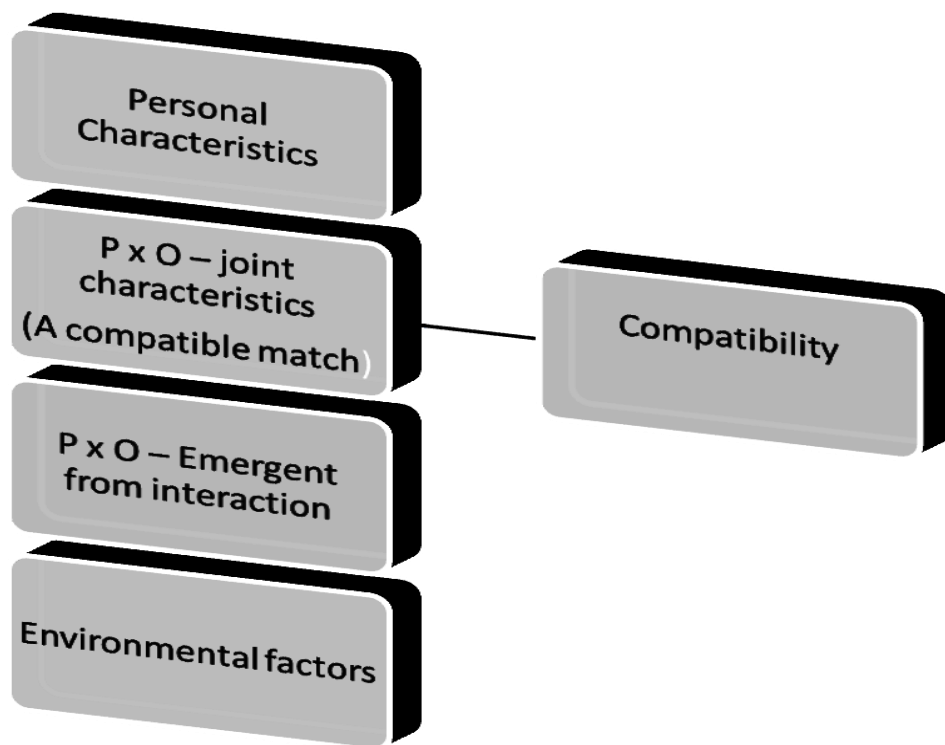


Figure 1. To understand the relationship compatibility we can find casual factors as personal characteristics as: agreeableness, emotional stability, extraversion; the union between personality partners, which reflects the compatible match (i.e. communication patterns), the result of this match in interaction and the environmental factors as social networks.

In sum, relationship compatibility can be conceptualized as consisting of behaviors that are rewarding, facilitating, and fair, and these behaviors result in positive feelings. In scholarship in the close relationships field, compatibility is inferred from related constructs, including satisfaction, commitment, and endurance of the relationship, although there is no reason that compatibility could not be measured more directly. Although compatibility may be thought of as a property of a relationship, members of the relationship and outside observers may have different views of the compatibility of a relationship. Perceptions of compatibility may include both a present and a future orientation, and the compatibility of the relationship is likely to change over time.

Compatible Matches in Relationship Science

As noted above, the joint consideration of P's and O's characteristics can refer specifically to being a *compatible match*, one causal factor of relationship compatibility. Just as little has been written in the scientific relationship field directly on the topic of relationship compatibility (the Ickes [1985] volume being an exception), little has been written specifically about the meaning of *compatible matches*. Nonetheless, when matching or matches are discussed in the literature, it is often in context of the three principles referred to above. That is, similarity, matching on socially desirable characteristics, and to a much lesser degree complementarity (or being opposites), are the three principles referred to in scientific discussion of good or compatible matches. All three principles refer to the alignment of P's and O's characteristics (e.g., traits, attitudes, interests, goals). Below, I provide a brief summary of the degree of empirical support for each principle, with an emphasis on recent research.

Similarity. The similarity effect, referring to similarity leading to attraction and satisfaction, has been described as one of the most well-established findings in the study of interpersonal attraction (Berscheid & Reis, 1998) and, indeed, "one of the most robust relationships in all of behavioral sciences" (Berger, 1975, p. 281). The importance of similarity has been demonstrated in many types of research, including mate selection studies, bogus stranger paradigm studies, brief interaction studies, and assessments of existing couples.

Although not generally referred to as studies on similarity, *mate selection studies* (in which participants are asked how much they desire various traits in a partner) have, in some cases, included items that refer to similarity. For example, several years ago, I asked university students to indicate the degree to which they desired various characteristics in a relational partner (the type of relationship that they were asked to consider was manipulated) (Sprecher & Regan, 2002). Included in the list, in addition to traits such as physical attractiveness, ambition, warmth and kindness, were four types of similarity: similarity on background characteristics (e.g., race, religion, social class), similarity on attitudes and values, similarity on social skills (e.g., interaction styles), and similarity on interests and leisure activities. Participants expressed preferences for all four types of similarity, as indicated by mean scores to the items that were above the midpoint of the

response scales. Of the different types of similarity, similarity in attitudes and values was most preferred. The order in which the other types of similarity were rated in importance was: similarity in interests, similarity in social skills (interaction styles), and similarity in background characteristics. Although similarity was generally desired across all types of relationships, it was preferred to a greater degree in a marital partner, particularly as compared to in a friend.

Similar results were found in an earlier partner preference study that I and my colleagues conducted (Regan, Levin, Sprecher, Christopher, & Cate, 2000). The participants rated the same four types of similarity to be moderately important in a partner. In addition, similarity in attitudes and values was rated more important than similarity in interests and leisure activities, which was judged to be more important than similarity in social skills (interaction styles) and similarity in background characteristics. This study also demonstrated that a preference for similarity was greater in a long-term romantic partner than in a short-term sexual fling.

In some mate selection studies, participants' own characteristics are assessed in addition to their preferences for the same characteristics in a partner. For example, Dijkstra and Barelds (2008) had their participants complete measures of the Big Five Personality characteristics (openness, agreeableness, conscientiousness, extraversion, neuroticism) and then indicate how much they would desire the same personal characteristics in a potential mate. Strong correlations were found between the individuals' own personality characteristics and the degree to which they desired the personality characteristics in a mate.

In a second type of research, *the bogus stranger paradigm* (e.g., Byrne, 1971), participants respond to a hypothetical or phantom other, about whom information is manipulated so that the hypothetical other varies in the level of similarity to the participant. Similarity research using this paradigm has led to the "law of attraction" (Byrne & Rhamey, 1965), which describes a positive linear association between the degree of similarity (e.g., attitudinal similarity) and attraction for another. Although the use of the bogus stranger paradigm to examine the similarity effect is less likely to appear in recent literature (the focus has shifted to the study of ongoing relationships), Aron, Steele, Kashdan, and Perez (2006) used this method to examine the effect of similarity of interests on initial attraction to a same-gender other. In their design, they manipulated not only the level of similarity of the other but also the expectation that a relationship could develop. Based on self-expansion theory (Aron & Aron, 1986), they predicted that when participants are not led to believe that a relationship was certain, the similarity effect will occur, but when there is certainty of a relationship, the effect of similarity may be reduced or even disappear (because a dissimilar other can be desirable for the self-expansion opportunities offered). The findings supported the predictions, particularly for men. The lack of effect found for women was explained as due to the lesser relevance of activities to the friendships of women.

