A Dynamical Systems Approach to the Development and Expression of Female Same-Sex Sexuality

Lisa M. Diamond

University of Utah

ABSTRACT—*Researchers have documented substantial variability in the development and expression of same-sex sexuality, especially among women, posing challenges to traditional linear developmental models. In this article, I argue for a new approach to conceptualizing the development and expression of female same-sex sexuality over the life course, based in dynamical systems theory. Dynamical systems models seek to explain how complex patterns emerge, stabilize, change, and restabilize over time. Although originally developed by mathematicians and physicists to model complex physical phenomena in the natural world, they have increasingly been applied to social-behavioral phenomena, ranging from motor development to cognition to language. I demonstrate the utility of this approach for modeling change over time in female same-sex sexuality, reviewing extant published research and also introducing data collected from an ongoing, 10-year longitudinal study of young nonheterosexual women. I provide evidence that female same-sex sexuality demonstrates the emblematic features of a dynamical system: nonlinear change over time, spontaneous emergence of novel forms, and periodic reorganizations and phase transitions within the overall system. I highlight the specific contribution of a dynamical systems perspective for understanding such phenomena and suggest directions for future study.*

Research on the nature and development of same-sex sexuality seems to suggest that the more we learn, the more we do not understand. There was a period around the late 1980s and early 1990s when scientific findings appeared to coalesce around a robust, essentialist, organismic model of the etiology and ontology of sexual orientation. According to this model, exclusive sexual predispositions for the same sex were determined by genes and/or perinatal hormonalization (Bailey, 1995; Bailey & Pillard, 1991, 1995; Dittmann, 1997; Ellis & Ames, 1987; Hamer, Hu, Magnuson, Hu, & Pattatuchi, 1993; Hu et al., 1995; Risch, Squires-Wheeler, & Keats, 1993) and began to manifest themselves during early childhood in a series of developmental milestones, beginning with "feelings of differentness" and progressing through gender atypicality, nascent same-sex attractions, and experimental same-sex behavior (Bailey & Zucker, 1995; Collaer & Hines, 1995; McClintock & Herdt, 1996; Phillips & Over, 1992; Savin-Williams, 1996, 1998).

Since that time, the picture has become substantially more complicated. As more data has been collected from increasingly diverse populations of sexual minorities (a term denoting all individuals with same-sex attractions or behavior, regardless of self-identification), it appears that same-sex sexuality is a multifactorial phenomenon, characterized by multiple causal factors, multiple developmental pathways, and multiple manifestations (Diamond, 2005; Diamond & Savin-Williams, 2000; Garnets & Kimmel, 2003; Hyde, 2005; Mustanski, Chivers, & Bailey, 2002; Peplau & Garnets, 2000; Savin-Williams & Diamond, 2000). Furthermore, different constellations of these factors are thought to be operative for different individuals (see, for example, Blanchard et al., 2002).

This diversity of developmental pathways and outcomes poses substantial obstacles for researchers seeking systematic models of the nature and development of same-sex sexuality. Clearly, neither biological determinism nor pure social constructionism (i.e., Foucault, 1980; Plummer, 1981; Weeks, 1986) adequately explains the extant data. Integrative models emphasizing interactions between biological and sociocultural factors provide a

Address correspondence to Lisa M. Diamond, Department of Psychology, University of Utah, 380 South 1530 East, Room 502, Salt Lake City, UT 84112-0251; e-mail: diamond@psych.utah.edu.

sensible compromise (Tolman & Diamond, 2001), yet even these models face a daunting task in unpacking the specific biosocial bases of sexuality's "dazzling idiosyncrasy" (Suppe, 1984, p. 17).

In this article, I will argue for a new approach to modeling the nature and development of same-sex sexuality, based in *dynamical systems theory*. Dynamical systems models were originally developed by mathematicians and physicists to model the order and patterning of complex physical phenomena in the natural world (for example, Kelso & Tuler, 1984). Such models seek to explain how complex patterns emerge, stabilize, change, and restabilize over time. Over the past decade, social scientists have increasingly applied this approach to complex human phenomena (for early, seminal examples, see Fogel & Thelen, 1987; Thelen, Kelso, & Fogel, 1987; Thelen & Smith, 1994) to better represent how dynamic interchanges between individuals and their environments give rise to novel forms of thought and behavior. Thus far, dynamical systems approaches have made notable contributions to our understanding of motor development (Kelso, 1997; Turvey, 1990), cognition (Thelen & Smith, 1994), perception (Gilden, 1991), emotion (Fogel, Nwokah, Dedo, & Messinger, 1992; Fogel & Thelen, 1987; Izard, Ackerman, Schoff, & Fine, 2000; Magai & McFadden, 1995), personality (Lewis, 2000; Read & Miller, 2002), language (Christman, 2002; Elman, 1995), children's play (Steenbeek & van Geert, 2005), coping (Lewis, Zimmerman, Hollenstein, & Lamey, 2004), antisocial behavior (Granic & Patterson, 2006), and even gender development (Fausto-Sterling, 2000).

A dynamical systems approach has never been applied to sexual orientation, but it should be. In particular, it is uniquely well-suited for modeling the development and expression of female same-sex sexuality over the life course. In this article, I support this claim with findings from extant research on female sexuality, as well as with the results of my own 10-year longitudinal study of 89 young, sexual-minority women. This study has documented notable within-person variability over time, particularly (a) nonlinear discontinuities in women's attractions, behaviors, and identities; (b) the abrupt emergence of novel erotic feelings and experiences in specific contexts; and (c) periodic episodes of reorganization in sexual self-concept at multiple points in the life course. Such phenomena are difficult to reconcile with conventional models of same-sex sexuality, hence they have historically been discounted as idiosyncratic, unexplainable "noise" in the data on sexual orientation.

Yet these experiences are explainable; in fact, they are the signature features of a dynamical system. The reason that conventional models cannot account for such phenomena is that these models fail to adequately conceptualize change in sexuality over time. Same-sex sexuality has been presumed to be a fundamentally stable phenomenon, such that within-person variability necessarily appears atypical and unexplainable. When change is studied, it is only in one form: the progressive, linear "unfolding" of same-sex desires thought to characterize an individual's initial realization and acceptance of his/her same-sex orientation.

