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Interpersonal Chemistry: What Is It, How Does It Emerge, and How Does It Operate?

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Abstract
Although chemistry is a well-known, sought-after interpersonal phenomenon, it has remained relatively unexplored in the psychological literature. The purpose of this article is to begin articulating a theoretically grounded and precise definition of interpersonal chemistry. To that end, we propose a conceptual model of interpersonal chemistry centered around the notion that when two or more individuals experience chemistry with one another, they experience their interaction as something more than the sum of their separate contributions. Our model stipulates that chemistry encompasses both behavior (i.e., what chemistry "looks like") and its perception (i.e., what it "feels like"). The behavior involves interaction sequences in which synchronicity is high and in which people's goals are expressed and responded to in supportive and encouraging ways. The perception of chemistry includes cognitive (i.e., perception of shared identity), affective (i.e., positive affect and attraction), and behavioral (i.e., perceived goal-relevant coordination) components. We review existing research on chemistry as well as supporting evidence from relevant topics (e.g., attraction, similarity, perceived partner responsiveness, synchrony) that inform and support this model. We hope that this conceptual model stimulates research to identify the circumstances in which chemistry arises and the processes by which it affects individuals, their interactions, and their relationships.

Keywords
chemistry, relationships, attraction, interpersonal connection

> The meeting of two personalities is like the contact of two chemical substances: if there is any reaction, both are transformed.
>
> —Carl Jung, *Modern Man in Search of a Soul*

> When musicians have chemistry, we can feel it. There's something special among them that's missing when they perform alone.
>
> —Kevin Berger (2019, para. 1)

Chemistry is a ubiquitous and highly prized goal in romantic relationships. When potential partners consider whether to pursue a romantic connection, they often ask themselves whether they experience chemistry—a feeling of intense connection or palpable "spark"—with one another. This question is a familiar one to users of online dating services—so much so, in fact, that many dating sites pledge in their advertising to help users find a partner with whom they feel chemistry. So alluring is the appetite for chemistry that one site, chemistry.com, features it in its name, pledging that its online personality tests and profiles will identify "personalized matches with the potential to trigger chemistry."

References to interpersonal chemistry appeared in fiction as early as the 1590s—the "fateful forces that governed the relationships between people" (Ball, 2008, p. 47)—and today online searches reveal thousands of articles coaching romantic hopefuls with tips to improve their chemistry and workshops to help writers craft characters with realistic chemistry. Furthermore, chemistry does not lose its appeal when couples move

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beyond dating; the term is also commonly applied to established relationships. Across the entire life cycle, committed relationships and even long-term marriages are often described as having chemistry, a claim intended to denote "extraordinary levels of compatibility in areas proven to create relationship success" (Bucior, 2012, para. 31, quoting from an eHarmony message).

The experience of chemistry is not limited to romantic relationships. Nonromantic friends—particularly close friends—often portray their connection in this way, denoting the existence of a special kind of compatibility that goes beyond the bounds of ordinary warmth or positivity. Chemistry is also a common metaphor in sports. For example, in football, exceptionally successful teamwork between a quarterback and wide receiver is sometimes described in terms of their chemistry, and successful professional sports teams (i.e., ones in which shared success among teammates exceeds measurable levels of individual skill) are more likely to experience chemistry (Mukherjee et al., 2019). On the other hand, failure in professional sports is sometimes attributed to a lack of chemistry, as when Devin Booker, a guard with the Phoenix Suns basketball team, cited a lack of team chemistry to explain a loss he called "embarrassing" (Rapp, 2018).

In a similar vein, a fruitful and innovative pairing of creative artists (e.g., Lennon and McCartney), scientists (e.g., Kahneman and Tversky), or inventors (e.g., Jobs and Wozniak) is often characterized in terms of chemistry. For example, the singer Justin Timberlake once remarked about his music career that "you could liken my chemistry with Timbaland to Marty Scorsese and Robert De Niro" (Pringle, 2013). The same metaphor has been used to describe work teams (Nicolini, 2002; Ricci & Wiese, 2016), news anchors (Diaz, 2018), academic mentoring relationships (Jackson et al., 2003), movie actors (Jaremko-Greenwold, 2015), and teacher–student relationships. In each of these usages, the term chemistry is used generically to refer to individuals who seem to mesh well together, who exhibit rapport, and whose coordinated actions appear seamless and effective.

These examples illustrate the extent to which the concept of chemistry is widely recognized, used, appreciated, and relevant across a diverse range of activities in which two or more individuals must coordinate their actions to create a joint outcome or product. Surprisingly, however, psychological science has paid scant attention to defining and characterizing this construct. Although a handful of studies, described below, have directly explored the idea of chemistry, nearly all of them are based on a lay understanding of the term rather than a precise definition of its predictors and consequences and its links to other relational constructs. In some respects, the current treatment of chemistry in the literature is reminiscent of Supreme Court Justice Potter Stewart's famous remark about obscenity: "Perhaps I could never succeed in intelligibly [defining obscenity]. But I know it when I see it" (*Jacobellis v. Ohio*, 1964, p. 197). The purpose of this article is to begin articulating a theoretically grounded and precise definition of interpersonal chemistry that might then be used to better identify the circumstances in which chemistry is most likely to arise and the processes by which it affects individuals and their social interactions.

This article begins by reviewing existing research on the subjective experience of chemistry, highlighting the relevance and limitations of this work. We then propose an integrative model of how chemistry emerges and operates, encompassing both the behavior associated with it (i.e., the "doing" of chemistry) and the perception of chemistry (i.e., feeling its presence). Next we discuss the evidentiary foundation for this model—namely, several areas of existing theory and research that are not about chemistry per se but bear directly on what people mean when they refer to the existence of chemistry. The article concludes with a research agenda: What are the key objectives of future research on chemistry? Which elements of the model are most important for future investigators to focus on? More generally, our hope is that this article inspires researchers to take the concept of chemistry seriously and to begin to explore its intriguing and potentially potent role in human social behavior.

What Is the Subjective Experience of Chemistry?

Some investigators have attempted to measure the experience of interpersonal chemistry. The results of these descriptive studies suggest how laypeople understand the term chemistry and what chemistry might feel like. To this end, the term chemistry in this research either is not invoked at all or is used generically without explicit attention to a formal definition. For example, a study that assessed chemistry with a five-item composite measure (including the items "We have chemistry" and "We click") found that both self-and partner ratings of chemistry predicted relationship satisfaction (Tou et al., 2018). In a study on speed dating, Eastwick et al. (2007) created a composite they labeled "felt chemistry" that was based on three items assessing participants' sense of connection, personality similarity, and common interests. Eastwick et al. found clear evidence of dyadic reciprocity—that is, partners reciprocated each other's feelings of chemistry over and above each person's general tendencies to endorse these items. Other researchers have applied the label chemistry to a measure of felt closeness (Bosson et al., 2006) or have focused on sexual chemistry in particular—for example, describing sexual (romantic) chemistry broadly as a global assessment of the quality of the sexual relationship (Leiblum & Brezsnyak, 2006), a central element to lustful feelings (Fisher, 2004, 1998), or a stable or changeable aspect of relationships (i.e., whether people characterize their relationship chemistry in terms of a fixed or growth-oriented mindset; Bohns et al., 2015).

More empirical approaches have been successful in identifying several key factors that characterize how interpersonal chemistry is experienced in daily life. To develop the Friendship Chemistry Questionnaire, Campbell et al. (2015) used an initial set of 35 items derived from the literature on friendship formation (e.g., "The communication between my friend and I is easy and effortless") and asked participants to describe "an instant connection between friends that is easy and makes the relationship seem natural" (p. 241). Factor analyses yielded five conceptually distinct factors: reciprocal candor and openness, having mutual interests, personableness (being warm and genuine with others), similarity of values and beliefs, and physical attraction. A composite friendship-chemistry score was significantly correlated with the Big Five personality traits of agreeableness, openness, and conscientiousness—interestingly, the same pattern found for romantic chemistry in subsequent research (in addition to a negative correlation with neuroticism; Tou et al., 2018).

Extending this model to both friendships and romantic relationships, a study from the same laboratory used an inductive approach to explore the qualitative experience of interpersonal chemistry (Campbell et al., 2018). Participants who reported ever having experienced romantic or friendship chemistry were asked to list "words and ideas" to define and describe the experience. The same five factors were identified with textual coding as in the earlier factor analyses, plus three additional core themes—love, instant connection, and indescribable factors. Similarity was found to be more characteristic of friendship chemistry, whereas attraction and love were more prevalent in accounts of romantic chemistry. In mining the phenomenology of chemistry, these studies have uncovered some of the key constructs that may be critical to a formal description of chemistry (e.g., similarity, attraction, mutuality). However, additional research is needed to expand beyond the retrospective designs used in these studies and to determine whether this factor structure is replicable in other contexts and samples.

Properties That a Model of Chemistry Should Emphasize

Although the aforementioned studies offer a useful entry point for a comprehensive model of interpersonal chemistry, they are limited in several respects. First, some studies lack an explicit definition that differentiates chemistry from other relationship constructs and variables. Some of this work also assumes an instantaneous connection, seemingly ruling out the possibility that relationship chemistry might unfold over time (e.g., Eastwick et al., 2007; Fisher, 2004). Finally, these studies have adopted a relatively narrow theoretical scope that we hope to broaden by proposing a new model of interpersonal chemistry that integrates concepts from several vibrant and highly relevant areas of relationship research (reviewed afterward). First, however, we briefly describe four attributes that a comprehensive and more broadly relevant theoretical model of chemistry should have.

Chemistry is an emergent phenomenon

In lay usage, chemistry represents a property of an interaction between two (or more) individuals, such that the outcome of their coordinated activity is superior to what either partner could have accomplished alone or in other, less well-matched partnerships. This idea evokes the concept of the Gestalt, as well as Aristotle's famous proposition that the whole is greater than the sum of its parts. This reasoning also implies that chemistry is an experiential attribute that is ideally assessed only after an interaction takes place, inasmuch as it is challenging to predict this level of successful coordination a priori.

As we explain later (in the section on interdependence theory), the kind of situations in which chemistry is likely to be experienced require coordination—namely during tasks in which desirable outcomes require that interacting persons blend their efforts precisely and effectively. For example, to be successful, a quarterback's pass must be thrown to a spot that exactly matches the timing and location of the receiver's path. Likewise, a listener's response to a friend's intimate self-disclosure will be experienced as most fitting when it meshes well, both verbally and nonverbally, with the discloser's needs and expectations. For this reason, we conceptualize the experience of chemistry as emerging from interaction rather than from "main effects" (i.e., individual attributes) of the persons involved, their expectations, or their perceptual biases. Indeed, this may be one reason why online daters have difficulty predicting from reading an online profile whether a sense of chemistry will develop. The emergent nature of chemistry may also help explain why there is yet no scientifically acceptable evidence for the effectiveness of matching algorithms promoted by some online dating services (Finkel et al., 2012; see, however, Park & MacDonald, 2019).