In a third type of similarity research, referred to as the *brief-interaction study* (Montoya, Horton, & Kirchner, 2008), pairs of strangers engage in a brief interaction, and/or their perceptions of similarity to each other or their actual similarity are correlated with their degree of liking after the brief interaction. Effects

of actual similarity involve measuring the previously unacquainted individuals' attributes prior to interaction and then examining how a calculated degree of similarity (e.g., a difference score) is associated with the liking for each other. Testing the effects of perceived similarity involves examining how the partners' beliefs about similarity (after the interaction) are associated with feelings of attraction. As an example of such a study, many years ago I had pairs of previously unacquainted individuals of the opposite sex engage in a "get-acquainted" hour interaction in a public location (Sprecher & Duck, 1994). The participants completed a questionnaire before and after their interaction. Participants' beliefs about their similarity (as assessed in the post-interaction survey) were found to be associated with both dating and friendship attraction for the other. Perceived similarity was also found to be associated with the perceived quality of communication in the interaction. In multivariate analyses, perceived similarity remained a significant predictor of romantic and friendship attraction, even controlling for perceived physical attractiveness of the other and ratings of the quality of the communication. Perceived similarity can be strongly associated with attraction and compatibility in early stages of a relationship, for a number of reasons beyond the role it plays as a proxy variable for actual similarity, including that the reverse causal direction could be operating – attraction can lead to perceptions of similarity (Morry, 2005, 2007). For other brief-interaction studies that provide support for actual or perceived similarity leading to attraction, see, for example, Tenny, Turkheimer, and Oltmanns (2009); and Sunnafrank and Ramirez (2004).

In a fourth type of research, based on *surveys with actual ongoing couples*, degree of actual similarity is assessed. One issue that is examined is whether there is greater than chance similarity in existing couples, which is referred to as positive assortative mating (Buss, 1984). The correlations between partners are generally strong for age, degree of education, physical attributes, overall physical attractiveness, leisure pursuits, and role preferences; somewhat moderate for political and religious attitudes; and weak or inconsistent for personality characteristics and attitudes (Buss, 1984; Barelds, 2005; Feingold, 1988; Gonzaga, Campos, & Bradbury, 2007; Houts et al., 1996; Luo & Klohnen, 2005; Rammstedt & Schupp, 2008). Barelds and Barelds-Dijkstra (2007) found that couples who were friends before their relationship had transitioned to a romantic one had greater personality similarity than those who had rapid onset to a romantic relationship, presumably because those who were friends first had the opportunity to learn more about each other and therefore more effectively engage in positive assortative mating. Research has also yielded evidence that active assortative mating (preference for similarity) that occurs at greater than chance cannot be explained away by social homogamy (shared background leading to similarity) or convergence (couples becoming more similar over time) (Houts et al., 1996; Luo & Klohnen, 2005).

More relevant to the topic of similarity leading to compatibility is another issue examined in some research that has studied similarity in ongoing couples -- how degree of similarity between partners is associated with relationship quality, such as satisfaction. Findings have been weak or inconsistent, however. Some

research has found that dyadic similarity is associated with greater satisfaction or relationship quality (e.g., for a review of early work, see Karney & Bradbury, 1995; for more recent research, see Gonzaga et al., 2007; Luo & Klohnen, 2005), whereas other research has found weak or non-existent associations (Barelds, 2005; Gattis, Berns, Simpson, & Christensen, 2004; Gaunt, 2006). When perceived similarity is the focus, individuals in ongoing relationships report that they are similar (more than they are different) with their partner, and beliefs about similarity are associated with relationship quality (e.g. Lutz-Zois, Bradley, Mihalik, & Moorman-Eavers, 2006; Sprecher, 1998a & b).

Montoya et al. (2008) conducted a meta-analysis study of the impact of actual and perceived similarity on attraction and satisfaction across studies using three of the methods referred to above: no-interaction (phantom other) studies, brief-interaction studies, and studies focused on existing couples. Reflecting the types of similarity most often examined in the literature, the meta-analysis focused on the similarity effect for attitudes and personality traits. The researchers reported that the effect for actual similarity was strong for no-interaction studies, moderate for brief-interaction studies, and weak for studies with existing couples. The effect of perceived similarity was found to be equally strong across the three types of research.

More recently, similarity effects have been examined with data collected from users at Internet dating sites, although this research has been limited to data from online dating sites (e.g., Match.com) that focus on self-selection, and not from the Internet sites that involve scientific compatibility matching (e.g., eHarmony). The standardized items that all members complete at such sites (e.g., Match.com) are generally limited to a few questions; therefore, similarity cannot be examined for personality and attitudes, the dimensions most frequently examined in prior research. With this caveat, the recent research indicates that users have preferences for similar others. For example, Fiore and Donath (2005) obtained from 65,000 users profile information, reported preferences for partners, and actual communication with other members at the site. They found that the users preferred others who were similar to themselves on several variables such as marital history, desire for children, self-reported physical appearance, and smoking behavior. Skopek, Schulz, and Blossfeld (2010), using data from 13,573 users at a German online dating site, found that both men and women were likely to initiate contact and respond to messages with those others who were similar in education. Similar results were found with users in a dating site in Israel (Shtatfeld & Barak, 2009). Studies conducted with data collected from matching sites have also indicated a preference for someone of the same race (Hitsch, Hortacsu, & Ariely, 2009).

Complementarity

One implication of the overwhelming evidence for the similarity effect is that little support is found for complementarity, or the notion that opposites attract or that differences lead to relationship compatibility. In fact, most of the similarity

research referred to above is also evidence for a lack of the complementarity effect. Some recent studies, however, have shown that in some contexts or for some variables, complementarity may occur and/or be associated with a positive outcome for the relationship. I referred earlier to Aron et al.'s (2006) phantom other study, which provided suggestive evidence that when there is a guarantee of being liked, attraction to differences can occur, at least among men for a same-gender other (based on differences in interests) in an experimental context. Benefits of differences were also found in a study by Baxter and West (2003), in which members of friendships and romantic couples were interviewed and asked to discuss both how they were similar and how they were different. The participants identified both similarities and differences in their relationships, and the differences (as well as the similarities) were described as having both good and bad consequences for the relationship. Individual growth was seen as the primary advantage of differences. Baxter and West concluded "our results suggest that, at any given point in time, the snapshot of a relationship contains both similarities and differences, sometimes lodged in the same phenomenon" (p. 510). Another recent study (Amodio & Showers, 2005) found that while perceived similarity was associated with liking in high-committed dating relationships of college students, in relationships characterized by low commitment, dissimilarity was associated with greater liking. In a study that focused on assortative mating across a range of variables in newlywed couples, Luo and Klohen (2005) found similarity on attitudes and some personality traits, but also found some evidence for complementarity (negative assortment) for the personality trait, extraversion. Although differences can sometimes be initially attractive (see, also, Dijkstra & Barelds, 2008), research by Felmlee (2001) on fatal attractions suggests that differences can lead to problems in the relationship over time.