In contrast, dynamical systems models focus specifically on understanding the processes and mechanisms of complex, nonlinear variability: "increases in complexity over time, the emergence of true novelty within developing systems, [and] transition points that permit both structural advances and individual diversification" (Lewis, 2000, p. 40). These are precisely the sorts of phenomena that have been observed—but set aside—in the study of female same-sex sexuality. Hence, I would argue that, by applying the concepts and methods of a dynamical systems approach, we can bring these perplexing forms of within-person variability back into the range of systematic analyses, greatly expanding our understanding of female same-sex sexuality in *all* of its complex manifestations.

Importantly, the concepts and methods of a dynamical systems approach can also be fruitfully applied to a wide range of sexual phenomena, from male same-sex sexuality to pubertal development to sexual decision making to sexual dysfunction. In particular, this approach provides a compelling advance beyond the traditional nature/nurture, essentialism/social-constructionism, gene/environment dichotomies that traditionally dominate sexuality research (for reviews and examples, see Bailey & Pillard, 1995; Baldwin & Baldwin, 1997; Bem, 1996; Buss, Larsen, Westen, & Semmelroth, 1992; Peplau, Spalding, Conley, & Veniegas, 1999; Rodgers, Rowe, & Buster, 1999; Tolman & Diamond, 2001; Veniegas & Conley, 2000). Yet I focus here on female same-sex sexuality because its apparent "fluidity" and "plasticity" (Baumeister, 2000; Diamond, 2006a) make a dynamical systems approach particularly apt. Hopefully, this article will serve as a springboard for broader applications of dynamical systems models to variability in human sexuality.

It bears noting that, although many dynamical systems approaches involve the application of highly technical, mathematical models of nonlinear change and development (Boker & Nesselroade, 2002; Butner, Amazeen, & Mulvey, 2005; Erlhagen & Schöner, 2002; Schutte & Spencer, 2002; van Geert & Steenbeek, 2005), mathematical predictions are not the goal here and are in fact beyond the purview of the data at hand. My intent, rather, is to demonstrate how the general framework of dynamical systems can productively reshape our understandings of, assumptions about, and methods for studying female same-sex sexuality. Hence, I am not offering dynamical systems theory as a new and definitive model of female same-sex sexuality, but as a new *approach* to posing and answering questions about this phenomenon, one that centers on the complex processes generating stability, change, and transformation in sexual attractions, behaviors, and identities over the lifespan.

I begin by briefly reviewing forms of variability in female same-sex sexuality that have proven historically problematic for conventional linear developmental models. I then review the basic components of a dynamical systems approach and introduce evidence, from published research as well as my own

longitudinal data, that female same-sex sexuality demonstrates the emblematic features of a dynamical system: nonlinear change over time, spontaneous emergence of novel forms, and periodic reorganizations and phase transitions within the overall system. I highlight the specific contribution of a dynamical systems perspective for understanding such phenomena and suggest directions for future study.

THE FEMALE PROBLEM IN SEXUALITY RESEARCH

There is increasing consensus that the origins, developmental trajectories, and manifestations of female same-sex sexuality are substantially different from those for male same-sex sexuality—enough so as to require altogether different explanatory frameworks (Bailey, Dunne, & Martin, 2000; Hyde, 2005; Mustanski et al., 2002; Peplau, 2001; Peplau & Garnets, 2000; Peplau et al., 1999). This represents a profound shift from older conceptualizations of sexual orientation, in which female–female and male–male sexuality were presumed to be two sides of the same coin. The current evidence for pervasive gender differences in practically every potential etiological pathway to same-sex sexuality and every stage of its expression (see reviews in Baumeister, 2000; Mustanski et al., 2002; Peplau, Fingerhut, & Beals, 2004; Peplau et al., 1999; Savin-Williams & Diamond, 2000) has convinced many researchers that "the male model of sexual orientation has been rejected in women" (Mustanski et al., 2002, p. 127).

For example, several large-scale, representative studies of both adolescents and adults have documented that women are more likely to report bisexual attractions than to report exclusive same-sex attractions, whereas the opposite pattern characterizes men (Baumeister, 2000; French, Story, Remafedi, Resnick, & Blum, 1996; Laumann, Gagnon, Michael, & Michaels, 1994; Russell & Consolacion, 2003; Russell & Seif, 2002). Notably, this pattern also characterizes women's and men's physiological arousal as well as their subjective desires (Chivers, Rieger, Latty, & Bailey, 2005; Rieger, Bailey, & Chivers, 2005). There is also evidence that women's attractions show a greater capacity for change over time and across situations than do men's attractions (Weinberg, Williams, & Pryor, 1994) and that women are more likely than men to ascribe a role for choice and circumstance in their same-sex sexuality (Golden, 1996; Whisman, 1996).

Differences in developmental timing are also well-established: Whereas many gay- or bisexual-identified men recall experiencing their first same-sex attractions a few years prior to puberty (similar to the age at which most heterosexual children recall their first other-sex desires, as pointed out by McClintock & Herdt, 1996), many women report that they did not experience same-sex attractions until adulthood, often as a result of encountering gay/lesbian/bisexual individuals or ideas or opportunities for same-sex contact (Cass, 1990; Diamond, 1998; Golden, 1987, 1994; Kitzinger & Wilkinson, 1995; Silber, 1990). This is often the case for "political lesbians," who typically report that they chose to orient their lives around women for social and political reasons and then found their sexual desires following suit (Ettore, 1980; Golden, 1987, 1994; Kitzinger & Wilkinson, 1995; Silber, 1990; Whisman, 1993, 1996).

In light of findings such as these, researchers have begun to conceptualize female sexuality and sexual orientation as more "plastic" or "fluid" than male sexuality (Baumeister, 2000; Diamond, 2003c, 2005, 2006a, 2006b; Peplau, 2001; Peplau et al., 1999), meaning that it is particularly sensitive to situational, interpersonal, and contextual factors (see, for example, the creative and generative "intimate careers" model of Peplau et al., 1999, which uses the analogy of career trajectories to highlight diversity and variability in women's erotic and affectional trajectories over the life course). Yet, from a scientific standpoint, the notion of fluidity leaves something to be desired. It invites misinterpretation as general "randomness," given how little is known about the specific mechanisms and parameters propelling and/or constraining change (Baumeister, 2000; Diamond, 2003c). We also do not know why some women appear to be substantially more "fluid" than are others, and why within-person changes appear to take different forms at different stages of the life course (Diamond, 2006a; Golden, 1996).