Chemistry is a relationship effect

Because chemistry can be expected to be positively correlated with likeability, the qualities that give rise to liking are also likely to be associated with reports of chemistry. As we review later, many individual difference variables are associated with likeability. Nevertheless, chemistry is about more than liking. In large part, interpersonal chemistry involves the belief that a given relationship is "special" (i.e., that the interaction differs from what might be experienced with another partner), suggesting that individual attributes alone should be insufficient for predicting ratings of chemistry (Kenny, 1990).

Conceptually, we propose that chemistry represents people's experience of a relationship-level effect—that is, the perception of a dyadic connection that exceeds what either partner might experience with other partners. Thus, to establish that chemistry uniquely exists in a given relationship, research should identify judgments that are disambiguated from more trait-like actor effects (e.g., how much chemistry Julian feels with others in general) and partner effects (e.g., how much chemistry other persons generally feel when interacting with Julian; Kenny & La Voie, 1982; for examples, see also Dyrenforth et al., 2010; Wood & Furr, 2016).

Chemistry is often embodied

Many aspects of chemistry (reviewed below) occur nonverbally, sometimes outside of awareness. For example, chemistry often involves communication through eye contact, mimicry of facial and bodily expressions, or synchronous movement (e.g., dancing). In the words of an opera singer:

> Playing in ensembles is . . . just a magical feeling. It made me realize that whatever's happening when we're in sync, we're exchanging a lot of intuitive information, and we use that to feed off each other. It has that intangibility, the stuff that happens below the level of consciousness that we're all fascinated by. (Berger, 2019, para. 5)

The sense of chemistry that exists in an interaction may therefore arise from the perception of somatovisceral and motor experience and foster embodied emotions (Niedenthal & Maringer, 2009).[1] Indeed, the fact that people refer to this feeling with a metaphor that alludes to a chemical reaction between elements, including those inside the body, rather than more prosaic terms such as closeness or meshing, hints at its fundamentally embodied nature.

Of course, the idea that feelings, as well as cognitions about those feelings, are based on perceptions of internal experience is not new. What we propose in this article is that the "doing" of chemistry—specifically, the behavior associated with it—involves the coordination of one's own and another person's embodied emotions. It is also plausible, although research has not yet examined this possibility, that the mirror-neuron system is implicated (Rizzolatti et al., 2001) because chemistry typically entails a strong inference that another person's emotional experience is similar to one's own. This conjecture is supported by models that suggest that social-interaction partners mirror each other's emotional states by embodying observed smiles, thereby activating relevant neural mechanisms (Niedenthal et al., 2010), as well as by research showing that conversation leads to the synchronization of neural activity (Wheatley et al., 2019) that then facilitates effective communication (G. J. Stephens et al., 2010).

Differentiating chemistry from other high-quality connections

Although relationships infused with chemistry are almost always experienced as positive connections, for reasons of conceptual clarity, it is important to specify how high-chemistry relationships differ from other types of high-quality relationships. Many relationships between kin, friends, coworkers, neighbors, and even romantic partners are productive and satisfying yet do not engender the unique experience of chemistry. Analogously, sometimes intense physical attraction, especially when felt "instantly," can be conflated with chemistry.

As we describe later in this article, interpersonal relationships that have a high degree of chemistry have unique properties. Our conceptual model of interpersonal chemistry, presented below and in Figure 1, aims to describe these properties, as well as to integrate key elements of several highly relevant approaches in the existing literature. Accordingly, we follow with a review of the relevant literature and constructs that inform and support this model. To elucidate the applicability of each literature to our model, we provide a table that lists which existing constructs are of primary (or central) relevance—and which are of secondary (or peripheral) relevance—to each element of our model. Our decisions about which constructs were primary versus secondary were admittedly subjective. We strove to distinguish constructs that are most informative about a specific process (e.g., similarity of goals, interests, and values was thought to be foundational to an understanding of shared identity) from those that are relevant

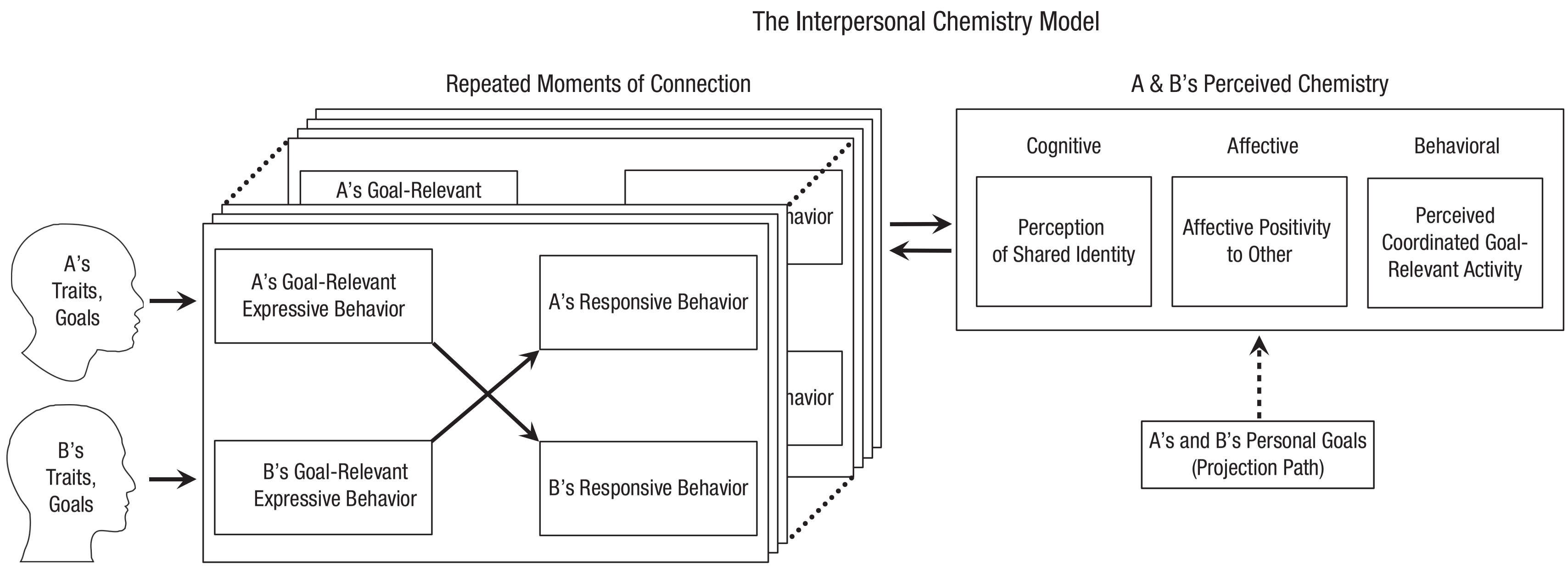

Fig. 1. The interpersonal-chemistry model. A series of connecting moments (left) leads to the cognitive, affective, and behavioral components of perceived chemistry (right). The letters A and B refer to two interacting persons.

but relatively less definitional (e.g., synchrony was thought to be relevant but less essential to the concept of shared identity).

The Interpersonal-Chemistry Model: A Conceptual Model of the Emergence of Chemistry

Before describing our new interpersonal-chemistry model, several general features merit note. First, it is a process model, positing that a sense of chemistry emerges from actual interaction. In other words, we exclude from consideration the idea that people may experience chemistry at "zero acquaintance"—that is, solely through their awareness of another person's qualities (although, to be sure, such awareness may instigate the interaction cycle that is critical to chemistry). Second, the model is fundamentally dyadic and transactional (i.e., involves repeated back-and-forth exchanges). Although perceptions of chemistry are not always mutual, we posit that the give and take of responsive interaction is crucial in helping individuals form impressions about how they fit together as an interactive unit—whether that activity involves a brainstorming meeting at work, a musical duet, a first date, or simply "shooting the breeze." Finally, although for simplicity the model is described in dyadic terms, it can readily be adapted to larger entities—for example, to professional, athletic, social, or political groups.

A simplified depiction of the interpersonal-chemistry model is shown in Figure 1.[2] The model is divided into two parts: the behavior associated with chemistry (i.e., what it "looks like"; Fig. 1, left) and the perception of chemistry (i.e., what it "feels like"; Fig. 1, right). We begin with the behavior, or "doing," part of chemistry—what one would see by observing chemistry. This process begins with an interaction sequence (Fig. 1, left) in which the goals, feelings, needs, or wishes of two individuals (Person A and Person B; Fig. 1, right) are expressed and responded to in a supportive and encouraging way, such that each person is perceived as a responsive partner to the other (Reis & Clark, 2013). These expressions and responses may occur verbally, nonverbally, or through actions—for example, the two people might share their life stories, describe their life or career goals verbally, emphasize the significance of their conversation through facial or vocal cues (e.g., smiling, directed eye gaze), or reveal what they care about through their actions (e.g., playing their partner's favorite song).

Responses can be similarly communicated via all three dimensions, but for chemistry to be experienced in repeated interactions two general properties are essential: First, to foster perceived partner responsiveness within the ongoing interactions, they should demonstrate understanding, appreciation, and support for the expresser's feelings and goals, all three of which are central to a sense of trust and safety; and second, to promote mutuality within the interactions, the listener should express similar or compatible feelings and goals. For example, Julia might describe to her new friend Julian her desire to spend a year sailing around the globe. A "moment of connection" (see below) is likely to ensue when Julian enthusiastically encourages her to pursue her dream, simultaneously disclosing his long-held desire to become a sculptor. In the ideal case, this process is cyclical, and partners repeatedly alternate as expressers and listeners.

As the interaction cycle unfolds, partners will often develop a substantial level of behavioral synchrony (e.g., linguistic matching, nonverbal synchrony, voicing similar thoughts and ideas). This important sequence of repeated expressive and responsive behavior, which we refer to collectively as a moment of connection, often unfolds quickly and spontaneously; thus, momentary or immediate chemistry is sometimes felt during the first one or first several such moments. Although we believe such episodic bursts of chemistry do occur, in principle, longer intervals and a greater number of interactions (e.g., in collaborative work teams) may be required for a sense of chemistry to develop. In other words, moments of connection typically need to cumulate before chemistry is felt and observed. The process is also iterative in the sense that a given moment of connection often leads to more such moments, likely as a result of the self-reinforcing nature of these experiences.