Matching

The matching principle refers to the notion that individuals tend to pair up with others who have about the same level of socially desirable characteristics, regardless of whether the socially desirable traits are the same or different between partners (Hatfield & Sprecher, 2009). Many years ago, Sociologist Erving Goffman (1952) observed that a proposal of marriage occurs when a man calculates his own social worth and suggests to a woman that her assets are not so much better as to "preclude a merger." Influenced by Kurt Lewin's (Lewin, Dembo, Festinger, & Sears, 1944) Level of Aspiration theory, Walster, Hatfield, Aronson, Abrahams, and Rottman (1966) proposed that in making dating and mate choices, people will choose someone of their own level of social desirability and they will do so because of being influenced by both the desirability of the other's traits and the chances of obtaining the other (Walster et al., 1966).

In the simplest form of the matching hypothesis, the focus is on physical attractiveness matching (Berscheid, Dion, Walster, & Walster, 1971; Feingold, 1988; Lee, Loewenstein, Ariely, Hong, & Young, 2008; Straaten, Engles, Finkenauer, & Holland, 2009). In more complex forms of matching, many factors

are considered when two people decide whether they are a well-matched couple. For example, one person can compensate for being unattractive by offering other characteristics, such as an exciting personality and material assets (Hatfield & Sprecher, 1986, 2009). Further research on matching (Kalick & Hamilton, 1986; see, also, Aron, 1988) has distinguished among *preferences*, *realistic choices*, and *what actually occurs* (i.e., what people settle for). Very little evidence has been found for matching when the focus is on preferences; instead, people want as much as they can get (e.g., Walster et al., 1966). But, in reality -- when everything is considered -- including what P desires, whether O likes P in return, whether P thinks O will like him/her, how much P is willing to risk a rejection to overtures, and market considerations (alternatives for P and O) -- matching on socially desirable characteristics often occurs. In addition, a traditional type of matching is gender-linked. In some matches, an older, wealthy, successful man pairs with a younger, attractive woman.

Analyses of data from a dating website collected recently by a team of economists demonstrated the complex matching that occurs in choices made at dating websites (Hitsch, Hortacsu, & Ariely, 2009; see also Hitsch, Hortacsu, & Ariely, 2010). In their study of 22,000 users of a major dating service over a three-month period, the researchers collected data on activities that included browsing profiles, sending messages, and actual two-way interactions. They also downloaded the photos that were posted and had University of Chicago students rate them on physical attractiveness. One issue that the researchers examined was the “trade-off” between different traits, i.e., how much a particular person with a negative trait or deficiency would need to make up on a positive trait in order for there to be a “trade-off” desirable to others. For example, using economic modeling, they estimated that with each decile decrease in a man’s physical attractiveness, an increase of \$8,000 to \$49,000 annual income would be needed to compensate, to receive the same number of responses from women at the site. The researchers estimated that the most unattractive men would need to earn \$186,000 above the median income (\$62,500), i.e., have an annual salary of \$248,500, to obtain an equivalent amount of interest from women. They also concluded that women could not make up in income what they lacked in physical attractiveness because men are not as attracted to income in women as women are to income in men.

In sum, compatible matches in the scientific relationship field most often refers to similar matches, although complementarity and matching on socially desirable characteristics are also considered. Being a compatible match may be a necessary but not sufficient condition for achieving relationship compatibility. If the two people are mismatched, they are not likely to be able to make their relationship compatible in the long run regardless of how hard they work at it. As noted by Berscheid (1985), “Some people are simply and irrevocably incompatible with each other” (p. 146) and “no amount of negotiation or ‘conflict resolution skills,’ no amount of relationship counseling, or ‘working on’ the relationship, may produce compatibility.” (p. 146). On the other hand, a compatible match at the beginning of the relationship is not a sufficient condition for long-term relationship compatibility. Returning to the causal model in Figure 1, relationship compatibility is influenced

by many other factors in addition to the P x O joint characteristics (i.e., matching). A couple could make a perfect match, but bad things can happen to good couples, and the relationship can become incompatible over time. In the next section, I turn to a discussion of the procedures used at the Internet matching sites to create compatible matches using scientific principles.

Compatibility Matching at the Internet Dating Sites

Although there were early attempts to use computers for matching, both for science (e.g., Coombs & Kenkel, 1966) and as a service for college students frustrated with traditional ways of meeting partners (see summary in Leonhardt, 2006, of “Operation Match” at Harvard University), High-speed Internet and personal computers needed to be created before successful modern day Internet matching could be developed. The first Internet matching site in the U.S., Match.com, was launched in 1995. Match.com, as well as many other matching sites (e.g., Yahoo! Personals, American Singles), primarily offer a venue for online personal advertisements or profiles. The profile information typically contains a combination of responses to check-box questions (questions about age, height, body type, occupation, etc.) and open-ended responses (e.g., “In my own words”), and also allows the user to post a photograph or photographs and sometimes also videotapes. Search engines are available for the members to narrow their search to a particular gender, age group, and geographical area; and to people with specific interests.

While Match.com (including Match.International which operates in approximately 25 countries, including Mexico) and other similar sites offer primarily a “searching” venue through electronic personal advertisements, a “scientific” Internet matching service was launched with eHarmony in 2000, followed by Perfectmatch.com in 2002 and Chemistry.com (part of Match.com) in 2005. (True.com also claims to provide scientific, compatibility matching.) These sites distinguish themselves from others by offering a “scientific approach” to matching (e.g., Gottlieb, 2006). Members who seek matches at these sites complete a lengthy questionnaire, which the sites state have “science” behind their construction (e.g., “PhD designed”). “Matching algorithms,” also claimed to be guided by scientific principles, are used to sift through the data and match pairs (Orenstein, 2003). Users pay more for the scientific matching sites than for the sites based on posting profiles.

What “science” is being used at these scientific matching sites, and how does this science correspond with what we know about compatibility and compatible matches based on the published science on relationships, as reviewed above? In addition, is it possible that the Internet sites that use scientific matching can create more compatible matches than alternative ways of meeting partners? Before I provide answers to these questions, a caveat is in order. There is not a definitive source of information available on the science used at the matching sites because such information is considered proprietary (intellectual property). Information on the science behind the match-making, however, can be gleaned

from their websites, from media summaries of interviews conducted with the major researchers and CEOs at the Internet sites, and from an examination of their surveys. In addition, the rationale behind the eHarmony matching system can be found in the company's patent application, available online (Buckwalter, Carter, Forgatch, Parsons, & Warren, 2004, 2008)^V.

Scientific expertise. All three major scientific matching sites have hired academic Ph.Ds. At Perfectmatch, this is sociologist and University of Washington Professor, Pepper Schwartz. Helen Fisher, a biological anthropologist at Rutgers University, is the academic scientist at Chemistry.com. Both Schwartz and Fisher, who work in a consulting capacity at the sites, were hired prior to the development of the sites' matching procedures, and were instrumental in creating them. At eHarmony, Gian Gonzaga is the chief (full-time) relationship scientist, although he was not part of the original team that created the matching survey. The survey at eHarmony was created by Neil Clark Warren, the original founder, who has a Ph.D. in clinical psychology from the University of Chicago, and Galen Buckwalter, who has a Ph.D in psychology and expertise in statistics and methods (e.g., Gottlieb, 2006). In addition, there are many other scientists who work at eHarmony or are serving in the role of advisors.