What we require, then, are new approaches to female same-sex sexuality that not only acknowledge *that* change occurs but can explain *how* it occurs, particularly in such nonlinear forms. Dynamical systems approaches are ideally suited for this task because they focus specifically on the underlying dynamics of complex, nonlinear variability in human experience over time.

A BRIEF INTRODUCTION TO DYNAMICAL SYSTEMS

Dynamical systems approaches to social-behavioral phenomena belong to a larger family of theoretical perspectives seeking to replace deterministic models with an emphasis on dynamic person–environment interactions occurring over time. Other examples of this approach include general systems theory, developmental systems theory, ecological perspectives, contextualism, transactionalism, and holistic-interactionism (reviewed in Granic, 2005). What makes a dynamical systems approach unique is its focus on *nonlinear variability*—abrupt changes and sometimes massive transformations in thought or behavior triggered by seemingly minor antecedent events. Hence, whereas traditional developmental models focus on processes of progressive, linear change, dynamical systems models focus on precisely the sorts of sudden, abrupt, unexpected transformations that linear approaches fail to capture.

There are actually several different types of dynamical systems models (van Geert & Steenbeek, 2005), but at their core they all emphasize transformative, bidirectional, changing interactions among endogenous factors (e.g., genes, hormones, skills, capacities, thoughts, feelings) and exogenous factors (e.g., relationships, experiences, cultural norms, family history).

According to dynamical systems theory, interactions among these elements can actually create novel psychological and behavioral phenomena during "phase shifts"—periods of fundamental reorganization in the overall system (Granic, 2005). Phase shifts occur when certain parameters governing the system—or certain relationships among parameters—start to vary outside of certain critical thresholds (Fogel & Thelen, 1987). As a result, existing patterns of thought and behavior break down and new patterns take their place.

This process is denoted *self-organization*, defined as the spontaneous development of order within a complex system (Kelso, 1997). A closely related concept is *emergence*, defined as the coming into being of altogether novel behaviors or experiences through dynamic, unpredictable interactions between different elements in the system. As reviewed by Fogel (2006), researchers and theorists have increasingly come to view emergence and transformation as fundamental processes of psychological change, encompassing not only qualitative shifts in subjective experience but also processes of cognitive discovery and creativity (for example, Gottlieb, 1992; Nelson, 1997; Overton, 2002; Tronick et al., 1998).

In emphasizing processes of self-organization and emergence, dynamical systems approaches stand in direct contrast to essentialist, organismic models of development that presume that complex behaviors or experiences unfold gradually and progressively according to innate, deterministic programs. Whereas the organismic approach predicts relatively uniform trajectories with consistent onsets and outcomes, dynamical systems approaches maintain that developmental pathways are necessarily idiosyncratic, shaped and reshaped by long cascades of diverse interchanges between individuals and their changing environments. As a result, at any one point it is nearly impossible to trace a particular phenomenon back to a single predictor or to determine the endpoint of any one trajectory with certainty. The technical terms for these two related concepts are *equifinality* and *multifinality*. Equifinality means that two individuals can reach the same outcome through different routes, whereas multifinality means that two individuals might have the same initial developmental "starting point," but will be propelled along different developmental trajectories toward different outcomes due to their own unique histories.

This does not mean that development is endlessly, inevitably variable. Rather, stability reliably emerges as new patterns of thought and behavior are repeated and reinforced via internal feedback mechanisms. Yet such stability is necessarily dynamic, meaning that it continues to be susceptible to ongoing change and realignment as a function of changing environments and situations (Fogel & Thelen, 1987). Different psychological and behavioral patterns have different degrees of dynamic stability: Some are relatively resistant to environmental perturbations, whereas others are "softly assembled" (Thelen & Smith, 1998), meaning that they tend to be more prone to reorganization when changes occur in the constituents of the system or in the local environment. But whether a particular behavior is fluid or rigid, its functioning can never be reduced to any single predictor (e.g., genes, cultural influences). Thus, whereas traditional scientific models focus on breaking phenomena down into their component parts to isolate unique effects (i.e., nature vs. nurture), dynamical systems approaches focus instead on understanding how complex phenomena take a variety of different forms according to the complex, changing relationships among multiple factors (Fogel, 1993).

APPLICATION TO FEMALE SAME-SEX SEXUALITY

The study of sexuality is well suited to a dynamical systems perspective, given that sexual feelings and behaviors necessarily involve complex, dynamic interactions among genes, hormones, maturational state, personality traits, situational features, interpersonal influences, and cultural norms (Savin-Williams & Diamond, 2004; Tolman & Diamond, 2001; Udry, 1990). Yet the study of female same-sex sexuality has perhaps the most to gain from this approach, because its most distinctive (and hard-to-explain) features are in fact hallmarks of dynamical systems: nonlinear change over time, spontaneous emergence of novel forms, and periodic reorganizations of the overall system (Lewis, 2000). I provide evidence for each of these phenomena, from published research as well as my own longitudinal data, and I show how a dynamical systems perspective clarifies their significance. I begin with an overview of my ongoing prospective research on female same-sex sexuality, more detail on which can be found in existing published reports (Diamond, 1998, 2000b, 2003b, 2005).

Overview of the Study

The original aim of this work was to prospectively describe the expression and development of same-sex sexuality among adolescent and young-adult women (all prior studies of sexual-minority development have been retrospective). For the first wave of data collection, I interviewed 89 nonheterosexual women between the ages of 16 and 23 (Diamond, 1998). Participants were recruited in two moderately sized cities and a number of smaller urban and rural communities in central New York State. The settings that were sampled included (a) lesbian, gay, and bisexual community events (i.e., picnics, parades, social events) and youth groups; (b) classes on gender and sexuality issues taught at a large university with a moderately ethnically diverse—but largely middle-class—student population; and (c) lesbian, gay, and bisexual student groups at a large public university with a predominantly White but more socioeconomically diverse population and a small, private, women's college with a predominantly White and middle-class student population.