Although the model proposed here is interactive, people's individual characteristics help to determine what they express, how they express it, how they perceive their partner, and how they respond to other people. Individual differences fundamentally shape people's goals (Sheldon & Elliot, 1999) and hence with whom they might be compatible. Moreover, certain individual differences facilitate or hinder the unfolding sequence depicted in the sequential boxes shown in Figure 1 (left); for example, as we review below, people high in traits such as attractiveness, agreeableness, and emotional expressiveness tend to be better liked by others. Likewise, the process is advanced along by individual differences contributing to responsiveness (e.g., perspective-taking skill, warmth, trust, or being a good listener), as well as by personal goals (e.g., desiring a new sexual relationship or a song-writing partner). Finally, these individual differences may also contribute to whether a person perceives the pace and tenor of the interaction to be appropriate and satisfying. Thus, the personal characteristics of the individuals involved—see boxes depicting A's and B's traits and goals in Figure 1 (far left)—provide an influential context for the interactive (behavior) component of chemistry.

As illustrated in our model (see Fig. 1, right), individual perceptions of chemistry have cognitive, affective, and behavioral components. The first, cognitive component refers to the fact that when people feel chemistry, they perceive similarity between themselves and their partners in their goals and preferences and possibly in other domains as well (e.g., values, personality). They also experience themselves as complementing each other in goal-relevant ways and as having a "unit" relationship (Heider, 1958), which contribute to a sense of safety and security. In romantic contexts, this often gives rise to couple identity—mental overlap between one's own and one's partner's attributes—and the perception of belonging to a relational unit that is distinguishable from other relationships (Aron et al., 2004; Giles & Fitzpatrick, 1984). In nonromantic settings, unit relationships are sometimes referred to as team belonging or team spirit, whereas in larger groups, the shared sense of belonging to a group is called collective identity. These cognitions provide an epistemic rationale for expecting and guiding coordinated activities with partners.

The second, affective component of perceived chemistry—feeling positive affect toward one's partner(s)—refers to liking and attraction, or, more generally, to positive affect and positive feelings about the other. When people experience chemistry, they feel drawn toward each other.[3] Interdependence theory posits that people become invested in each other when they have shared goals and when they act jointly to accomplish those goals (Kelley & Thibaut, 1978). Moreover, unit relationships and perceived similarity typically engender positive sentiments toward interaction partners (Heider, 1958). In the specific case of chemistry, interaction sequences that foster the development of chemistry almost always involve positive feelings toward the other—for example, warmth (P. A. Andersen & Guerrero, 1996), enthusiasm for the other's success (Gable & Reis, 2010), and expressions of caring and admiration (Reis & Clark, 2013). These feelings may well motivate people to perceive higher levels of understanding and caring (Reis & Clark, 2013). Moreover, positive emotions expressed toward a person one likes may be particularly important for chemistry when they are shared—for example, when involving shared laughter (Kurtz & Algoe, 2015) and mimicry of smiles and other positive nonverbal expressions (Karremans & Verwijmeren, 2008). Positive affect helps reinforce attraction to interaction partners (Fredrickson, 2013; Lyubomirsky et al., 2005), and so to the extent that shared goal-directed activity produces positive affect, we would expect it to reinforce feelings of chemistry.

The third, behavioral component—the perception of coordinated goal-directed activity—emerges from the interactive nature of chemistry—that is, repeated moments of connection. To be clear, a goal is a mental representation of a future outcome that one is committed to attain (Elliot, 2006). When chemistry exists, partners perceive that they will be more effective together than alone in accomplishing their shared goals. Along with trust, such perceptions encourage partners to work together toward their common goals. In romantic relationships, these shared goals usually span various domains—for example, lifestyle goals, relationship goals, or sexual goals. In friendly conversations, these goals might encompass social functions, such as advice or enjoyment. In work or team relationships, shared goals are relatively more likely to be domain-specific—for example, running an organization smoothly, making pleasing music, or winning football games.

Accordingly, when two or more people experience chemistry with one another, they perceive their interaction as something more than the sum of their separate contributions. In this respect, our model borrows from interdependence and transactive goal-dynamics theories in describing how the attainment of many kinds of goals requires coordination among interacting, interdependent individuals (Fitzsimons et al., 2015; Kelley & Thibaut, 1978). When people consider other persons with whom they share, or might share, pursuit of a goal, they often appraise whether the other person's actual or potential contributions would fit well with their own contributions—that is, whether their combined abilities and effort would make goal achievement more likely, more efficient, or more enjoyable. This assessment is often prospective—that is, whether successful coordination seems likely in future goal pursuits—but is based in part on prior experiences. In other words, moments of connection during interaction can provide a foundation for perceiving a high likelihood of sustained and effective coordination in future activities.

We posit that the perception of coordinated goal-oriented activity must be substantial or enduring for a relationship to be experienced as having chemistry to distinguish it from other types of interactions (often fleeting) that also involve mutual striving toward end points (such as teamwork). Although perceptions of chemistry can and do arise in the absence of behavioral evidence, they are unlikely to be sustained over time. That is, once a relationship perceived as having chemistry has begun, partners will attempt to pursue their goals, both shared and personal, in a coordinated fashion. For example, a researcher might bring the seed of an idea for a new project to a colleague, anticipating that by working through the initial idea together, a more influential study will result. If such pursuits are reasonably successful—that is, if they result in repeated moments of connection—their perception of chemistry is likely to be reinforced. If such pursuits are unsuccessful—that is, if their abilities or actions do not mesh adequately or if their joint strivings are ineffective—their perception of chemistry is likely to fade. Of course, relationships can persist in the absence of chemistry. Nonetheless we suggest that a continuing sense of chemistry will require periodic confirmation by behavioral evidence—that is, when it is clear to both partners that their interaction is producing joint, mutually desirable outcomes.

One final note: Figure 1 (bottom right) includes a direct path from people's personal goals to the three components of chemistry. This link reflects the fact that people sometimes project their personal thoughts and beliefs onto others, especially others with whom they have or desire a close relationship (Lemay et al., 2007). For example, romantic partners tend to overperceive the extent to which their partners enjoy the sexual experiences that they themselves prefer (de Jong & Reis, 2014). These projections serve the motivated purpose of believing that a partner wants what one wants and reciprocates one's liking and attraction, thereby strengthening the foundation for an enduring relationship. We would expect such projections to be most influential early in the development of a relationship because, with time and feedback, actual evidence accumulates, lessening the impact of projection. Projection also likely plays a significant role in cases in which chemistry is momentary, felt instantaneously, or is perceived only from the perspective of one person—that is, before partners are likely to have had a series of connecting moments. Note that we use a dashed line to depict the influence of projection to indicate that although projection commonly contributes to relationship chemistry, it is not a necessary influence in the process model we propose.

Existing Research That Informs the Model of Interpersonal Chemistry

Repeated moments of connection

As described above, we propose that the three components of perceived chemistry (Fig. 1, right) emerge from repeated moments of connection (the behavior part of chemistry; Fig. 1, left). Several lines of research support the pivotal role that a sequence of connecting interactions, which accumulate over time, contribute to the feeling of chemistry. However, among the various process-oriented constructs that describe close relationships, perceived partner responsiveness (PPR) is foundational for such interactions to occur and, thus, probably most closely akin to chemistry. Hence, we begin with PPR, situating it as a construct of "primary" relevance to chemistry; hence, it appears in the second column of Table 1. (To locate the research discussed in this section, see primary constructs in Table 1, Row 1.)

Perceived partner responsiveness. PPR refers to the belief that a relationship partner understands, validates, and cares for oneself (Reis et al., 2004). Numerous studies have shown that PPR is an influential predictor of relationship well-being in both romantic and nonromantic relationships (for a review, see Reis & Clark, 2013). Here we focus on why the three components of PPR may be particularly relevant to creating moments of connection.

Before describing these three components, it is useful to note that PPR depends on the interaction partners opening up to one another—that is, on self-disclosure. These self-disclosures ideally should concern central features of the self (Morton, 1978; Reis & Shaver, 1988), reveal how the person experiences the world (Pinel et al., 2006), and be personalistic (i.e., geared toward the listener; Jones & Archer, 1976). More important, PPR arises when such self-disclosures are met by attentive, responsive listening by the partner (Laurenceau et al., 1998; Reis & Shaver, 1988).[4] One particular element of responsive listening, a many-faceted interpersonal skill (Itzchakov et al., 2014; Worthington & Bodie, 2018) that applies to PPR, is the extent to which a listener communicates genuine personal interest in the discloser's comments. Studies have shown that when listeners are behaviorally attentive, and particularly if that attentiveness is emotionally attuned, people feel heard and supported (Collins & Feeney, 2000; Maisel et al., 2008; Nils & Rimé, 2012), and this feeling in turn fosters continued openness and trust (Murray et al., 2006), as well as encouraging reciprocity (Canevello & Crocker, 2010). Both of these elements contribute to the moments of connection that constitute the doing part of chemistry and from which the perception of chemistry emerges.

All three components of PPR may be necessary for partners to experience connecting interactions. The first, understanding, refers to the belief that a partner knows the "real" you, including both your virtues and your shortcomings (Reis et al., 2017; Swann, 1990). It seems unlikely that people would feel a deep and special connection with a nonunderstanding partner, inasmuch as close connections require authenticity (Kernis & Goldman, 2006).[5] Moreover, because perceived chemistry—and the moments of connection it emerges from—depends to an extent on perceived goal compatibility, people need to believe that their partners are aware of their personally meaningful goals. The second component, validation, describes feeling respected, appreciated, and valued by a partner, perceptions that

Table 1. Constructs in the Existing Literature of Primary and Secondary Relevance to Chemistry

Row No.	Element of chemistry model	Primary constructs	Secondary constructs
1	Repeated moments of connection	Perceived partner responsiveness Mutual-attentiveness component of rapport Positivity resonance Reciprocated liking High-quality connections Flow	Affective positivity component of rapport Attraction
2	A's and B's personal traits and goals	Individual differences Charisma	Flow Synchrony component of rapport
3	Perception of shared identity	Similarity Complementarity Inclusion of other in the self	Transference Pheromones
4	Affective positivity to other	Affective positivity component of rapport Attraction Spark	Pheromones Individual differences Charisma Reciprocated liking Similarity Complementarity Transference
5	Coordinated goal-relevant activity	Synchrony component of rapport Interdependence theory	Mutual-attentiveness component of rapport Flow Similarity Complementarity
6	Projection path	Projection Transference	

are intrinsic to recognizing a bond that goes beyond simple liking. Caring, the third component of PPR, concerns the communal qualities of a relationship in which partners feel that their needs will be supported (Clark & Aragon, 2013). A communal relationship makes it possible to expect a partner's support in working toward valued goals. Signals of validation and caring also imply the partner's commitment to a continued relationship, reinforcing a sense of acceptance and safety in the relationship (Murray et al., 2006) and providing encouragement for personal growth (Feeney & Collins, 2015).