Use of prior scientific literature. All three sites have referred to the development of their compatibility survey as being based on prior literature in the relationship field. eHarmony states that its patented matching technique is "based on 35 years of clinical research and rigorous relationship research to determine which commonalities between partners are consistently associated with successful relationships."^{VI} In his interview with Gottlieb (2006), Buckwalter (who appears to have been the primary creator of the survey at eHarmony) referred to reviewing the psychology literature "to identify the areas that might be relevant in predicting success in long-term relationships" (p. 60). Perfectmatch.com states that their approach is based on "over 30 years of research."^{VII} And, Chemistry.com has stated about their scientific matching, "Our singles matching models are based on 35 years of clinical experience and rigorous relationship research..."

The scientific principles behind the matching. The primary scientific principle for compatibility matching used at eHarmony, according to public domain information, is similarity. In an interview summarized in Gottlieb (2006), Warren said, "Similarities are like money in the bank. Differences are like debts you owe. It's all right to have a few differences, as long as you have plenty of equity in your account."^{VIII} He also has stated that after counseling many failing couples, he concluded that "opposites attract, but then they attack"^{IX}. But which types of similarity are emphasized at eHarmony? As discussed above, there are many

^V <http://www.google.com/patents?vid=USPAT6735568>
<http://www.google.com/patents?vid=USPAT7454357>

^{VI} <http://www.eharmony.com/why>

^{VII} <http://www.perfectmatch.com/hp/indexaff.asp?p=n>

^{VIII} <http://old.nationalreview.com/interrogatory/warren200502140751.asp>

^{IX} <http://old.nationalreview.com/interrogatory/warren200502140751.asp>

ways in which partners can be similar to each other. In addition, prior research has indicated that similarity on one dimension is not necessarily associated with similarity on another dimension (e.g., Houts et al., 1996). The eHarmony website refers to matching on 29 dimensions, which are grouped into four categories: personality, character, emotional skills, and family and values. The survey measures these dimensions and many other variables with a survey of over 250 items. Greg Waldorf, eHarmony's CEO, has stated in a recent interview: "We found that over time the superficial stuff doesn't matter. It doesn't matter that you both love tennis or skiing. What's important is that you have the same attitudes to family and finances."^x

The Duet Total Compatibility System at Perfectmatch.com is based on both similarity and complementarity, and Pepper Schwartz has argued that both are necessary for romantic compatibility (see interview reported in Gottlieb, 2006). The test is described as being based on the same theory behind the famous Myers Briggs Type indicator. In a relatively brief questionnaire (with items that are dichotomous yes/no questions), eight personality characteristics are measured: romantic impulsivity, personal energy, outlook, predictability, flexibility, decision-making style, emotionality, and self-nurturing style. Schwartz has stated (see Gottlieb, 2006) that similarity operates for the first four factors, and either similarity or differences for the final four. The Perfectmatch.com website also refers to matching "not only with people who are similar to you but also people who complement you."^{xi}

Chemistry.com's survey and matching process focus more on chemistry than compatibility. The survey has approximately 150 questions, with responses to questions designed to measure four personality types, each associated with a particular hormone or chemical: Explorer (Dopamine), Builder (Serotonin), Director (Testosterone), and Negotiator (Estrogen). For example, users are asked in one question to indicate the length of their index finger relative to their ring finger (which can be related to the level of testosterone). In another question, users are asked to recognize sincere versus insincere faces, which Fisher argues is related to estrogen (being a Negotiator) (Gottlieb, 2006). Based on their responses to a variety of questions, people are classified according to a primary personality type and a secondary personality type. In media interviews, Fisher has argued that falling in love depends on both similarity and complementarity^{xii}. For example, in one recent interview she stated, "I think we are unconsciously attracted to those who complement ourselves biologically, as well as socially, psychologically, and

^x <http://www.telegraph.co.uk/finance/newsbysector/retailandconsumer/6142658/Appliance-of-science-in-finding-love-online.html>

^{xi}

<http://www.perfectmatch.com/?p=n&OVRAW=perfectmatch.com&OVADGRPID=18556335400&OVKEY=perfectmatch.com&OVMTTC=standard&OVADID=57164700512&OVKWID=417229309012&OVCAMPID=8516457012&OVNDID=ND1>

^{xii} <http://www.chemistry.com/drhelenfisher/interviewdrfisher.aspx>
http://www.scientificblogging.com/run_and_tumble/helen_fisher_who_we_love_and_how_science_can_help_us_find_our_soulmate
<http://www.webmd.com/sex-relationships/features/the-science-behind-romance>

intellectually. I think we fall in love with someone who has a different chemical profile for dopamine, serotonin, estrogen, and testosterone that complements our own. This is the basic premise behind my work with Chemistry.com"^{XIII} She has also stated that it is the prominent neurochemical within an individual that determines whether the preference is for similarity or complementarity. Explorers and Builders will prefer similarity, whereas Directors and Negotiators will select each other (Fisher, 2009).^{XIV}

In-house empirical research. The sites also refer to their own scientific research for the purpose of developing their matching procedures. eHarmony has stated that their patented scientific model for matching is based on data collected from 5,000 married couples. Although I could not find the detail of this study (see also discussion of this omission by Houran, Lange, Rentfrow, & Bruckner, 2004), the study is referred to in various published sources (e.g., Gottlieb, 2006). For example, Carter (2005) wrote that his first involvement as a research scientist with eHarmony was to conduct construct validity for a set of factors from a 1000+ item survey that had been administered to approximately 3,000 married couples. He also refers to replicating the factor structure with a second sample of couples.^{XV} In addition, as can be gleaned from various sources, including the eHarmony patent (Buckwalter et al., 2004, 2008), this large sample of couples has been used to determine what combination of traits is found in couples who have the highest level of satisfaction.

The sites also appear to use data collected from their members to improve their matching procedures. At eHarmony, users' actions after they are sent matches (e.g., whether they click on particular matches to obtain more information) are used as input into the model for the particular users almost immediately.^{XVI} Chemistry.com has had a post-meeting "chemistry check" in which members give feedback after a date. Helen Fisher has stated in several media interviews that she is using the data and feedback from the users to modify the Chemistry.com matching procedure. In addition, Fisher has referred to having data from 28,000 users and being prepared to publish the Chemistry's matching procedure for peer review.^{XVII} She has classified these users into different profiles and followed their dating experiences. According to interviews, these data have led to her conclusions that people with the primary personality associated with dopamine and serotonin prefer each other while those with the personality type associated with testosterone are attracted to those with a personality type of estrogen.

^{XIII} Interview with Helen Fisher. <http://www.chemistry.com/drhelenfisher/interviewdrfisher.aspx> Downloaded 6/8/10
<http://www.elle.com/Life-Love/Sex-Relationships/The-Laws-Of-Attraction>

^{XIV} http://www.santacruzsentinel.com/politics/ci_11602383

^{XV} <http://www.psychologicalscience.org/observer/getArticle.cfm?id=1726>

^{XVI} http://www.computerworld.com/s/article/9127711/Online_dating_The_technology_behind_the_attraction

^{XVII} http://www.computerworld.com/s/article/9127711/Online_dating_The_technology_behind_the_attraction

Finally, eHarmony is the industry leader in scientific research designed to answer basic research questions about relationships and contribute to peer-reviewed, academic research. The eHarmony research labs include research by Gian Gonzaga, Thomas Bradbury, and other relationship scientists (<http://www.eharmony.com/labs/>). The current eHarmony research facilities, which opened in spring of 2007, include a state-of-the-art laboratory for studying couple interaction. As noted at the website for eharmonyLabs, "While some of the research we conduct is for product development, and therefore proprietary, much of our research is submitted for peer review and academic publication. We are committed to sharing the knowledge we gain and we collaborate with an expert advisory committee to better the field of research and improve relationships."^{xviii} Several online studies are advertised at the Lab's website. In addition, a marriage study is currently underway which involves extensive data collected from couples, including observations of their interaction.