This recruitment strategy succeeded in sampling sizable numbers of bisexual women, as well as nonheterosexual women

who declined to label their sexual identity, both of which are underrepresented in most research on sexual minorities. In all, 42% of participants identified as lesbian at Time 1 (T1), 30% identified as bisexual, and 28% declined to adopt a sexual-identity label. The mean and median age of the participants was 19, and there were no significant age differences across sexual-identity categories. However, the sample shares a chronic drawback with other samples of sexual minorities in that it comprises predominantly White, highly educated, middle- to upper-class individuals. Nearly all of the college-aged participants had enrolled in college at one point, and 75% came from families in which at least one parent had completed college. Sixty-three percent of women came from families in which at least one parent had a professional or technical occupation, and 84% were White. None of the study's findings have been found to vary as a function of women's social class or their recruitment site.

I reinterviewed respondents over the phone four additional times, approximately every 2 to 3 years. Thus, the T2, T3, T4, and T5 interviews represent 2-year, 5-year, 8-year, and 10-year follow-ups, respectively. Detailed notes were taken of the first, in-person interview and transcribed immediately afterward. Verbatim typed transcriptions were taken of the T2 interviews while they were being conducted; all subsequent interviews were tape-recorded and transcribed. Four lesbians, one bisexual, and four unlabeled participants could not be relocated at T2. At T3, an additional 3 lesbians and 1 bisexual could not be located, but the 4 unlabeled women who had been missing at T2 were successfully recontacted. Two respondents could not be recontacted between T3 and T4 (one had identified as unlabeled and the other as bisexual at T1). One T1 lesbian that had been lost between T2 and T3 was successfully recontacted for T4. No respondents were lost between T4 and T5. Thus, the final T5 sample size was 79, comprising 89% of the original respondents.

At each of the interviews, women described their current sexual identity, recalled the process by which they first questioned their sexuality (including the ages of their first same-sex attractions, first same-sex contact, and first conscious questioning), and recounted any changes they had recently undergone regarding their experience or conceptualization of their sexuality. To assess same-sex attractions, women were asked to report the percentage of their current day-to-day attractions that were directed toward the same sex; separate estimates were provided for sexual versus romantic/affectional attractions. This yields an estimate of the relative frequency of same-sex versus other-sex attractions, regardless of the intensity of these attractions or the total number of sexual attractions experienced on a day-to-day basis. At subsequent interviews, participants indicated the number of men and women with whom they had engaged in sexual contact (defined as any sexually motivated intimate contact) since the preceding interview, as well as the number of men and women with whom they had had romantic relationships.

PHENOMENON #1: NONLINEAR DISCONTINUITIES

Traditional models of sexual-identity development (also known as "coming out" models) posit that sexual-minority individuals follow a series of ordered stages beginning with early, vague interest in the same sex (typically around age 10, corresponding to the hormonal changes of adrenarche; McClintock & Herdt, 1996) and progressing through more intense same-sex desires and fantasies (sometimes accompanied by sexual experimentation), intensive questioning about the nature of one's sexual orientation, and eventual embrace of one's lesbian/gay/bisexual identity label and open pursuit of same-sex relationships (reviewed in Cohen & Savin-Williams, 1996). Hence, these models reflect organismic assumptions about the progressive unfolding of same-sex sexuality over time.

In contrast, the hallmark of a dynamic system is nonlinear, discontinuous change (see Granic, 2005; Thelen, 2005). *Nonlinear*, in this context, means that "proportionality between consequence and cause does not hold" (van Geert, 1998, p. 150), such that seemingly minor events or perturbations can have abrupt, large, and unpredictable effects (Thelen, 2005). These nonlinear changes create discontinuities between prior and current states of the system, such that the current state may diverge sharply from what preceded it instead of building upon the previous state in a continuous, predictable fashion.

Variability in Timing: Late Bloomers

What is the evidence that female same-sex sexuality exhibits such nonlinearity and discontinuity? First, consider the timing of women's sexual questioning. Whereas traditional linear models of sexual-identity development presume that same-sex attractions emerge at an early age, this is not always the case. Studies of sexual-minority adolescents and young adults have consistently found that women report later ages of first awareness and first questioning of their sexuality than do men (for example, D'Augelli & Hershberger, 1993; Herdt & Boxer, 1993; Rosario et al., 1996; Savin-Williams & Diamond, 2000). Even more striking, however, are the many cases of women who report no awareness of same-sex attractions altogether until mid- to late adulthood (Blumstein & Schwartz, 1977; Cassingham & O'Neil, 1993; Charbonneau & Lander, 1991; Kitzinger & Wilkinson, 1995; Loewenstein, 1985; Saghir & Robins, 1973).

Historically, such long delays in awareness were attributed to repression and latency. For example, writing in the 1970s about the late-life lesbian transitions they observed among their own research participants, Saghir and Robins (1973) attributed these cases to "dormancy" in women's underlying homosexuality. Yet over the years, studies probing the antecedents and phenomenology of such late-life transitions have suggested that the dormancy model is not always accurate. Loewenstein (1985), for example, concluded from her research on over 700 women that those reporting late-life same-sex "passions" were undergoing

"a genuine shift in love object orientation. . . . Some respondents were bona fide heterosexual women who switched in midlife to a lesbian orientation" (p. 22). Similarly, Kitzinger and Wilkinson (1995) interviewed 80 lesbians whose first sexual questioning took place in adulthood rather than adolescence. Over two thirds of these women had been previously married; the average age of their first same-sex experience was 18, and the average age of first lesbian identification was 34. Although some women described themselves as having suppressed their lesbianism for many years, others experienced the transition to same-sex sexuality as a sudden transformation, described in terms of "rebirth," a "quantum leap," a "conversion experience," or "emerging from a chrysalis" (Kitzinger, 1995, p. 100).

Golden (1996) interviewed over 100 lesbian, bisexual, and heterosexual women and found that, although a subset of late-blooming lesbian or bisexual women described their heterosexual pasts in terms of repression and falsehood, another subset stridently maintained that their sexuality had actually changed. As one woman simply stated, "Then I was heterosexual, and now I'm a lesbian" (p. 236). Golden took care to clarify that the abruptness of such transitions did not mean that women were blithely "deciding" to "be lesbian"— rather, they typically described the onset of their same-sex desires as strong, spontaneous, and often surprising.