PPR is important to connecting interactions for another reason: Because responsiveness inspires trust (Murray et al., 2006), it spurs reciprocity and thereby establishes mutuality of caring and concern in a relationship. Wieselquist et al. (1999) characterized this process as one involving mutual cyclical growth: Receiving responsive support from a partner fosters trust and commitment, which in turn enhances motives to provide responsive support to that partner. This cyclical process helps explain why interpersonal chemistry in our model evolves spontaneously out of moments of responsive interaction—one partner's responsiveness stimulates the other to respond in kind, which further encourages the first person, and so on in a repeated iterative process. Consistent with this idea, although chemistry can be perceived by a single individual, the full phenomenon requires interaction and therefore is likely to be fully experienced and sustained only when the feeling is reciprocated (Eastwick et al., 2007). Another way of describing this process is that PPR acts simultaneously as a signal and propellant, indicating to both parties that the interaction should continue while also pushing it forward.

Rapport. In a pair of seminal articles, Tickle-Degnen and Rosenthal (1987, 1990) defined rapport as having three components: affective positivity, mutual attentiveness, and synchrony.[6] Because rapport is relevant to multiple elements of our interpersonal-chemistry model (and, indeed, chemistry is sometimes referred to as rapport), we define these three components in this section and then describe affective positivity in more detail in a later section.

Affective positivity refers to the experience of pleasant, congenial feelings and emotions during an interaction. Although affectively positive interactions will not necessarily develop into the types of connecting interactions that are characteristic chemistry, they are more likely to do so than neutral or negative interactions.

Existing research, ever since Heider's (1958) seminal description of the association between "sentiment" and "unit" relations, strongly supports the idea that when two people like each other, they experience a sense of connection, and vice versa (for a review, see Baumeister & Leary, 1995). Thus, this component of rapport is listed as a secondary contributor to the repeated moments of connection element of our model (see secondary constructs in Table 1, Row 1).

Of primary relevance to moments of connection is the mutual attentiveness component of rapport (see primary constructs in Table 1, Row 1). Mutual attentiveness, or partners' focused attention on each other across both nonverbal (e.g., eye contact, body posture, facial expressions) and verbal channels signals interest and generates engagement with each other. Attention indicates that another person is interested in oneself, welcomes interaction, and perceives oneself as a worthy interaction partner. Such attention is intrinsic to being a good listener. Good listeners are attentive and undistracted during conversation, engage their targets through various verbal and nonverbal behaviors, and give the impression of ignoring outside stimuli (e.g., Bavelas et al., 2000; Itzchakov et al., 2014; Pasupathi & Rich, 2005). When this sort of focused attention is mutual, people begin to experience a visceral connection with each other—often experienced as the sequence of connecting moments that set the stage for chemistry and its building blocks (i.e., similarity, attraction, and coordinated activity).

Synchrony refers to coordinated movement between interaction partners, such that each person's actions or vocalizations are matched by the other. This construct is critical to the extensive coordinated goal-relevant activity element of chemistry (see Fig. 1, right) but is also likely to characterize repeated moments of connection. Thus, like affective positivity, the coordination component of rapport has secondary relevance to this section and is described in detail later where it is of primary relevance (see primary constructs in Table 1, Row 5).

A growing body of research documents the effects of synchrony on liking and rapport (and indeed, in some accounts, synchronized body movements are prerequisite to chemistry Fredrickson, 2016). For example, behavioral synchrony in previously unacquainted same-sex dyads predicted ratings of warmth and mutuality, over and above ratings of closeness and general affect (Vacharkulksemsuk & Fredrickson, 2012; see also Templeton et al., 2019), and momentary physiological linkage was more likely to occur during shared positive emotions than negative emotions (Chen et al., 2020).

Other studies have shown that interactional synchrony, or the related behavior of nonconscious nonverbal and motor mimicry, predicted liking in social (Chartrand & Bargh, 1999; Lakin & Chartrand, 2003; Niedenthal et al., 2010), romantic (Karremans & Verwijmeren, 2008; Kurtz & Algoe, 2015; Sharon-David et al., 2018), and sexual (Birnbaum et al., 2019) contexts, as well as behavioral cooperation (Valdesolo et al., 2010; Wiltermuth & Heath, 2009) and judgments of rapport (Bernieri et al., 1994), affiliation (Hove & Risen, 2009), entitativity (Lakens & Stel, 2011), and perceived similarity and compassion (Valdesolo & DeSteno, 2011). A few studies even showed that neural synchrony—similar and temporally coupled brain activity in dyads—facilitated speakers' and listeners' shared understanding of their conversation (G. J. Stephens et al., 2010; Wheatley et al., 2019) and predicted both cooperative behavior and superior creativity (Xue et al., 2018).

A key component of interactional synchrony is emotional synchrony. Emotional synchrony may be particularly influential in human bonding and chemistry. Notably, biobehavioral synchrony plays a prominent role in Fredrickson's (2016) conception of positivity resonance (discussed below), which describes momentary interpersonal connections that foster emotional well-being and bonding (e.g., Major et al., 2018). Emotional synchronization (sometimes called emotional coregulation) is a central process in close adult relationships (for a review, see Butler & Randall, 2013). Some of this research focuses on psychophysiological indicators of emotion, building on the hypothesis that emotional interdependence is a relatively "deep" marker of dyadic closeness (e.g., Coan et al., 2006; Levenson & Ruef, 1997; Sels, Cabrieto, et al., 2020). In this light, Brown et al. (2021) found that in marital conversations, coexperienced affect, especially coexperienced positive affect, was a better predictor of relationship quality than individually experienced emotions. It bears noting, however, that although emotional synchrony can promote sharing of positive experiences, it sometimes can also amplify distress, as a classic study by Levenson and Gottman (1983) illustrated.

Positivity resonance. Relevant research from affective science has also explored connecting interpersonal interactions that we believe are likely to play a role in producing chemistry. Grounded in the broaden-and-build theory of positive emotion, Fredrickson (2013) introduced the construct of positivity resonance as a "momentary experience that occurs when two or more people have an interpersonal connection" consisting of three core elements—shared positive emotion, mutual care and concern, and, as we just discussed, biobehavioral synchrony (Major et al., 2018, p. 1631). In Fredrickson's model, positivity resonance is conceptualized as a *momentary* interpersonal experience rather than as a general characteristic of dyads that develops over time and through repeated interactions. Accordingly, chemistry could be conceptualized as a "built resource" that accrues out of repeated moments of positivity resonance (see Fredrickson, 2016). Notably, reports or codings of positively resonant moments of connection have been found to predict increases in positive emotions, feelings of connectedness over time, and marital satisfaction (Fritz et al., 2019; Otero et al., 2020). Positivity resonance is also more characteristic of social interactions that take place face-to-face (with visual or audio vs. digital contact) and with close (vs. distant) interaction partners (Fritz et al., 2019; Otero et al., 2020). In results supporting this claim, sharing of positive experiences enhances those experiences only when the partners know each other and are in the same room, rather than in adjacent rooms (Boothby et al., 2016). We believe that positivity resonance is intrinsic to the individual moments of connection that foster the broader experience of chemistry, and vice versa: When chemistry exists, people are more likely to have interactions characterized by positivity resonance. Thus, we situate it as a central construct in our model (see primary constructs in Table 1, Row 1).

Reciprocated liking. As mentioned above, although affective positivity, or liking for the other, is important, moments of connection are clearly about more than mere liking. One important difference is that moments of connection typically require the assumption that the other person feels similarly about oneself—that is, the liking is reciprocated or is anticipated to be reciprocated. An extensive body of research demonstrates that people tend to like others who express liking for them or who can be expected to like them (Berscheid & Reis, 1998). With regard to the types of social interactions that make up chemistry, a more nuanced level of analysis may be informative. The social-relations model (Kenny, 1994) distinguishes between generalized reciprocity of liking (i.e., that people who like others in general tend to be liked by other people) and dyad-specific reciprocity of liking (i.e., those who like a particular person more than they like people in general tend to be liked by that person more than that person likes others in general). This latter dyad-specific form of reciprocated liking is most relevant to repeated moments of connection.

Studies have supported the existence of relationship-specific reciprocity of liking. For example, investigations of liking at zero (initial) acquaintance have found significant dyadic-reciprocity effects (e.g., Back, Schmukle, & Egloff, 2011; Eastwick et al., 2007; Kenny, 1994), as have studies of people who know each other (Kenny & DePaulo, 1993). Moreover, in most studies, people commonly assume that reciprocated liking is high in both new acquaintances (DePaulo et al., 1987) and established relationships (Kenny, 1994; Kenny & DePaulo, 1993) at levels that are more—"sometimes much more" (Kenny, 1994, p. 113)—than actual levels of reciprocity.

Several processes underlie these effects. For one, because people are usually pleasant in initial encounters, both interactors and observers tend to assume that the partners like each other. Reciprocity of liking is also a strong descriptive norm in relationships (Kenny et al., 1996), a tendency that would likely be strengthened when people are motivated to establish a friendship, information is limited, and partners are on their best behavior. In findings consistent with this idea, some studies show that speed daters anticipate that their dating choices will be reciprocated more than they actually are (Back, Penke, et al., 2011). A third reason is that people tend to project their feelings of liking onto others, especially when these feelings are strong (Lemay & Wolf, 2016). Thus, to the extent that moments of connection involve assumed reciprocity of liking, a partner's likeability may give rise to such moments and, ultimately, to perceptions of chemistry (see primary constructs in Table 1, Row 1).

High-quality connections. Research from organizational psychology has examined positive moments of connection in the workplace, focusing on positive short-term dyadic interactions known as "high-quality connections" (HQCs; Dutton & Heaphy, 2003; J. P. Stephens et al., 2012). HQCs are defined as positive interactions between individuals with three structural features that set them apart from other workplace interactions—that is, relatively high emotional expression (or carrying capacity), ability to bounce back from setbacks (or), and openness to new ideas and influences (or connectivity). HQCs have been associated with a variety of positive workplace outcomes, including knowledge creation, feelings of psychological safety, and team learning, performance, and resilience (Brueller & Carmeli, 2011; Carmeli et al., 2009; J. P. Stephens et al., 2013). Such HQCs are thought to be fostered through cognitive (e.g., perspective taking), emotional (e.g., emotional contagion), and behavioral (e.g., respective engagement) mechanisms (Dutton & Heaphy, 2003), suggesting parallels with the types of repeated moments of connection that we posit are key to interpersonal chemistry. Hence, HQCs are included as a primary construct in Table 1 (see Row 1).

Flow. The experience of chemistry is often anecdotally described as feeling "on the same wavelength" or "in sync" with another person or persons. If different forms of synchrony and coordination are as critical to chemistry as we believe, then this phenomenological experience is not surprising. Indeed, positivity resonance is currently assessed by asking partners whether they are in sync with one another and whether thoughts and feelings "flow with ease" between them (Major et al., 2018). These observations suggest that the repeated moments of connection key to chemistry are likely to possess elements of flow—and to shared flow states in particular (hence the inclusion of flow as a primary construct in Table 1, Row 1).