The "algorithms." The matching algorithms, regardless of the underlying scientific principles, can be considered a form of science. Calculations are conducted with mega-data to determine the best matches for the sites' members. A media interview with the CEO at eHarmony refers to "1 billion calculations each day."^{xix} He (Greg Waldorf) also gives credit to the group of Ph.Ds behind the science, who he refers to as the company's "big brain." Waldorf states: "The Ph.D.s are a special breed, they have expertise in everything from psychology, how do relationships get formed, all the way through from computer science and mathematics to really figure out the complexity of the massive scale of our system, how to make it all happen in a very predictable way for the user, knowing we have a lot of choices that we can make to which choices we can deliver."^{xx}

The exact matching algorithms at the various sites may never be publically known, but even if we could know, they are likely to change and be fluid depending on a number of factors. One aspect of the calculations is likely to involve psychometric theory and analyses^{xxi} guiding the process of combining items into factor scores, for each individual. Then, these scores are likely compared to benchmarks determined by prior data sets and to current data from potential matches' responses on the same dimensions. One description for eHarmony's matching procedure was found in an early report by Carter (2005): "...users' factor scores are compared to various benchmarks to determine which compatibility models are statistically valid for them, and then these models are used to compute compatibility coefficients for each logically possible pairing in the user pool." In addition, the eHarmony patent (Buckwalter et al., 2004, 2008) suggests that users are first classified according to an individual satisfaction score, representing the likelihood that they would be satisfied in relationships and then further collapsed

^{xviii} <http://www.eharmony.com/labs/about/>

^{xix} http://www.electronicretailermag.com/er0209_eharmony/
http://www.computerworld.com/s/article/9127711/Online_dating_The_technology_behind_the_attraction

^{xx} <http://abcnews.go.com/print?id=10701151>

^{xxi} <http://www.eharmony.com/labs/about/>

into three groups based on likelihood of being satisfied: unlikely, average, good. This consideration of an individual satisfaction score is similar to the consideration of personal factors affecting compatibility, as displayed in Figure 1. Then, within each of these groups, a satisfaction score is approximated with each possible match within the same category. This approximated satisfaction score is likely based on a similarity index. For example, in a recent empirical report, eHarmony scientists Carter and Buckwalter (2009) wrote that their online system: “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.” (Carter & Buckwalter, 2009, p. 107).

In sum, there are scientists and a scientific stamp at the three major Internet matching sites. eHarmony seems to focus exclusively on the principle of similarity, although on dimensions (e.g., personality) that have shown in some published relationship literature to have only modest, positive assortative mating in actual couples (e.g., Montoya et al., 2008). Chemistry.com and PerfectMatch.com claim to focus on both similarity and complementarity, with the dominant principle seeming to depend on the particular variable, circumstances, and individual preferences. As reviewed earlier in this article, however, almost no published research exists to indicate that complementarity on attitudes, values, or personality is associated with relationship satisfaction or success in long-term relationships. In addition, variables associated with neurochemicals and brain chemistry (as at Chemistry.com) are not among the variables measured in the published social scientific research on attraction and close relationships. Therefore, although there may be science behind the Internet match-making services, it is not always the same science as in the published relationship literature. Nonetheless, the “proof is in the pudding;” future peer-reviewed publications from the scientists at the matching sites may provide validity for their choices of variables and their emphasis on complementarity for at least some variables or for some people. eHarmony appears to be the leader in terms of several aspects of science, including the use of published scientific literature behind their matching, conducting their own scientific research to improve the matching, and in contributing to academic research on couples.

Can the Science Behind the Matching Create More Compatible Matches than Alternative Ways of Meeting?

The theoretical perspective underlying the online matchmaking paradigm is that who you are and who you choose to be with will have an enormous impact on the quality of your marriage. Matchmaking services also assume it is possible to affect your selection when looking for a mate in a way that will improve on the outcome in a manner that would likely not occur without intervention (Carter & Buckwalter, 2009, p. 106).

This is one of the major arguments of scientific matching internet sites -- that they can provide something more than just another (efficient) way to meet partners. The argument is that that they offer a better way because the scientific procedures that they use for match-making can result in more compatible matches, which can

then lead to long-term compatibility. Warren (founder of eHarmony) has stated, "Seventy-five percent of what makes for a great marriage has to do with successful selection of a partner."^{XXII} At this time, however, the "social experiment of an unprecedented proportions" referred to in the opening quote (Gottlieb, 2006) to this article has yielded only limited and mixed evidence for the premise that Internet scientific-based matches are more compatible than those that have their origin in more traditional ways.

In a recent published study, Carter and Buckwalter (2009), scientists at eHarmony, compared a group of 157 couples who had been matched through eHarmony with a comparable group of couples (matched on marriage length and age of spouses) who were recruited through a separate online sampling procedure. On a number of variables that referred to personality, affect, and values, the couples who had been matched through the eHarmony site were more similar than those who met in other ways. In addition, the online matched couples had higher satisfaction scores, as indicated by their scores on Dyadic Adjustment scale. Similar results had been found in an earlier study reported by Carter and Snow (2004), using a similar sampling procedure. This research could be considered as supportive evidence that scientific matching leads to compatible relationships, although it is difficult to draw valid conclusions based on a comparison of two convenient samples that each have unknown selection biases. In addition, independent verification is needed by researchers unassociated with a dating website.

In a recent study *not* funded by a dating website, Sociologist Rosenfeld (2010) analyzed a new data set, Wave 1 of the "How Couples Meet and Stay Together." The sample consisted of a U.S. national representative sample of 4002 individuals, 3009 who were partnered. Rosenfeld found that the Internet has clearly gained in importance as a way to meet partners. Of those who had met in the two years prior to the study, 23% of heterosexual couples and 61% of gay couples had met through the Internet. Rosenfeld compared couples, based on how they met, on a relationship quality score, and found no significant differences. In additional analyses that controlled for a large number of variables, including relationship duration, how the couple met continued to be unrelated to relationship satisfaction. Although Rosenfeld's study was based on a representative sample, it is also limited in what it can tell us about scientific-based matches at Internet sites because: 1) the analyses did not distinguish between those meeting through dating services versus those meeting in other on-line ways (e.g., chatrooms); and 2) the satisfaction measure was only one item. Therefore, more research is needed on this issue of whether scientific matching can create more compatible matches. In fact, OnlineDatingMagazine.com has advertised a survey that assesses whether online relationships are more successful than offline relationships.^{XXIII} Regardless of the findings, however, this study will also be limited by self-selection biases of the couples who respond.