My own longitudinal research has replicated these findings. The age at which respondents first questioned their sexuality was quite broad, ranging from 8 to 22 (the cutoff age for participating at T1 was 23), and 18% of the sample reported no awareness of same-sex attractions until they were 18. Notably, many of these women reported that they eventually scrutinized their childhood and adolescent memories, looking for evidence of suppressed same-sex attractions. Yet often, no such evidence emerged. As one woman reported, "I sort of searched my past, kind of wanting to find some early clue that I had always felt this way, but honestly I don't really remember anything like that." Another remarked, "I feel like some people want me to say, 'oh, ever since I was a little girl,' and all that, but for me it's like I was heterosexual, and now I'm not. I don't know how else to explain it."

The Role of Context: Lesbian by Chance? Choice?

In addition to the timing of women's sexual questioning, the *context* of this process is also noteworthy from a dynamical systems perspective. Traditional linear models portray the process of sexual questioning as unfolding gradually, driven by progressive awareness of same-sex attractions. Yet in actuality, research on women has reliably found that a range of situational and idiosyncratic social factors frequently trigger the questioning process, seemingly "by accident" (Gagnon, 1990, p. 197) and often unconnected to straightforward sexual feelings. For example, beginning with the feminist movement of the 1970s and extending decades afterwards, researchers have observed that women's immersion in feminist politics coupled with the development of strong same-sex friendships and exposure to lesbian/gay/bisexual peers often proved to be powerful triggers for new and unexpected same-sex attractions and fantasies (Charbonneau & Lander, 1991; Golden, 1987, 1994; Shuster, 1987).

I have documented similar phenomena in my longitudinal study. Nearly half of my respondents attributed the onset of their sexual questioning not to same-sex attractions but to social and situational antecedents such as "meeting a lesbian friend," "taking a course on lesbian/gay/bisexual issues," "my female roommate told me she was attracted to me," or "watching an *Oprah* show about lesbianism." As one participant recounted:

> In my freshman year a friend of mine came out to me. I thought to myself, "good for her," and I thought about what it must be like for her. . . . Then I started to think, "well, how would I explain being heterosexual? How do I even really know that I'm heterosexual?" I started thinking about it more and more, and around the same time I was developing a really intense friendship with this other girl, we were becoming really close, and we were both taking this course about gender which was taught by a bisexual woman. We used to talk about a lot of the stuff in class together, and eventually one night we were talking on the phone and she said that she was probably bisexual, and I realized—and told her—I am too!

In other cases, women's first attractions and first sexual questioning came together in singular transformative moments rather than after long periods of progressive, unfolding awareness. For example, one woman recalled that when she was 17 she stayed up all night in intense conversation with a close bisexual friend on her soccer team. After hours and hours of deepening emotional intimacy, they kissed, and she described the effect as "an on-on switch. It turned on, and it stayed on."

Such sudden transformations might seem implausible: How can just thinking about the prospect of same-sex attractions give rise to such attractions, and how can a single moment in a single relationship utterly change one's constellation of sexual desires? Is it possible that these women had been experiencing same-sex attractions all along but were simply unaware of them? If this were so, then one might expect that as the years went by and as women repeatedly revisited these stories of early questioning, they would eventually recant these accounts and report that they *had* experienced early attractions that had previously escaped their memories. Yet over 10 years of interviews, this has not been the case.

These examples also raise questions about whether such women were being "seduced" into same-sex sexuality, or whether they were "choosing" to become lesbians. Such notions of conversion, seduction, and choice are often posited in opposition to essentialist conceptualizations of sexual orientation, as if any behavior that is not innately "programmed" is amenable to direct control (by oneself or another). Yet the women in my sample who experienced the development of their same-sex sexuality in abrupt, transformative moments did not conclude that they therefore chose to be lesbian or bisexual. Overall, only

18% of my respondents believed that choice had played a role in their sexuality, and "late bloomers" were not more likely to endorse notions of choice than were women who had begun experiencing their same-sex attractions at an early age. Furthermore, women who described the sudden onset of their same-sex attractions within a particular relationship (such as the woman describing the "on-on switch") were just as likely to believe that they were "born" with their sexuality as women who described earlier and more gradual development of same-sex attractions (overall, two thirds of women felt they were born with their sexuality). Hence, they did not interpret particular friends or lovers as "converting" them but, rather, as allowing a preexisting potential to develop into an actual reality.

Continued Change

Notably, over the 10 years of my study, a number of women underwent additional abrupt transformations in their desires. By the T5 interview, 10% of the women who had originally identified as lesbian ended up settling down into long-term relationships with men. In fact, fully 60% of the 1995 lesbians had engaged in sexual contact with one or more men over the ensuing 10 years, and 36% had a romantic relationship with a man. Notably, such phenomena have long been observed and debated within lesbian-bisexual communities: The colloquial term "hasbian" refers to lesbians who have returned to periodic heterosexual behavior, and among college women this phenomenon is denoted with the acronym LUG, for "lesbian until graduation" (Davis, 1999; Kyrakanos, 1998; Rimer, 1993). Women's descriptions of their unexpected shifts to other-sex sexuality revealed the same type of abrupt, nonlinear transformation that I described earlier with respect to the onset of same-sex sexuality. Again, women typically felt they had no control over these changes, and some were actually disappointed by them:

> I've kind of straightened out! I still call myself bisexual but I'm on the edge of heterosexual, which I'm not pleased about. I mean, straight culture—yuck, bad! I never really wanted to be heterosexual but I don't have much choice in the matter. . . . I think sexuality changes, but I don't have any idea what causes those changes.

Do such cases suggest that the desultory notion of bisexuality or lesbianism as a "phase" is actually true, and that many bisexual/lesbian women "go back" to heterosexuality eventually? I would argue that this is a gross and simplistic misinterpretation. Notions of "phases" and of "going back" to men are inaccurate precisely because they suggest reversal—a return to a previous state—which is not consistent with respondents' reports. Rather, women who reinitiated other-sex behavior—and sometimes readopted heterosexual identities—typically described these experiences as feeling fundamentally different from the forms of heterosexuality they had pursued prior to ever questioning their sexuality. Hence, they did not perceive themselves as going back to men but, rather, as *moving forward* toward new forms of sexual and erotic experience. Among the 12 women who ended up reidentifying as heterosexual during the study (5 of whom returned to a lesbian, bisexual, or unlabeled identity by the 10-year point), only 3 claimed that they no longer experienced attractions for women, and yet even these women acknowledged that they could not completely rule out the possibility of attractions to women in the future. Thus, lifetime changes in same-sex *and* other-sex sexuality may follow abrupt, nonlinear trajectories, but they nonetheless have lasting effects on the way women experience and interpret their sexual identities and possibilities. In other words, once sexual transformations occur, there is no such thing as "going back."