Defined by Csikszentmihalyi in 1975, flow is characterized by feelings of intense focus, loss of reflective self-consciousness, a sense of control, and distortion of temporal experience (e.g., time passing very quickly or very slowly; Csikszentmihalyi, 1975/2000, 1990; Nakamura & Csikszentmihalyi, 2002). Csikszentmihalyi argued that to experience flow, individuals must perceive a challenge that is appropriate to their skills and faculties and must receive immediate feedback about the progress of a clear goal. Although usually characterized as a solitary experience, research suggests that individuals can experience social flow, which is more enjoyable than individual flow activities (Tse et al., 2018; Walker, 2010). Momentary experiences of connection may be similar to social flow in both their cognitive and behavioral manifestations (i.e., loss of track of time, intense absorption and focus on the other) and their preconditions (i.e., tangible progress toward a mutually agreed on, coordinated, clear goal, as discussed below).

Personal traits and goals

Extending the left side of the interpersonal-chemistry model (see Fig. 1), we propose that the traits and goals of two interactions partners affect the extent to which they will experience the repeated moments of connection necessary for perceptions of chemistry to emerge and develop. Specifically, individual differences in how and how much two individuals self-disclose, view, and respond to one another will tend to boost (or reduce) the likelihood that one or more connecting interactions will occur. Research on individual differences contributing to likeability supports this feature of the model (see primary constructs in Table 1, Row 2).

Individual differences relevant to likeability. Ever since the publication of Dale Carnegie's pioneering and enduringly popular book, *How to Win Friends and Influence People*, in 1936, scholars and practitioners have sought to catalogue the qualities that predict likeability. Some of these qualities involve individual differences such as attractiveness, extraversion, openness, agreeableness, concern for others, optimism, attachment security, emotional expressiveness, and emotional stability, among others. Other approaches have focused on behavior, such as smiling, using positive language, greeting others by their name, appearing genuine, and being a good listener. Because chemistry depends to some extent on liking, it is reasonable to expect that these qualities would also contribute to the experience of chemistry and, in particular, to the interaction sequence that gives rise to chemistry (see Fig. 1, left).

Individuals with particular personality traits may also be more prone than others to experience the repeated moments of connection that we posit are the behavioral foundation for chemistry. Because they are characterized as sociable and outgoing (Costa & McCrae, 1992), extraverted individuals are likely to be involved in relatively more connecting interpersonal interactions. In addition, relative to introverts, extraverts have been shown to have not only more frequent and more enjoyable social interactions than introverts (Lucas et al., 2008) but also qualitatively different experiences of social interactions. For example, two studies by Smillie et al. (2015) found that extraversion was associated with the perception that one has an impact on one's social world (e.g., contributing more to conversations), which mediated its relationship with positive affect. Although whether an interaction is enjoyable or fun is not a sufficient condition to give rise to the sequence of communications that characterizes moments of connection, extraverts may find social interactions more intrinsically rewarding and more engaging, which could in turn facilitate the self-disclosure and responsiveness that foster connection and, ultimately, chemistry. By contrast, certain personality traits that are known to interfere with engagement in social interactions and feeling a sense of closeness—for example, attachment avoidance (M. C. O. Tidwell et al., 1996) and low self-esteem (Murray et al., 2002)—likely make connecting interactions less prone to occur.

Charisma. One underexplored individual difference with particular relevance to the building blocks of chemistry is charisma (see primary constructs in Table 1, Row 2). Friedman and colleagues defined charisma as "dramatic flair involving the desire and ability to communicate emotions and thereby inspire others" (Friedman et al., 1988, p. 204) and closely linked it to nonverbal emotional expressiveness (Friedman et al., 1980). More recent work by Tskhay and colleagues characterized charisma in terms of two constructs: the ability to influence others (influenceability) and the ability to make others feel comfortable and at ease (affability; Tskhay et al., 2018). Charismatic individuals are energetic, enthusiastic, and likable and communicate in a "dramatic, memorable, and attention-grabbing" style (Guerrero & Floyd, 2006, p. 156). They are also reliably perceived as influential and affable by new acquaintances and old friends alike (Tskhay et al., 2018). Because these traits are readily apparent in both initial and longer-term interactions, charisma may facilitate interacting partners experiencing the repeated moments of connection that characterize chemistry. However, little research has directly examined the impact of charisma on the development of relationships.

One area in which charisma has received considerable attention is leadership. The sociologist Max Weber (1924) introduced the concept of charismatic leadership by describing such leaders as

> set apart from ordinary [people] and treated as endowed with supernatural, superhuman, or at least specifically exceptional powers or qualities. These as such are not accessible to the ordinary person, but are regarded as of divine origin or as exemplary, and on the basis of them the individual concerned is treated as a leader. (p. 328)

In more recent accounts, charismatic leaders—also called transformational leaders (Judge & Bono, 2000)—exude confidence and enthusiasm; are skilled at inspiring their subordinates' effort, trust, and commitment; and are perceived to be high in emotional intelligence (George, 2000). Charismatic leaders usually combine a clear, idealistic vision with a dynamic, expressive, and inspirational communication style; this combination fosters among subordinates a strong sense of connectedness with the leader (Waldman & Yammarino, 1999). This latter sense is sometimes perceived as chemistry, although only from the perspective of the subordinate.

Individual differences that contribute to flow. Individuals who are more likely to experience flow states may also be more likely to experience repeated moments of connection, in part because they are relatively more likely to enter flow within a conversation (see secondary constructs in Table 1, Row 2). Csikszentmihalyi (1990) described such individuals as having an autotelic personality—that is, a set of metaskills, including general curiosity and interest in life, persistence, low self-centeredness, and high intrinsic motivation. These metaskills are thought to encourage the experience of flow states and appear good candidates to test in future research for facilitating experiences of the types of connecting interactions that give rise to chemistry.

Perception of shared identity

We now turn to existing research that informs the cognitive, affective, and behavioral components of perceived chemistry (Fig. 1, right). We begin with the cognitive component: When individuals experience chemistry together, they perceive themselves as similar, complementary, and/or having a shared or collective identity. The potential role that similarity plays in interpersonal chemistry is discussed first, followed by research on complementarity and on inclusion of other in the self (see primary constructs in Table 1, Row 3). It is also worth noting that the three constructs discussed in subsequent sections—pheromones (because of their potential role in affiliation and bonding), transference (because of positive significant-other activations), and synchrony (because it may prompt people to view themselves as working together as a unit)—may also facilitate or foster feelings of shared values and togetherness (see secondary constructs in Table 1, Row 3).

Similarity and associated constructs. Ever since Byrne's (1969) pioneering studies, similarity has consistently been identified as one of the main determinants of attraction. The same can arguably be said about similarity's role in perceptions of chemistry (Fig. 1, right). Thus, it would be reasonable to assume that empirically documented similarity effects on attraction—for example, similarity in physical attractiveness (Feingold, 1988), personally important attitudes and values (Montoya & Horton, 2013), certain personality traits (Montoya & Horton, 2013), language style (Ireland et al., 2011), and even Facebook "likes" (Youyou et al., 2017)—also apply to perceived chemistry. Several mechanisms underlying similarity effects have received strong support (for a meta-analytic review, see Montoya & Horton, 2013). Of particular relevance to chemistry is the idea that similar others are construed as more likely to bolster one's goal-directed activity (our third proposed element of perceived chemistry)—whether that activity is a revealing or constructive conversation, a theatrical performance, or a study group for the bar exam. That is, when a new acquaintance's perspectives, goals, or behavioral intentions seem similar to one's own, possibilities for coordinated, and hence more effective, activity become stronger, consistent with the observation that well-functioning dyads and romantic couples often work together to accomplish shared goals (Fitzsimons et al., 2015; Higgins, 1998; Johnson & Johnson, 1972; Orehek & Forest, 2016).

Another, more specific way of thinking about similarity and chemistry is suggested by research on self-schema matching. Prior research has shown that when persuasive messages match aspects of an individual's self-conception, they are viewed more favorably and are more likely to be accepted (Wheeler et al., 2005). Although this model has been tested primarily with attitudinal appeals and consumer choices, a similar process may apply in early encounters with other persons: The more their attributes seem to match a person's self-conception—for example, when someone looking to make a difference in the world befriends a politically active acquaintance—the higher the degree of chemistry experienced. A study of initial attraction in a speed-dating context supports this conjecture (N. D. Tidwell et al., 2013), as does research showing that people are attracted to others who are similar to their ideal selves—that is, the self they wish to become (Strauss et al., 2012).

Existing research notwithstanding, a meta-analysis suggested that although similarity may predict initial attraction, its role in established relationships is more equivocal (Montoya et al., 2008). That is, once its gatekeeper role in relationship initiation is complete, actual similarity demonstrates little or no influence on stable relationships. It may be premature to discount a role for actual similarity in attraction, however. One reason is that, of course, no experimental studies have been conducted in which participants are randomly assigned to long-term relationships (romantic or friendship) on the basis of their similarity or dissimilarity. A second reason is that established relationships likely exhibit restricted range: Because similarity shapes relationship formation, long-term relationships between dissimilar partners are relatively rare. Additional research is needed before concluding that actual similarity does not contribute to a sense of relationship chemistry over the long haul.

Although the impact of actual similarity in established relationships may be uncertain, the role of perceived similarity is clear: The more similarity partners perceive, the more satisfied they are in those relationships (Montoya et al., 2008). Thus, we argue that experiencing a similar outlook on the world contributes to the development of a shared reality, an important component of couple identity (Echterhoff et al., 2009; Rossignac-Milon et al., 2021) and our interpersonal-chemistry model (see cognitive element of perceived chemistry in Fig. 1). Research has routinely shown that people perceive higher levels of similarity than actually exists in their positive relationships—for example, believing one's friends are just as progressive or conservative as oneself when they are not (e.g., de Jong & Reis, 2014; Goel et al., 2010; Sels, Ruan, et al., 2020), and, as we discuss later, at least some of this overperception involves projecting one's own attitudes and preferences onto the other (Morry, 2005). Because we believe perceived chemistry reflects perceptions of a match between oneself and a partner, and notwithstanding the likelihood that perceived similarity is based on some level of actual similarity, it is useful to conceptualize the cognitive element of chemistry in terms of perceived similarity over and above actual similarity. In that case, we speculate that people experience a sense of perceived similarity when their interaction smoothly facilitates movement toward shared, personally relevant goals. For example, members of a seamlessly successful dance troupe, football squad, or legal defense team are likely to overestimate the degree to which they share opinions and values.