^{XXII} <http://old.nationalreview.colm/interrogatory/warren200502140751.asp>

^{XXIII} <http://www.onlinedatingmagazine.com/columns/2009editorials/modernlovestudy.html>

Speculation also exists on how the attraction process differs between relationships that meet in traditional face-to-face contexts versus those that meet on-line, regardless of the specific on-line venue (Cooper & Sportolari, 1997; Merkle & Richardson, 2000; Sprecher, 2009; Sprecher, Schwartz, Harvey & Hatfield, 2009). The speculations offer suggestions as to how components of or pathways to compatibility can differ as a function of how the relationship begins. For example, the process of attraction in a face-to-face romantic relationship is likely to involve first the influence of proximity and physical attractiveness, and then the discovery of similarity, followed by the rewards of self-disclosure (Merkle & Richardson, 2000). In contrast, Internet-initiated relationships have been described as involving “an inverted developmental sequence,” (Merkle & Richardson, 2000) which first often involves a high level of mutual and sometimes intense self-disclosure, and an initial minimal role for physical attractiveness and proximity. Although there may be an exchange of photographs between potential matches, physical attractiveness and other “chemistry” factors generally play less of a role initially. Furthermore, once two people meet, the impact of physical attractiveness can be reduced because it follows learning other information about each other. As Cooper and Sportolari speculate, “the felt intensity and meaning of any unappealing physical traits are then more likely to be mitigated by the overall attraction that exists” (p. 9).

Another difference is that social networks may play a lesser role in aiding the development of Internet-based relationships. In traditional ways of forming relationships, people are often introduced by friends or two people meet based on friend-created social settings that bring people together (e.g., Parks, 2007). Relationships formed through the Internet need to overcome barriers of geographic distance (in some cases) and lack of integration of the couple in a larger social network in order to become compatible for the long-term.

Conclusions

Recent Internet studies have brought “compatibility” and “compatible matches” to the public’s attention. In addition, the publicity from the sites has drawn public’s attention to relationship science and its potential role in helping to create compatible matches. This article first reviewed the scientific perspective on relationship compatibility and compatible matches. Although a compatible match (e.g., similarity) is one major factor leading to relationship compatibility (i.e., satisfaction, commitment), many other factors play a role as well. Some dating sites recognize this. For example, eHarmony has advertised that they use science not only to help in mate selection, but also for “relationship enhancement.” Relationship information, based on scientific research, is available on their website to help couples maintain their relationship and achieve happiness.

In the last section of this article, I reviewed what public domain information reveals about scientific-based compatibility at the Internet dating sites. There is some “compatibility” between the sites’ science and the published science on

relationships, but also some “incompatibility.” For example, there is very little evidence in the published science that complementarity can lead to long-term compatibility, although this is a principle used at some of the sites for matching. In addition, even when the similarity principle is emphasized at the sites, it is sometimes in regard to variables that have not been investigated in prior scientific literature. Furthermore, although complex matching and trade-offs occur in regard to socially desirable traits in relationship formation that occurs in both traditional contexts for meeting and in the self-selection process at Internet dating sites such as Match.com (Hitsch et al., 2009), it is unclear whether the scientific-based matching sites also use this principle in their matching.

Regardless of the validity of the science at the matching sites, one important function they offer is to provide legitimization for matches, similar to that provided by other third parties. My first scientific paper, at the first International Conference on Personal Relationships (Madison, Wisconsin, USA, in 1982), was a paper on the *legitimizing factors in the initiation of relationships* (Marwell, Sprecher, McKinney, DeLamater, & Smith, 1982). Based on a random sample of college sophomores at the University of Wisconsin, we discussed the important role of friends and family in introducing romantic partners. We stated that friends and family are important because they help to legitimize the relationship. Let me end this paper, written almost 30 years after my first conference paper, by stating that this legitimization factor may also be an important function served by the scientific-based Internet matching. Even if the science behind the compatibility matching does not result in relationships that are any more compatible than those formed through traditional ways of meeting, the science-based matches, similar to a friend-initiated matches, provide a “legitimization” of the relationship. The sites can vouch for the fact that based on their matching procedures, this is not a poor match, and may even be a very compatible one.

References

- Agnew, C. R., Loving, T. J., & Drigotas, S. M. (2001). Substituting the forest for the trees: Social networks and the prediction of romantic relationship state and fate. *Journal of Personality and Social Psychology*, 81, 1042-1057.
- Amodio, D. M., & Showers, C. J. (2005). ‘Similarity breeds liking’ revisited: The moderating role of commitment. *Journal of Social and Personal Relationships*, 22, 817-836.
- Aron, A. (1988). The matching hypothesis reconsidered again: Comment on Kalick and Hamilton. *Journal of Personality and Social Psychology*, 54, 441-446.
- Aron, A., & Aron, E. (1986). *Love and the expansion of self: Understanding attraction and satisfaction*. New York: Hemisphere.
- Aron, A., Steele, J. L., Kashdan, T. B., & Perez, M. (2006). When similar do not attract: Tests of a prediction from self-expansion model. *Personal Relationships*, 13, 387-396.
- Barelds, D. P. H. (2005). Self and partner personality in intimate relationships. *European Journal of Personality*, 19, 501-518.

- Barelds, D. P. H., & Barelds-Dijkstra, P. (2007). Love at first sight or friends first? Ties among partner personality trait similarity, relationship onset, relationship quality, and love. *Journal of Social and Personal Relationships*, 24, 479-496.
- Baxter, L. A., & West, L. (2003). Couple perceptions of their similarities and differences: A dialectical perspective. *Journal of Personal and Social Relationships*, 20, 491-514.
- Berscheid, E. (1985). Compatibility, interdependence, and emotion. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 143-161). New York: Springer-Verlag.
- Berscheid, E. (1999). The greening of relationship science. *American Psychologist*, 54, 260-266.
- Berscheid, E., Dion, K., Walster, E., & Walster, G. W. (1971). Physical attractiveness and dating choice: A test of the matching hypothesis. *Journal of Experimental Social Psychology*, 7, 173-189.
- Berscheid, E., & Regan, P. (2005). *The psychology of interpersonal relationships*. Upper Saddle River, NJ: Pearson Education (Prentice Hall).
- Berger, C. R. (1975). Task performance and attributional communication as determinants of interpersonal attraction. *Speech Monographs*, 40, 280-286.
- 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* (Vol. 2, 4th ed. Pp. 193-281). New York: McGraw-Hill.
- Bradbury, T. N., & Karney, B. R. (2010). *Intimate relationships*. New York: Norton.
- Buckwalter, J. G., Carter, S. R., Forgatch, G. T. Parsons, T. D., & Warren, N. C. (2004, May 11). *Method and system for identifying people who are likely to have a successful relationship*. U.S. Patent 6,735,568. Washington, DC.
- Buckwalter, J. G., Carter, S. R., Forgatch, G. T. Parsons, T. D., & Warren, N. C. (2008, Nov. 18). *Method and system for identifying people who are likely to have a successful relationship*. U.S. Patent 7,454,357B2. Washington, DC.
- Buss, D. M. (1984). Marital assortment for personality dispositions: Assessment with three different data sources. *Behavior Genetics*, 14, 111-123.
- Byrne, D. (1971). *The attraction paradigm*. New York: Academic Press.
- Byrne, D., & Rhomey, R. (1965). Magnitude of positive and negative reinforcements as a determinant of attraction. *Journal of Personality and Social Psychology*, 2, 884-889.
- Carter, S. R. (2005, Feb.). For modern-day Cupids, data replaces dating: Psychological science is behind the successful matches made at eHarmony. *Association for Psychological Science Observer*, 18. Downloaded from <http://www.psychologicalscience.org/observer/getArticle.cfm?id=1826>.
- 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.