This is consistent with the fact that "reparative" or "reorientation" therapies, which seek to change gay/lesbian/bisexual individuals into heterosexuals, have proven reliably unsuccessful in eliminating individuals' same-sex attractions (Drescher, 2002), although they appear somewhat more successful in helping individuals to enhance their emotional attachments to other-sex partners (Spitzer, 2003). Hence, it appears easier to "add" novel attractions and attachments to one's existing patterns than to eliminate them.

In summary, the fact that so many women appear capable of abrupt, discontinuous shifts in their sexuality—shifts that seem "out of proportion" to the events that prompted them (a kiss, a Women's Studies course, an episode of *Oprah*)—provides strong evidence that the development of female same-sex sexuality behaves as a dynamical system, capable of idiosyncratic, nonlinear changes at multiple points in time. Such changes have long been observed by sex researchers but have been traditionally treated as random and unexplainable, attributable to "error" or "fate" (Pillard, 1990, p. 89). This is not altogether surprising. Such discontinuities pose such notable challenges to traditional, organismic models of sexual development that perhaps the only solution is to relegate them to a wastebasket category of exceptions.

Yet clearly these cases are too numerous, and too consistently observed across different cohorts and populations, to be exceptions. By reconceptualizing female same-sex sexuality as a dynamical system in which nonlinear change is treated as normative and systematically explainable we can bring these "exceptions" back into the range of systematic inquiry and focus on charting and testing their specific mechanisms and parameters. Specifically, we can model abrupt transformations in sexuality as paradigmatic cases of self-organization and emergence, as I will now outline.

PHENOMENON #2: SELF-ORGANIZATION AND EMERGENCE

Self-organization refers to the spontaneous development of order within a complex system, arising out of repeated interactions

and reciprocal influences among both endogenous and exogenous elements. Within a dynamical system, self-organization is thought to create novel, emergent phenomena that could not necessarily have been predicted beforehand. Thus, with respect to sexuality, this means that under certain circumstances some women should be capable of developing authentically new, emergent forms of erotic thought and behavior at any stage of life (as in the cases described earlier), regardless of the pattern of thought and behavior that characterized their childhood and early adolescence.

Facultative Versus Constitutional Same-Sex Sexuality

One example of emergent same-sex desires concerns heterosexually identified women who come to experience—and act on—same-sex desires in specific, circumscribed contexts, such as incarceration (Gagnon & Simon, 1968; Garland, Morgan, & Beer, 2005; Hensley & Tewksbury, 2002; Hensley, Wright, Koscheski, Castle, & Tewksbury, 2002; Ward & Kassebaum, 1965). Historically, such behavior has been described as "facultative" or "situational" homosexuality, to distinguish it from "constitutional" homosexuality, which is presumed to be driven by an innate predisposition rather than by situational factors (Bell, Weinberg, & Hammersmith, 1981; Money, 1988). The distinction between constitutional and facultative homosexuality has been critiqued as overly rigid and simplistic, given that "social behaviors are based on a range of constitutional propensities interacting with a range of facultative opportunities" (Kirkpatrick, 2000, p. 390). Kirkpatrick's view, which concords nicely with a dynamical systems perspective, suggests that we should situate same-sex sexuality along a continuum representing the degree to which different individuals' desires and behaviors are respectively determined by a range of consitutional *and* situational factors.

This might also help to explain cases in which "facultative" same-sex sexuality persists and deepens even outside of the atypical environment that gave rise to it. For example, qualitative studies have found that, for some incarcerated women, positive experiences with same-sex sexuality prompt them to embark upon a broader questioning of their sexuality and to consider continuing their participation in same-sex sexuality even after release (Severance, 2004). Another example is provided by Dixon (1984), who studied a group of 50 married women who first pursed same-sex behavior in middle adulthood in the context of "swinging" relationships. Her respondents described their initial forays into same-sex activity as gradual and tentative, typically occurring with the encouragement of their husbands, and only 16% rated their first experiences as "excellent." Yet with time and experience they reported increasing enjoyment of same-sex contact: Two thirds rated their current same-sex experiences as "excellent," and they pursued such behavior frequently. The median number of female sex partners in the sample was 12 and ranged from 3 to over 200. All of the women described their current orientation as bisexual, despite the fact that none of them recalled any same-sex attractions or behaviors, or even same-sex crushes, in childhood or adolescence.

Relationship-Specific Desires

Another salient type of emergent same-sex sexuality concerns the phenomenon of "relationship-specific" desires, or cases in which the emotional intensity of a particular relationship is described as spilling over into novel same-sex desires, albeit restricted to the relationship in question (Blumstein & Schwartz, 1990; Cass, 1990; Cassingham & O'Neil, 1993; Diamond, 2000a, 2003c, 2006b). Even after decades of otherwise-satisfying heterosexual marriages, the process of developing an intense affectional bond with a close female friend often provides the impetus for women to question their sexual identity and orientation, and in fact this is one of the most frequently documented antecedents of abrupt, late-life transitions to same-sex sexuality (Cass, 1990; Cassingham & O'Neil, 1993; Diamond, 2000a, 2002; Kitzinger & Wilkinson, 1995; Penelope & Wolfe, 1989; Pillard, 1990; Shuster, 1987; Stanley & Wolfe, 1980). For example, over three fourths of the women interviewed by Kitzinger and Wilkinson (1995) reported that a sexual or emotional relationship with a particular woman sparked their transition to lesbianism. This occurs cross-culturally as well: Blackwood (1985) noted that strong affectional relationships between co-wives in some polygamous societies often transition to erotic contact over time.

From a dynamical systems perspective, these cases suggest that transformative interactions between the basic psychobiological systems underlying sexuality and affectional bonding may be responsible for such emergent desires. Supporting this view, numerous sexual-minority women have reported that their attractions for women are predominantly emotional or that their sexual desires are usually triggered or enhanced by feelings of emotional connection (Blumstein & Schwartz, 1990; Esterberg, 1994; Gramick, 1984; Hedblom, 1973; Nichols, 1987; Ponse, 1978; Savin-Williams, 1998; Vance & Green, 1984; Weinberg et al., 1994). Other women report that their desires are not so much directed toward women at all but, rather, to "the person and not their gender" (Blumstein & Schwartz, 1990; Cassingham & O'Neil, 1993; Diamond, 2002, 2006b; Golden, 1987). In reviewing his own program of research on the heritability of sexual orientation, Pillard (1990) noted that such cases were numerous enough to pose chronic methodological problems with respect to categorization: "Our raters found it more difficult to establish Kinsey ratings on the female subjects. Many of these women, though they were mature adults, were continuing to experience changes in their sexual lives. . . . [Their] sexual feelings seemed to depend more upon the partner they were with; in general, they seemed to have the ability for a 'situational response,' which the men lacked" (p. 92).