Complementarity. Indirect support for the role that a shared identity plays in chemistry comes from research on complementarity—the idea that opposites attract. Long maligned as a basis of attraction, especially compared with similarity, some evidence suggests that complementarity may be beneficial when it promotes carrying out tasks that require partners to adopt reciprocal yet compatible roles—for example, in informal conversations (Markey et al., 2003) and in sexual activity (de Jong & Reis, 2014). In such interactions, successful coordination is more likely when partners enact complementary rather than similar (identical) behaviors. Their chemistry, in other words, is evident when partners efficiently blend differential expertise or actions in a way that maximizes their outcomes. Research is needed to examine the role of complementarity in fostering perceptions of chemistry.

Inclusion of other in the self. Although the construct of inclusion of other in the self is typically associated with the general idea of closeness (Aron et al., 2004), it may also contribute to the sense of shared identity intrinsic to perceiving chemistry. Experimental evidence has demonstrated that when partners are close, they tend to adopt each other's goals, resources, and perspectives as their own (e.g., Aron et al., 1991), as well as, more generally, constructing a couple identity, or a sense of the self and the other as a unit (Agnew & Etcheverry, 2006; Aron et al., 2004; Heider, 1958). This process is similar in certain respects to the process that gives rise to shared reality—that is, forming the belief that partners experience commonality in their convictions, judgments, and feelings regarding relevant aspects of the world. Shared reality inculcates in partners a sense that their experience of the world is "real" (Boothby et al., 2016; Rossignac-Milon et al., 2020) and, more generally, contributes to trust, closeness, and rapport (Rossignac-Milon et al., 2021). Although close relationships need not have chemistry, we posit that relationships in which the partners feel a sense of chemistry are typically experienced as close, as well as possessing most of the elements of shared reality. Thus, cognitively, when partners experience chemistry, they are likely to include relevant aspects of the other into their own self-conceptions.

Affective positivity to other

Affective positivity toward one's partner—and the attraction it engenders (Berscheid, 1985)—is the affective component of perceived chemistry (see Fig. 1, right center). Of primary relevance to this construct (see Table 1, Row 4) is research documenting the role of positivity as a critical element of rapport.

Rapport and positivity. As described earlier, Tickle-Degnen and Rosenthal (1987, 1990) proposed that one of the three components of rapport is positivity, or mutual friendliness, warmth, and caring during an interaction. Positive feelings toward partners are essential to perceptions of chemistry. Existing reviews consistently show that affective positivity is a critical contributor to many desirable relational constructs (e.g., intimacy, satisfaction, belonging; P. A. Andersen & Guerrero, 1996), whereas its absence is characteristic of most destructive relationship processes (e.g., hostile conflict, withdrawal). Not surprisingly, then, motivational theorists posit affective positivity as a precondition for evolutionarily significant drives such as the need to belong (e.g., Baumeister & Leary, 1995; Ryan & Deci, 2002), primarily because affectively positive interactions allow people to feel rewarded by continuing their involvement in relationships and groups. More generally, extensive evidence has confirmed that positive emotions help people build their social resources (Fredrickson, 1998) and feel connected to each other (Fredrickson, 2013) and that happy people are better liked and more readily accepted than less positive people (Lyubomirsky et al., 2005). Affective positivity in the specific form of warmth also contributes to the development of communal caring (Clark & Aragon, 2013). Finally, affective positivity promotes attraction (Berscheid, 1985; Byrne, 1971), which fuels the experience of chemistry when the attraction is requited. For these reasons, we propose that affective positivity toward another (or others) in social interactions is one of the critical components of perceived chemistry.

Attraction and spark. Attraction is one of the most venerable topics in social psychology, dating back to early research in the 1960s (for an overview, see Berscheid & Walster, 1978). Attraction has most often been conceptualized as an attitude, an affect, or a behavioral intention (Berscheid & Reis, 1998), but common to these different theoretical frameworks is the idea that attraction provides the motivating force, or "glue," for the development and maintenance of relationships. Notably, attraction applies to all types of relationships, romantic and otherwise. Thus, when people feel attraction toward another, they are motivated to initiate, deepen, or sustain the relationship; when feelings of attraction are missing, they ignore or avoid the possibility of relating. When interacting partners experience the repeated moments of connection that define the doing component of chemistry, their resulting attraction to each other impels the further development and continuation of their relationship. Thus, we include attraction as a primary construct in Table 1 (see Row 4).

In the particular case of romantic relationships, and especially in new romantic relationships, the affective positivity component of perceived chemistry often involves a palpable sense of passion, or "spark," sometimes paired with a sexual charge (see primary constructs in Table 1, Row 4; see also Fisher, 2004). We are unaware of research that explicitly examined such feelings of attraction.[7] Nevertheless, our model suggests that they may arise when new romantic relationships strongly suggest the availability of all three components of chemistry. Relatedly, theorists have proposed that passion denotes rapid increases in intimacy (Baumeister & Bratslavsky, 1999), a view that has received empirical support (Rubin & Campbell, 2012). This conceptualization of passion seems very likely to correspond to rapid incremental growth on both sides of our model—that is, on one side with repeated moments of expressive communication and responsiveness and on the other side with perceptions of shared identity, affective positivity, and the anticipation of extensive goal-relevant activity. Furthermore, the fact that romantic relationships tend to become exclusive relatively quickly may contribute to the rapid rise in chemistry, consistent with the tendency, at least in the modern Western world, to prioritize these relationships as a focal point for caring, personal growth, and many important life activities (Finkel, 2018). Thus, although our model is intended to describe chemistry broadly, it is well suited to describe the specific case of relatively instantaneous romantic sparks.

Pheromones. What factors or processes might contribute to affective positivity or attraction to another person? One relevant line of research concerns pheromones (see secondary constructs in Table 1, Row 4). Derived from the Greek words *pherein* ("to convey") and *horman* ("to impel or set in motion"), pheromones are chemical substances released by an organism into the environment that influence the behavior or physiology of other organisms. There is little doubt that pheromones play a significant role in the social behavior of nonhuman mammals (for a review, see Liberles, 2014), including affiliation, bonding, aggression, and sexual attraction and activity. Because of the last of these effects, in folklore, pheromones have long been reputed to have aphrodisiacal qualities for humans, triggering sexual responses, usually outside of awareness. Reflecting this folklore, advertisements for pheromones claiming to increase sexual desire, potency, or affection are popular.

Whether pheromones exert meaningful influences on human behavior, especially in regard to sexual and reproductive interest, is controversial. The literature includes several well-publicized studies that support such effects. For example, one of the earliest studies found that men rated the smell of vaginal secretions from ovulating women as more pleasant than samples from low-fertility women (Doty et al., 1975). Likewise, T-shirts worn by ovulating women were rated as sexier and more pleasant than T-shirts worn by nonovulating women (Thornhill et al., 2003). Women's preferences have shown parallel results. For example, ovulating women reacted to male axillary (armpit) secretions by rating male vignettes and facial photographs as more attractive (Thorne et al., 2002). Compatible findings have been obtained in more externally valid research. One striking example comes from McCoy and Pitino (2002), who added a synthetic female pheromone or a control chemical to women's perfume for 6 weeks. Women given the synthetic pheromone reported more instances of sexual intercourse, sleeping with a partner, formal dates, and physical affection.

On the other hand, human pheromone research has been criticized for several methodological shortcomings, such as the absence of chemical-specific bioassays; small sample sizes; p-hacking (Wyatt, 2015); ambiguous biochemistry (Semwal et al., 2013); lack of standard experimental controls (Mostafa et al., 2012); unrepresentativeness resulting from the fact that humans bathe regularly and mask their odors (e.g., with deodorants and perfumes), especially in dating contexts (Wyatt, 2015); and mistaken assumptions about humans' olfactory abilities (Grammer et al., 2005) and functional anatomy (Liberles, 2014) for detecting pheromones. In addition, although studies documenting the effects of female ovulation on male behavior may reflect olfactory cues, they might also be attributable to downstream effects of ovulation, such as behavior, vocal pitch, or appearance (Haselton & Gildersleeve, 2011). Publication bias has also presumably excluded nonconfirming evidence from the literature.

Nevertheless, the absence of convincing evidence is not convincing evidence of absence, and it remains possible that future well-designed studies will find evidence for pheromone-based effects on human sociosexual interest (i.e., chemistry) and behavior. Some scholars believe that human olfactory abilities have been underestimated (Kohl et al., 2001), and the fact that humans possess at least some of the anatomical features necessary for producing and detecting pheromones suggests that their role may not be vestigial. Moreover, social psychologists know well that even subtle cues operating outside of awareness can profoundly affect cognition and emotion (Fiske & Taylor, 2017; Zajonc, 1998), which hints at the possibility that olfactory stimuli may yet turn out to play a meaningful role in human attraction.

Other relevant constructs. Because the affective component of perceived chemistry represents positive feelings and attraction, a number of individual differences are likely to reinforce (or undermine) this component of chemistry, in that some people are more likely to like or be liked by their partners (see secondary constructs in Table 1, Row 4). For example, as mentioned above, individuals who are relatively more charismatic, attractive, extraverted, open-minded, and agreeable—and those who are relatively better listeners and communicators—are more likely to engender positive affect during social interactions. Furthermore, the partners of such individuals are more likely to feel positive and attracted to them. The perception that one is liked or esteemed by a partner is also well known to be a potent factor in inducing reciprocal feelings (Berscheid & Reis, 1998). Finally, the perception that one's partner's views, goals, and values are similar or complementary also promotes positive affect and attraction.

Perceived coordination of goal-relevant activity

Our third and final proposed component is the perception of coordinated goal-directed activity (see Fig. 1, far right), which is observed after repeated cycles of expressive and responsive moments of connection have taken place. The perception of these behavioral manifestations of chemistry involves the belief that partners can effectively coordinate their actions and strivings to produce joint, mutually desirable outcomes. Research on coordination (interactional, behavioral, and emotional synchrony) and interdependence theory richly inform this aspect of our model (see primary constructs in Table 1, Row 5).

Synchrony. We argued earlier that the most important facet of rapport is interactional synchrony (or coordination)—that is, harmony and synchronization between interaction partners, such that each person's actions or communications are matched by the other (Tickle-Degnen & Rosenthal, 1987, 1990). This process is facilitated when interaction partners share a common goal, a collective identity, and similar or complementary interests and when they are mutually focused on a common activity, pursuit, or goal. Synchrony is also likely during flow, a state of absorption and deep interest when the challenges of a goal-relevant activity are matched by the partners' skills or expertise. For this reason, we consider the construct of synchrony (listed in primary constructs in Table 1, Row 5), as well as the related constructs of similarity, complementarity, mutual attentiveness, and flow, as relevant to this component of our model (see secondary constructs in Table 1, Row 5).