- Carter, S., & Snow, C. (2004, May). *Helping singles enter better marriages using predictive models of marital success*. Paper presented at the 16th Annual Convention of the American Psychological Society.
- Caughlin, J., Huston, T., & Houts, R. (2000). How does personality matter in marriage? An examination of trait anxiety, negativity, and marital satisfaction. *Journal of Personality and Social Psychology*, 78, 326-336.
- Clark, M. S. (1985). Implications of relationship type for understanding compatibility. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 119-140). New York: Springer-Verlag.
- Coombs, R. H., & Kenkel, W. F. (1966). Sex differences in dating aspiration and satisfaction with computer-arranged partners. *Journal of Marriage and the Family*, 28, 62-66.
- Cooper, A., & Sportolari, L. (1997). Romance in cyberspace: Understanding online attraction. *Journal of Sex Education and Therapy*, 22, 7-14.
- Dijkstra, P., & Barelds, D. P. H. (2008). Do people know what they want: A similar or complementary partner? *Evolutionary Psychology*, 6, 595-602.
- Feingold, A. (1988). Matching for attractiveness in romantic partners and same-sex friends: A meta-analysis and theoretical critique. *Psychological Bulletin*, 104, 226-235.
- Felmlee, D. H. (2001). From appealing to appalling: Disenchantment with a romantic partner. *Sociological Perspectives*, 44, 263-280.
- Fisher, H. (2009). *Why him? Why her? Finding real love by understanding your personality type*. Henry Holt.
- Etcheverry, P. E., Le, B., & Charania, M. R. (2008). Perceived versus reported social referent approval and romantic relationship commitment and persistence. *Personal Relationships*, 15, 281-295.
- Felmlee, D. H. (2001). From appealing to appalling: Disenchantment with a romantic partner. *Sociological Perspectives*, 44, 263-280.
- Fiore, A. T., & Donath, J. (2005). Homophily in online dating: When do you like someone like yourself? *CHI*, conference on human factors in computing systems. 1317-1374.
- Furman, W. (1985). Compatibility and incompatibility in children's peer and sibling relationships. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 61-87). New York: Springer-Verlag.
- Gattis, K. S., Berns, S., Simpson, L. E., & Christensen, A. (2004). Birds of a feather or strange birds? Ties among personality dimensions, similarity, and marital quality. *Journal of Family Psychology*, 4, 564-574.
- Gaunt, R. (2006). Couple similarity and marital satisfaction: Are similar spouses happier. *Journal of Personality*, 74, 1401-1420.
- Goffman, E. (1952). On cooling the mark out: Some aspect of adaptation to failure. *Psychiatry*, 15, 451-463.
- 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.

- Gottlieb, L. (March, 2006). How do I love thee? *The Atlantic Monthly*, 58-70. Retrieved June 14, 2009 from <http://www.theatlantic.com/doc/200603/online-love>.
- Hatfield, E., & Sprecher, S. (1986). *Mirror, mirror: The importance of looks in everyday life*. Albany: State University of New York Press.
- Hatfield, E., & Sprecher, S. (2009). Matching hypothesis. In H. T. Reis & S. Sprecher (Eds.), *Encyclopedia of human relationships* (Vol. 2, pp. 1065-1067). Newbury Park, CA: Sage.
- Hatfield, E., Traupmann, J., Sprecher, S., Utne, M., & Hay, J. (1985). Equity and intimate relations: Recent research. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 91-117). New York: Springer-Verlag.
- Hendrick, C., & Hendrick, S. S. (Eds.) (2000). *Close relationships: A sourcebook*. Thousand Oaks, CA: Sage.
- Hitsch, G. J., Hortacsu, A., & Ariely, D. (2009). What makes you click? Mate preferences in online dating. http://home.uchicago.edu/~ghitsch/Hitsch-Research/Guenter_Hitsch_Files/Mate-Preferences.pdf.
- Hitsch, G. J., Hortacsu, A., & Ariely, D. (2010). Matching and sorting in online dating. *American Economic Review*, 100, 130-163.
- 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.
- Huston, T., Niehuis, S., & Smith, S. (2001). The early marital roots of conjugal distress and divorce. *Current Directions in Psychological Science*, 10, 116-119.
- Ickes, W. (Ed.) (1985) *Compatible and incompatible relationships*. New York: Springer-Verlag.
- Ickes, W. (1985). Introduction. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 1-7). New York: Springer-Verlag.
- Ickes, W., & Charania, M. R. (2009). Compatibility. In H. T. Reis & S. Sprecher (Eds.), *Encyclopedia of human relationships* (Vol. 1, pp. 283-286). Newbury Park, CA: Sage.
- Kalick, S. M., & Hamilton III, T. E. (1986). The matching hypothesis reexamined. *Journal of Personality and Social Psychology*, 51, 673-682.
- 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.
- Karney, B. R., & Bradbury, T. N. (2005). Contextual influences on marriage: Implications for policy and intervention. *Current Directions in Psychological Science*, 14, 171-174.

- Kelley, H. H., Berscheid, E., Christensen, A., Harvey, J. H., Huston, T. L., Levinger, G.,... Peterson, D.R. (1983). Analyzing close relationships. In H. H. Kelley, E. Berscheid, A. Christensen, J. H. Harvey, T. L. Huston, G. Levinger... D. R. Peterson (Eds.), *Close relationships* (pp. 20-67). New York: Freeman.
- 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.
- Lamb, M. E., & Gilbride, K. E. (1985). Compatibility in parent-infant relationships: Origins and processes. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 33-60). New York: Springer-Verlag.
- Lee, L., Loewenstein, G., Ariely, D., Hong, J., & Young, J. (2008). If I'm not hot, are you hot or not?: Physical-attractiveness evaluations and dating preferences as a function of one's own attractiveness. *Psychological Science*, 19, 669-677.
- Leonhardt, D. (2006, March 28). The famous founder of Operation Match. *New York Times*. Retrieved December 22, 2007, from <http://www.nytimes.com/2006/03/28/business/29leonside.html>.
- Levinger, G., & Rands, M. (1985). Compatibility in marriage and other close relationships. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 309-331). New York: Springer-Verlag.
- Lewin, K., Dembo, T., Festinger, L., & Sears, P. (1944). Level of aspiration. In J. McV. Hunt (Ed.), *Personality and the behavior disorders* (Vol. 1, pp. 333-378). New York: Ronald Press.
- Loving, T. J. (2006). Predicting dating relationship fate with insiders' and outsiders' perspective: Who and what is asked matters. *Personal Relationships*, 13, 349-362.
- Luo, S., & Klohnen, E. C. (2005). Assortative mating and marital quality in newlyweds: A couple centered approach. *Journal of Personality and Social Psychology*, 88, 304-326.
- 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.
- Madden, M., & Lenhart, A. (2006). *Online dating*. Washington, DC: Report for the Pew Internet & American Life Project. Retrieved January 21, 2009, from <http://www.pewinternet.org>.
- MacDonald, T. K., & Ross, M. (1999). Assessing the accuracy of predictions about dating relationships: How and why do lovers' predictions differ from those made by observers? *Personality and Social Psychology Bulletin*, 25, 1417-1429.
- Marwell, G., Sprecher, S., McKinney, K., DeLamater, J., & Smith, S. (1982). Legitimizing factors in the initiation of heterosexual relationships. Paper presented at the First International Conference on Personal Relationships, Madison, WI.