An elegant example is provided by a respondent I will call "Jennifer." When I first interviewed Jennifer, she considered herself primarily attracted to men, although she did not attach any particular label (such as heterosexual or bisexual) to her sexuality. She recounted that, during her sophomore year of college, she developed an intense emotional bond with a female friend. After about a year, her friend revealed that she had physical feelings for Jennifer. Jennifer had never before experienced same-sex attractions and had never even considered the possibility of being anything "other than heterosexual." Yet, once her friend made the overture, Jennifer realized that she was interested, and they embarked on a physically and emotionally intimate relationship that lasted for nearly a year. Jennifer found the relationship extremely emotionally and sexually satisfying—more satisfying than the sexual relationships she had had with men—although it was clear to her that most of her other sexual attractions were directed toward men. After the relationship ended, she continued to experience periodic attractions to women, which were almost always emotionally based. In her words, "what I find attractive about women is almost an outgrowth of an emotional attachment to them. You know, a good friend that I sort of will get this overwhelming feeling of being attracted to the way they're giving, or loving."

As the years went by, Jennifer revealed in subsequent interviews that, although she was periodically drawn to women, she felt that her emotional and physical attractions were predominantly male centered, largely because all of her sexual and emotional relationships were now with men, and she tended to be sexually oriented exclusively to whoever she was currently involved with. As she explained in her fourth follow-up interview,

> Being with a woman is not completely out of the question, but probably unlikely. Um, I don't think my core attractions changed, but circumstances change: I've been in only heterosexual relationships for 8 years or so, and I've been with my current partner for a while. When I'm involved with someone, my attractions to them are always more intense than any attractions to anybody else, male or female.

By the 10-year point, she was 33 years old and married. The same-sex attractions that had initially blossomed in the context of her same-sex affair 13 years earlier continued to be an important part of her sexual make-up, but, in her words, "it's an element of relationships with good female friends that, you know, is kind of in the background." She felt that she was pretty much heterosexual and identified as such.

Interpreting and Explaining Emergent Desires

Despite the fact that such cases of relationship-specific and emotionally-triggered desires have cropped up consistently across historical, anthropological, and psychological research, both scientists and laypeople have tended to doubt their authenticity. After all, traditional, organismic models of sexual development dictate that there is no such thing as having "just some" sexual desires for "just one" emotionally significant friend (Blumstein & Schwartz, 1990). Even if one argues that women with relationship-specific attractions are "really" bisexual, one would still expect them to experience same-sex desires for more than one person, since sexual orientations (whether heterosexual, bisexual, or lesbian/gay) are supposed to represent generalized sexual predispositions. Hence, it is tacitly assumed that, given enough time and self-reflection, such individuals will eventually conclude that they have been attracted to women "all along."

Yet findings from my research suggest otherwise. Over 10 years of observation, none of the 11 women who reported emergent, person-specific attractions in 1995 have since retracted these initial accounts. They continue to perceive the initial onset of their same-sex sexuality as relationship specific, although they have shown remarkably diverse patterns of desire and behavior since that initial relationship. Two ended up settling down with female partners and identifying as lesbian by 2005, 2 had settled down with men and identified as heterosexual. Another 2 considered themselves bisexual, and 5 attached no label to their sexuality whatsoever. Of these bisexual and unlabeled women, 4 were monogamously committed to men in 2005, and 3 to women. Overall, only 1 of these women claimed that she no longer experiences same-sex attractions. The rest—even those currently involved with men—reported that, although their same-sex attractions began within a single relationship, such attractions developed into an enduring (if only sporadically activated) feature of their sexuality.

Furthermore, the very same phenomenon of person-specific attractions sometimes emerges among lesbians, motivating their abrupt and unexpected initiation of sexual and romantic relationships with men. As one lesbian reported:

> I'm currently seeing a man that I met in my graduate program. I was pretty surprised . . . I didn't think we'd end up dating, we'd talked about it a bit when we were becoming really emotionally close. . . . and then we ended up together. I guess I'm still more inclined to date women, he's really the only man I really have any attractions for. . . . But I can't say I'm a lesbian dating a man. People just don't accept that, even though that's sort of what I feel like. . . . My feelings about women haven't really changed, it's just that I'm more open and accepting about my feelings for men, or at least to *this* man.

At that time, this respondent was uncertain whether this relationship would continue, but by the 10-year point, they had gotten married, and she continued to think of him as the "exception" to her otherwise robust attractions for women.

From a dynamical systems perspective, these can be interpreted as examples of self-organization, in which initially slight variations in one relevant psychological parameter—in this case, the depth of a developing emotional attachment—even-

tually bring about abrupt and massive reorganizations within a related system (sexual desire). Hence, reports of emotional attachment giving rise to novel sexual desires may not, in fact, represent denial of previous attractions or temporary confusion but, instead, paradigmatic cases of emergence, in which dynamic, ongoing interactions among the biosocial processes underlying sexual desire and emotional attachment potentiate the coming into being of altogether novel forms of thought, affect, and behavior (Fogel & Thelen, 1987; Lewis, 2000).

There is actually a biological basis for such dynamic, generative processes. Although the biobehavioral systems underlying the formation of emotional attachments are distinct from the biobehavioral systems underlying sexual desire (Aron et al., 2005; Fisher, Aron, Mashek, Li, & Brown, 2002), there are also cultural, psychological, and neurobiological interconnections between them (reviewed in Diamond, 2003c). For example, several of the neurochemicals known to mediate attachment formation—most notably oxytocin, vasopressin, and dopamine—also mediate sexual behavior, and these neurochemicals often show hormone-dependent, gender-specific patterns of functioning (Carter, 1992; Carter & Keverne, 2002). Hence, the development of novel sexual desires in the context of emotional bonds might be interpreted to indicate that, under certain circumstances, neurobiologically mediated links between love and desire reorganize to produce emergent, relationship-specific desires.