We propose that interactional synchrony contributes to the feeling of chemistry in at least two ways. First, synchrony facilitates extensive coordinated goal-relevant activity (see Fig. 1, far right)—that is, by making it easier for interacting persons to coordinate their actions, inasmuch as their attention is mutually focused on each other and the demands of the environment. From an evolutionary perspective, shared attention has been theorized to facilitate physiological coregulation and thus efficient preservation of important metabolic resources (Beckes & Coan, 2011). For example, tribe members hunting prey who closely watch each other's movements are more effective at allocating arduous tasks such as running and throwing. Indeed, this process may have ontologically significant roots in that the coregulation of basic biological systems between mothers and infants is a critical contributor to survival early in life and to the development of self-regulatory ability (Feldman, 2007; Isabella et al., 1989; Tronick, 1989). For example, mothers who closely watch their infants are more likely to detect and respond effectively to signs of distress, hunger, or illness. The fact that interactional synchrony in adults typically occurs outside of awareness and in nonverbal channels—that is, in embodied visceral sensations and kinesthetic activity that yield a sense of attunement with another person (Tickle-Degnen & Rosenthal, 1987, 1990)—further supports an evolutionary account.

Second, because social information processing is often embodied (Niedenthal et al., 2005), interactional synchrony may enhance the partners' beliefs that they see matters similarly—a shared sense of social reality—both in general and in the moment, thereby contributing to perspective taking, empathy, and the perception of inclusion with the other (Echterhoff et al., 2009; Fredrickson, 2016; Rossignac-Milon et al., 2021). These attributes encourage partners to perceive that they are working together as a unit toward the accomplishment of a common goal. Of course, they also contribute significantly to the shared-identity component of perceived chemistry (see secondary constructs in Table 1, Row 3).

An interdependence-theory perspective. Interdependence theory, first proposed by Thibaut and Kelley (1959) and later refined by Kelley and Thibaut (1978), provides a systematic representation of how the ways that partners coordinate their behavior determine their joint outcomes. Interdependence theory has most typically been used to describe established relationships, such as between spouses and between work colleagues. Nevertheless, insights from interdependence theory are particularly pertinent to the construct of chemistry because the theory explicitly addresses questions about how interacting partners harmonize their goal-directed behavior. Because this process of harmonizing depends on how partners construe their situation with regard to each other—namely, in what manner and to what extent their goals are experienced as interdependent—we include this construct on the right-hand side of Figure 1. In other words, the perception of behavioral goal interdependence may directly contribute to the perception of chemistry.

We draw on three principles from interdependence theory here. First, in any situation, the degree of interdependence is contingent on the extent to which each person's outcomes depend on the other's actions. When partners experience repeated instances in which their outcome interdependence is low—for example, a pair of news anchors hosting different segments of the same news program—they have little or no influence on each other's outcomes; each person does what he or she wants, with little regard to the other. On the other hand, when partners perceive that their outcome interdependence is high—for example, a pair of news anchors engaging in witty repartee on the same news program—each person's outcomes are strongly affected by the other's actions, and partners are therefore motivated to attend to, become involved with, and influence each other (for a review, see Rusbult & Van Lange, 1996). Chemistry seems more likely to involve the latter rather than the former perception.

Second, chemistry requires that partners view their outcomes as corresponding rather than conflicting. When outcomes conflict, one partner's goal attainment necessarily precludes the other's goal attainment—for example, when members of a track team race one another to qualify for a championship. In this situation, competitive motives become salient, giving rise to emotions such as envy, jealousy, hostility, and hurt feelings, all of which are unlikely to create either moments of connection or the perception of chemistry. By contrast, when outcomes are seen to correspond—that is, when partners share their successes and failures, as when members of a track team compete together against other teams in a relay race—cooperation is encouraged, thereby fostering a sense of oneness with the others, openness to influence, and mutual investment in each other's welfare. These appear to be essential for partners to experience chemistry with each other.

The third principle refers to the nature of interaction required by the task at hand—that is, whether a task requires that partners coordinate their activities to produce desirable outcomes or whether each partner's independent actions are sufficient to determine their own and/or their partner's outcomes. To clarify: In coordination situations, to attain desirable outcomes, partners must synchronize their behavior, prioritizing social processes relevant to communication and mutual agreement about how to act (e.g., perspective taking, negotiation, listening, and responsiveness). Such interactions seem relatively likely to be experienced as moments of connection. In contrast, in so-called exchange situations, each partner's actions are effective regardless of what the other one does. Although exchange situations may give rise to prosocial norms such as communal concern, reciprocity, equity, and fairness, they do not encourage coordinated—that is, synchronized and integrated—activity, which, we theorize, is central to fostering the kinds of interactions that are distinctive to chemistry.

When people experience chemistry, they perceive that their actions, thoughts, and emotions fit together, yielding outcomes that are greater than the sum of their parts. In work-related chemistry, for example, each party contributes specific and interlocking actions or expertise, resulting in a product that is superior to what might have been produced independently—for example, when John Lennon and Paul McCartney recognize that a song written jointly by them is better than what either one of them might have written independently. In a conversation, friends who feel chemistry may experience just the right amount of openness, intuition, and responsiveness when they open up to each other (Reis & Clark, 2013) so that the discloser's needs and goals are matched by the responder's insights and support, fostering a strong sense of shared reality (Echterhoff et al., 2009). In a sexual relationship, people may feel comfortable knowing that their partner will do just the right thing at precisely the right moment. All of these examples are coordination situations because each partner's preferences and actions are effective only to the extent that they mesh well with the other's preferences and actions. Of course, this process of perceiving a sense of harmony between one's own and a partner's goals often occurs outside of awareness and therefore necessitates little or no deliberate thought and is experienced as spontaneous and natural.

More broadly, interdependence theory provides a foundation for Fitzsimons et al.'s (2015) model of transactive goal dynamics (which we draw on in our own model). Fitzsimons and her colleagues described a relationship between two partners as a single self-regulating system characterized by a dense network of shared goal-directed pursuits (e.g., raising a child, saving for retirement). In other words, because so much of interdependent partners' lives is contingent on what each of them does, Fitzsimons et al. characterized the two partners' self-regulatory activities as part of a unified, rather than independent or even linked, system. Their conceptualization seems particularly apt for understanding relationships that have chemistry because chemistry implies (a) a relatively high level of outcome interdependence, (b) corresponding rather than conflicting or independent outcomes, and, especially, (c) an expectation that partners will frequently, willingly, and appropriately coordinate their goal-directed activities to the benefit of both (thereby viewing themselves as part of a single, self-regulating system, as Fitzsimons et al. described). Indeed, these three attributes are fully embodied in our inclusion of the perception of coordinated goal-relevant activity in our model. It is plausible that these attributes are likely to constitute a self-perpetuating feedback cycle: A sense of chemistry leads partners to see themselves as part of a single self-regulatory unit, encouraging them to adopt shared goals and goal-directed behaviors (e.g., writing a book, starting a business), creating additional moments of connection (Fig. l, left), which, if successful, enhance the perception that chemistry exists (Fig. 1, right).

Projection path

The bottom right of Figure 1 includes the projection path—that is, the process by which an individual's goals might influence their sense of shared identity, positivity, or attraction toward their partner(s) via "projection," or motivated overperception (see also primary constructs in Table 1, Row 6). For example, in an initial sequence of social interactions, a woman's desire for a romantic, professional, or close-friend relationship might lead her to believe that her partner's values are more similar to hers than they really are and that her partner is enjoying the interactions more than the partner really is. Notably, the more projection, the greater likelihood that the chemistry perceived is one-sided, immature, or undeveloped. Not surprisingly, this type of "chemistry" is marked by none or few of the elements we propose in Figure 1 (or to a relatively lesser degree)—for example, minimal perceived similarity and limited or no coordinated goal-relevant activity.

Projection. People's tendency to expect that others' feelings and beliefs are similar to their own, called projection, may contribute to the perception of chemistry. Projection is a well documented and influential process in social perception. Extensive research has shown, for example, that individuals commonly assume that others share their beliefs about in-groups and out-groups (Robbins & Krueger, 2005), perceive them much as they see themselves (e.g., Kenny & Acitelli, 2001; Mosch & Borkenau, 2016), and feel similar emotions (Clark et al., 2017; Van Boven & Loewenstein, 2003). We posit that projection may sometimes lead people to assume that partners share their perceptions of chemistry in the relationship. Two sets of findings about projection are particularly relevant here: First, research has shown that people are likely to project their goals,[8] both conscious and nonconscious, onto others (Kawada et al., 2004), especially when those goals are associated with strong drives (e.g., emotional arousal; Van Boven & Loewenstein, 2003), as they often are in the case of chemistry; second, projection has been shown to be motivated by the desire to form or increase social connections (Lemay & Clark, 2015; Robbins & Krueger, 2005). For example, in one set of studies, the degree to which participants wished to be valued by an interaction partner predicted the degree to which they assumed that those partners had positive sentiments about themselves (Lemay & Spongberg, 2015). In another set of studies, participants' romantic or sexual desire for a partner led them to believe that those partners reciprocated those feelings more than they actually did (Lemay & Wolf, 2016).

Situations in which chemistry commonly arises seem well described by these conditions—that is, when there is a desire to connect with others, potentially involving romantic or other strong feelings, and personally relevant goals are active (which sometimes are emotionally charged). Thus, projection has the potential to create the belief that chemistry exists. Of course, projection also makes more likely the possibility that moments of connection will be created via a self-fulfilling prophecy, as the left-facing arrow in the center of Fig. 1 suggests. Nevertheless, if subsequent interactions fail to engender the sorts of moments of connection that constitute chemistry, we posit that the perception of chemistry is likely to fade.

Transference. One potential but as yet unexplored mechanism by which people's personal goals might influence their perception of chemistry—particularly their sense of shared identity with and positivity toward their partner—involves transference (see primary constructs in Row 6 as well as secondary constructs in Rows 3 and 4 in Table 1). A comprehensive program of research by Andersen and colleagues has shown how evaluations of new acquaintances can be influenced by nonconsciously triggered resemblances to influential relationship partners—typically, but not necessarily, a parent or a prior romantic partner. In most of these studies, significant-other representations are activated by presenting participants with cues earlier established to characterize the previously known person, usually descriptive adjectives (S. M. Andersen et al., 1996) or facial images (Günaydin et al., 2012; Kraus & Chen, 2010). For example, a woman feels that she instantly "clicks with" a first date, not realizing that his facial features subconsciously remind her of her high school sweetheart. Because these cues are subtle enough to evade recognition, and may even be subliminal (Glassman & Andersen, 1999), automatic processes are implicated (Przybylinski & Andersen, 2015). Across many experiments, the positivity or negativity of significant-other activations has been shown to influence a variety of outcomes—for example, affect toward and evaluations of a new acquaintance, expectations of acceptance and rejection, approach motivation, adoption of shared goals, and inferences about the new acquaintance's behavior (for reviews, see S. M. Andersen & Berk, 1998; Przybylinski & Andersen, 2015).