- Merkle, E.R., & Richardson, R.A. (2000). Digital dating and virtual relating: Conceptualizing computer mediated romantic relationships. *Family Relations*, 49, 187-192.
- Miller, R. S., & Perlman, D. (2009). *Intimate relationships* (5th edition). Boston: McGraw Hill.
- 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. (2005). Relationship satisfaction as a predictor of similarity ratings; A test of the attraction-similarity hypothesis. *Journal of Social and Personal Relationships*, 22, 561-584.
- Morry, M. M. (2007). The attraction-similarity hypothesis among cross-sex friends: Relationship satisfaction, perceived similarities, and self-serving perceptions. *Journal of Social and Personal Relationships*, 24, 117-138.
- Murstein, B. I. (1987). A clarification and extension of the SVR theory of dyadic pairing. *Journal of Marriage and the Family*, 49, 929-947.
- Orbuch, T. L., Veroff, J. Hassan, H., & Horrocks, J. (2002). Who will divorce: A 14-year longitudinal study of black couples and white couples. *Journal of Social and Personal Relationships*, 19, 179-202.
- Orenstein, S. (August 1, 2003). The love algorithm Match.com thinks it has found a formula for ruling the online dating business: A scientific way to find Mr. or Ms. Right. *Business 2.0 Magazine*. Retrieved on June 14, 2009 from http://money.cnn.com/magazines/business2/business2_archive/2003/08/01/346313/index.htm.
- Parks, M. R. (2007). *Personal relationships, personal networks*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Rammstedt, B., & Schupp, J. (2008). Only the congruent survive – Personality similarities in couples. *Personality and Individual Differences*, 45, 533-535.
- Regan, P. C., Levin, L., Sprecher, S., Christopher, S., & Cate, R. (2000). Partner preferences: What characteristics do men and women desire in their short-term sexual and long-term romantic partners? *Journal of Psychology and Human Sexuality*, 12, 1-21.
- Reis, H. T. (1985). The role of the self in the initiation and course of social interaction. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 209-231). New York: Springer-Verlag.
- Ridley, C. A., & Avery, A. W. (1979). Social network influence on the dyadic relationship. In R. Burgess & T. Huston (Eds.), *Social exchange in developing relationships* (pp. 223-246). New York: Academic Press.
- Rosenfeld, M. J. (2010, April). Meeting online: The rise of the Internet as a social intermediary. Presentation at the Population Association of America Meetings, Dallas, TX.
- 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.

- Shtatfeld, R., & Barak, A. (2009). Factors related to initiating interpersonal contacts on Internet dating sites: A view from the social exchange theory. *Interpersona: An International Journal on Personal Relationships*, 3, 19-37.
- Skopek, J., Schulz, F., & Blossfeld, H-P. (2010). Who contacts whom? Educational homophily in online mate selection. *European Sociological Review*.
- Sprecher, S. (1998a). Insiders' perspectives on reasons for attraction to a close other. *Social Psychology Quarterly*, 61, 287-300.
- Sprecher, S. (1998b). What keeps married partners attracted to each other? *Free Inquiry in Creative Sociology*, 26, 193-200.
- Sprecher, S. (2009). Relationship initiation and formation on the Internet. *Marriage and Family Review*, 45, 1-21.
- Sprecher, S., & Duck, S. (1994). Sweet talk: The importance of perceived communication for romantic and friendship attraction experience during a get-acquainted date. *Personality and Social Psychology Bulletin*, 20, 391-400.
- Sprecher, S., & Feilmee, D. (1992). The influence of parents and friends on the quality and stability of romantic relationships: A three-wave longitudinal investigation. *Journal of Marriage and the Family*, 54, 888-900.
- Sprecher, S., & Feilmee, D. (2000). Romantic partners' perceptions of social network attributes with the passage of time and relationship transitions. *Personal Relationships*, 7, 325-340.
- Sprecher, S., Feilmee, D., Orbuch, T. L., & Willetts, M. C. (2002). Social networks and change in personal relationships. In A. Vangelisti, H. Reis, & M. A. Fitzpatrick (Eds.), *Stability and Change in Relationships* (pp. 257-284). Cambridge: Cambridge University Press.
- Sprecher, S., & Regan, P. C. (2002). Liking some things (in some people) more than others: Partner preferences in romantic relationships and friendships. *Journal of Social and Personal Relationships*, 19, 463-481.
- Sprecher, S., Schwartz, P., Harvey, J., & Hatfield, E. (2008). Thebusinessoflove.com: Relationship initiation at Internet matchmaking services. In S. Sprecher, A. Wenzel, & J. Harvey (Eds.), *Handbook of relationship initiation* (pp. 249-265). New York: Psychology Press/Taylor & Francis.
- Straaten, I., Engles, R. C. M. E., Finkenauer, C., & Holland, R. W. (2009). Meeting your match: How attractiveness similarity affects approach behavior in mixed-sex dyads. *Personality and Social Psychology Bulletin*, 35, 685-697.
- Sunnafrank, M., & Miller, G. R. (1981). The role of initial conversations in determining attraction to similar and dissimilar strangers. *Human Communication Research*, 8, 16-25.
- Sunnafrank, M., & Ramirez, A. (2004). At first sight: Persistent relational effects of get-acquainted conversations. *Journal of Social and Personal Relationships*, 21, 361-379.
- Tenny, E. R., Turkheimer, E., & Oltmanns, T. F. (2009). Being liked is more than having a good personality: The role of matching. *Journal of Research in Personality*, 43, 479-585.

- Vangelisti, A. L., & Perlman, D. (Eds.) (2006). *The Cambridge handbook of personal relationships*. Cambridge University Press.
- Walster, G.W., Hatfield, E., Aronson, V., Abrahams, D., & Rottman, L. (1966). Importance of physical attractiveness in dating behavior. *Journal of Personality and Social Psychology*, 4, 508-516.
- Watson, D., Klohnen, E. C., Casillas, A., Simms, E N., Haig, J., & Berry, D. S. (2004). Match makers and deal breakers: Analyses of assortative mating in newlywed couples. *Journal of Personality*, 72, 1029-1068.
- Whisman, M. A., Beach, S. R. H., & Snyder, D. K. (2008). Is marital discord taxonic and can taxonic status be assessed reliably? Results from a national, representative sample of married couples. *Journal of Consulting and Clinical Psychology*, 76, 745-755.

© Universidad Nacional Autónoma de México, 2011.

Los derechos reservados de *Acta de Investigación Psicológica*, son propiedad de la Universidad Nacional Autónoma de México (UNAM) y el contenido de esta revista no puede ser copiado ni enviado por correo electrónico a diferentes sitios o publicados en listas de servidores sin permiso escrito de la UNAM. Sin embargo, los usuarios pueden imprimir, descargar o enviar por correo electrónico los artículos para uso personal.

Copyright of *Psychological Research Record* is the property of Universidad Nacional Autónoma de México (National Autonomous University of Mexico, UNAM) and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.