Experiences of chemistry with a new acquaintance, particularly a sense of shared identity and feelings of attraction and positivity toward him or her, may be a product of this sort of transference—that is, activation of outside-of-awareness representations of a significant person from an earlier (and presumably positively valenced) relationship, such as a parent, a former love, or a childhood best friend. Although existing research has been limited to descriptive adjectives and facial cues, other common features may also trigger transference—for example, smell, body shape, posture, or movement; vocal tones or linguistic habits; or hobbies. The perception of chemistry, then, may arise from the activation of superficial resemblances between a current interaction partner and an earlier relationship. In the specific case of romantic acquaintances, this conjecture bears some resemblance to the psychoanalytic theory idea that mate choices are influenced by internalized models of one's opposite-sex parent (Wilson, 1981). However, this psychoanalytic idea has received scant empirical support, and its presumptive mechanism is not consistent with what is currently known about social cognition. Instead, the model of transference advanced by Andersen and colleagues is that cognitive representations of significant others are permanently stored in the human brain and, when triggered by circumstances or other persons, may become at least temporarily accessible and influential.

Implications and Future Directions

Although the experience of interpersonal chemistry is so palpable as to be named in terms of its metaphoric similarity to a physical science, it remains relatively unexplored in psychological science. Because chemistry overlaps with a number of important theoretical and empirical constructs across several psychological disciplines, we used the existing research as a foundation to propose an integrative process model of chemistry, describing what it is and how it might develop between individuals. We then reviewed the relevant research to situate the construct of chemistry within existing theoretical and empirical work.

Needless to say, much more theory and research is needed to further develop and elucidate what chemistry looks like, what predicts its emergence, and how it operates. Skeptical readers might ask, what will deeper exploration of the construct of chemistry buy us as a science? We would point to the ubiquity of this construct in people's accounts of their most compelling relationships. Existing models of attraction and relationship development have been limited to constructs that for the most part do not capture the depth of feeling and interconnection that chemistry connotes. By better understanding chemistry, the field would gain valuable insights into this type of deeply felt, behaviorally absorbing connection, as well as the downstream consequences of such connection, including a sense of purpose and success in pursuits that would have been unlikely without chemistry. In this regard, one useful step would be to develop measurement instruments, both self-report and observational, on the basis of our conceptualization. Another step would be to refine, improve, and test predictions from our proposed interpersonal-chemistry model. We list several such predictions below and offer ideas for how to start addressing a few of them.

To begin, we have conceptualized chemistry here as uniformly applicable across varied social domains. Future empirical research could examine the experience of chemistry in different settings to identify the ways in which the social context might moderate the experience of chemistry—and its three key elements—and to determine whether distinct forms of chemistry might emerge in different interpersonal contexts and social roles (e.g., sexual, romantic, intellectual, companionate, cultural). For example, the perception of coordinated goal-relevant activity may be more critical to chemistry in teams or work relationships. Research also suggests that friendship and romantic chemistry differ in terms of the experience of similarity (more relevant to the former) and attraction (more relevant to the latter; Campbell et al., 2018). Although these findings are far from conclusive, they point to the possibility of important context-dependent differences in the experience of chemistry.

Future research could also examine whether and to what degree interpersonal chemistry is observable to outsiders. If chemistry differs from other high-quality social interactions, then an onlooker should be able to detect interactions characterized by interpersonal chemistry by observing the repeated moments of connection depicted in Figure 1 (left). A related question is how witnessing the emergence of interpersonal chemistry among others might affect the witness. That is, would an onlooker feel uplifted and inspired after observing such a positive interaction or instead feel envious and left out?

Furthermore, although chemistry clearly occurs in groups or teams larger than two, we have primarily focused on chemistry between two individuals—both for the sake of simplicity and because of the constraints of the extant relevant literature. Much more work needs to focus on understanding whether the elements, preconditions, and moderators of group chemistry might qualitatively differ from those of dyadic chemistry. For example, perceived coordinated goal-directed activity may be even more critical to chemistry in teams than in dyads, and charisma may promote or reinforce chemistry in groups only when it characterizes the group leader, not individual group members.

We stipulated experiences of affective positivity and attraction as a key component of perceived chemistry in our conceptual model, including therein the occurrence of shared positive emotions, which are a core element of rapport, high-quality connections, and positivity resonance. An additional intriguing question, however, challenges this stipulation: Does shared positive emotion play a necessary or unique role in the emergence or maintenance of chemistry? Although relevant research is limited, we speculate that certain shared negative or mixed emotions may also facilitate the experience of chemistry—for example, shared nostalgia, shared righteous anger, shared grief, or shared anxiety about impending stress. However, partners who are angry at each other or who are both depressed are unlikely to perceive chemistry between them. Research is needed to identify when shared negative emotions will facilitate chemistry and when they will impede it.

Another key question for future research involves investigating the many potential individual difference and situational factors that might moderate the emergence and maintenance of chemistry or its building blocks (such as expressive and responsive behavior). Our earlier review of the literature raised several possibilities, including charisma, extraversion, self-disclosure, authenticity, eye contact, and flow. Other variables undoubtedly have strong potential to affect the likelihood that chemistry will develop and continue. Examples include trust, perceived safety, physical attractiveness, relationship obstacles, and humor. We hope future investigators will turn their attention to examining the role these constructs might play in interpersonal chemistry.

One construct of particular relevance and interest is happiness, or the experience of relatively frequent positive emotions and high life satisfaction (Diener et al., 2018). In cross-sectional and longitudinal studies, happier people—or those who report more positive affect—have been found to possess many characteristics that we believe are conducive to chemistry and its key elements. Unlike their less happy peers, they like other people more (Lyubomirsky & Tucker, 1998) and are liked more by others (Bell, 1978; Wright & Staw, 1999). In their interpersonal interactions, they are relatively more likely to respond with empathy (Strayer, 1980), to self-disclose, and to have more intimate conversations (Berry & Hansen, 1996). In addition, relative to less happy others, happy individuals are judged to have greater warmth (Schimmack et al., 2004) and social skills (Diener & Fujita, 1995), engage in relatively more daily interactions, and show more commitment and closeness in their relationships (Berry & Hansen, 1996; Berry & Willingham, 1997).

More persuasively, experimental studies have shown that induced positive affect leads people to initiate conversations more and to be more attentive (Isen, 1970; McMillen et al., 1977) and collaborative (Baron et al., 1990; Baron et al., 1992), to disclose more information about themselves (Cunningham, 1988), and to report more relationship closeness (Waugh & Fredrickson, 2006). Of course, the causal path is likely to run in both directions, such that the presence of chemistry may also boost happiness—both directly (because the experience of chemistry feels good) and indirectly (inasmuch as it promotes and strengthens close relationships, a critical contributor to well-being).

A final important question addresses temporal processes involved in the development, maintenance, and possible deterioration of chemistry. How and why does one instance of connection make subsequent instances more likely? Moreover, in particular, we theorize that the three components of perceived chemistry specified in our model—shared identity, affective positivity, and coordinated goal-relevant activity—may vary in their relevance as a function of relationship stages. For example, attraction is probably predominant early in relationships, especially high-arousal positive emotions directed at the other person and especially in romantic relationships. Analogously, Tickle-Degnen and Rosenthal (1990) proposed that the positivity component of rapport may matter more for establishing rapport at the onset of a relationship, when an individual is deciding whether to continue an interaction and further develop a relationship. On the other hand, partners' coordinated goal-relevant activities probably matter more in later stages, when interaction has become routinized and frequent and as individuals become more familiar with one another and thus more attuned to the nonverbal cues necessary for behavioral synchrony (e.g., nonverbal mimicry, behavioral style matching; see also Tickle-Degnen & Rosenthal, 1990). Future research is needed to explore these and other questions about the temporal dynamics involved in the emergence, growth, and maintenance of chemistry.

In sum, future investigators have no shortage of questions to tackle as part of a research agenda to fully delineate and understand the construct of chemistry. Additional questions we would propose include, but are not limited, to the following: (a) What are the optimal approaches to measuring and inducing chemistry—both the behavior piece (the "lived" or observed chemistry) and the perception piece (the felt chemistry)—in the laboratory and in natural settings; (b) what are the necessary and sufficient conditions for chemistry to occur; (c) what are the moderators of the emergence of chemistry; (d) what predicts whether chemistry will last and when it might be lost; and (e) is chemistry (consistent with prior findings regarding positivity resonance and moments of connection) more likely to occur face-to-face than in remote (e.g., digital, text-based) contexts (see Lee et al., 2019; Sbarra et al., 2019)?

Conclusion

The metaphor of chemistry to describe relationships is pervasive, indelible, and powerful, yet as a psychological construct it remains slippery and elusive. Ask anyone what it means to experience chemistry, and with little effort, they are likely to mention a feeling of intense connection that is "magnetic" and intangible. Our hope is that this article serves as a springboard for cross-sectional, longitudinal, and experimental work to render chemistry more tangible, and that by measuring and understanding it, researchers may ultimately identify ways to facilitate its occurrence in people's relationships and in their everyday professional and social lives.

Transparency

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Notes

1. This conceptualization also suggests overlap with the concept of "flow" (Csikszentmihalyi, 1990), which is reviewed later in this article.
2. The left-hand side of the model builds on the interpersonal process model of intimacy (Reis & Shaver, 1988) but differs

from it in at least two important ways: the relevance of goals and the importance of interpersonal synchrony. Unlike the current model, the intimacy model also does not clearly distinguish between the behavioral-interaction and perception components.

3. In the case of romantic chemistry, these positive feelings toward the other usually involve high-arousal emotions—for example, passion and excitement—but later in romantic relationships, and more generally in nonromantic relationships, these feelings may involve low-arousal positive emotions—for example, warmth and a sense of fitting together.

4. Note that self-disclosures need not be verbal or deliberate. Rather, the term here applies to the belief that important aspects of the self, including one's needs, goals, and fears, are visible to the partner.

5. This is true even if that sense is illusory, as may well be the case in initial acquaintances or in parasocial relationships—for example, as expressed in the Roberta Flack lyric: "He sang as if he knew me in all my dark despair."

6. Tickle-Degnen and Rosenthal (1990) labeled this component "coordination."

7. However, Maxwell and colleagues included the item "If a couple is truly in love, partners will naturally have high sexual chemistry" in a measure of implicit theories about sexuality and relationship well-being (Maxwell et al., 2017).

8. These goals (e.g., to be in a romantic or business relationship) may be the same as the goals on the left-hand side of the model, but they refer to different processes. On the left-hand side, goals impel expressive and responsive behavior. Here, goals lead to projection, or the perception of shared identity, affective positivity, and coordinated activity.

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