Of course, however, many women participate in intense, affectionate same-sex bonds without ever developing same-sex attractions. What accounts for the difference? Similarly, in cases in which two best friends end up sexualizing their relationship, why is it that one partner might continue to pursue same-sex relationships throughout her life whereas the other might return to exclusively heterosexual attractions and relationships? It may seem easy enough to postulate that only the former woman was "biologically" lesbian/bisexual all along, but in actuality we have no evidence to this effect. Researchers have not even attempted to differentiate the multiple potential factors that might lead two women with similar histories of same-sex emotional intimacy to follow sharply divergent pathways subsequent to those early experiences. As Bancroft (1990) noted, "You might say that the only thing that distinguishes between the adolescent and adult experiences of lesbian and heterosexual women is that the former group tend to sexualize their most intimate same-sex bonds, and the latter do not. Why this is so remains an open empirical question" (p. 104). Along the same lines, Brown (1995) suggested that perhaps instead of wondering why some women become lesbians, we should instead turn the question around and ask why heterosexual women with prior histories of intense affectionate same-sex bonds never eroticize them.

All of these questions speak to the notions of equifinality and multifinality—the notion that similar experiences (for example, adolescent same-sex emotional intimacy) can branch onto notably different pathways and outcomes (heterosexuality on one hand, lesbianism/bisexuality on the other), just as divergent experiences can eventually converge on the same pathway and outcome (i.e., some lesbians report long histories of intense same-sex attractions, whereas others report no such memories). From the standpoint of traditional approaches to sexual orientation, both equifinality and multifinality are perplexing problems, as the longstanding goal has been to identify a stable set of predictors of same-sex sexuality and to chart the "similar biographies and common personalities" (Gagnon, 1990, p. 198) that characterize lesbians and gay men and set them apart from heterosexuals. From the perspective of dynamical systems approaches, however, equifinality and multifinality not only are to be expected but also represent some the most important phenomena to study, as they help us to hone in on the specific positive- and negative-feedback processes responsible for shaping the regularization or attenuation of same-sex desire across different episodes of life and across different relationships and environments.

Clearly, much remains unknown about these processes. Yet a dynamical systems approach is ideally suited for framing the right questions and investigative approaches. Whereas cases of relationship-specific desires have been historically dismissed as arising from women's misrepresentations or misperceptions of their "true" sexual natures, a dynamical systems perspective provides us with a conceptual basis for recasting these cases as authentic and important examples of the capacity for dynamic person–context interactions to create altogether novel patterns of experience at any stage of the life course (Lewis, 2000).

PHENOMENON 3: RECURRING PHASE SHIFTS AND "DYNAMIC STABILITY"

As discussed earlier, dynamical systems theorists conceptualize phase shifts as episodes in which old patterns of thought and behavior break down and new forms self-organize in response to changes in a system's parameters beyond certain threshold levels. As described by Granic (2005), "Phase transitions are points of increased sensitivity, when small fluctuations or perturbations have the potential to disproportionately affect the interactions of multiple system elements. . . . After the period of flux, developmental systems restabilize and settle into new habits" (p. 401). Thus, phase shifts demonstrate the capacity for dynamical systems to oscillate between periods of stability and change depending on the circumstances. This is what Fogel and Thelen described as "dynamic stability" (Fogel & Thelen, 1987; Thelen & Smith, 1998).

In the case of female same-sex sexuality, a paradigmatic example of a phase shift is identity change, specifically identity change that occurs after a woman's initial "coming out" as lesbian or bisexual. Conventional models of sexual identity development cannot accommodate such changes: They posit a clear-cut beginning, middle, and end to the identity-adoption process (Sophie, 1986), with each step building linearly from

what preceded it. Once an individual reaches the final stage of accepting, integrating, and definitively adopting a lesbian or bisexual identity, no subsequent changes are presumed to occur.

However, research increasingly indicates that this is not always the case. Rust's (1993) survey of attractions and identification among nearly 400 lesbian and bisexual women found that 75% of the bisexual respondents reported having once identified as lesbian and that over 40% of the lesbian respondents reported having once identified as bisexual. Longitudinal studies provide additional, more rigorous evidence for identity change. Rosario and colleagues (Rosario, Schrimshaw, Hunter, & Braun, 2006) tracked changes in sexual identity over a 1-year period among an ethnically diverse sample of over 150 gay/lesbian/bisexual youths (aged 14–21) in an urban setting. They found that, over a 1-year period, 28% changed identity labels. Among those who changed, over 60% transitioned from a bisexual label to a gay/lesbian label, 19% transitioned from a gay/lesbian label to a bisexual label, and 19% transitioned from a gay/lesbian/bisexual label to a heterosexual label.

Phase Shifts Over a 10-Year Period

The present prospective study has the advantage of tracking such identity transitions over a full 10 years, thereby revealing whether such transitions simply reflect residual identity confusion during the first few years after coming out or whether they indicate longer-term processes of continual identity questioning and realignment. The results clearly support the latter possibility. Between the T1 and T2 interviews, one third of women changed identity labels; of these women, 13% switched from lesbian to bisexual labels, 13% switched from bisexual to lesbian, 37% switched from "unlabeled" identities to lesbian or bisexual, and 37% switched from lesbian or bisexual to either unlabeled or heterosexual identities. Yet, importantly, women continued to undertake additional identity changes throughout the 10 years of observation. One fourth of respondents changed their identities between T2 and T3, 31% between T3 and T4, and 28% between T4 and T5. Notably, these percentages have not significantly declined (as one might expect if women's identities were progressively stabilizing). By the 10-year point, fully two thirds of women had changed their identity label at least once since the T1 interview, and one fourth of women had done so more than once.

These findings challenge the notion that identity development typically progresses in an orderly, linear fashion toward stable gay/lesbian/bisexual identification, and in fact suggests that the opposite is true—consistent lesbian or bisexual identification over the entire 10 years of the study turned out to be the *least common* identity trajectory. Hence, models that presume stability to be the normative state of a mature sexual identity may be inaccurate.

In contrast, identity change is fully interpretable from a dynamical systems approach, which would view such phase transitions as inevitable adjustments to variability in the parameters defining the system. Hence, as women experience fluctuations in various parameters beyond certain threshold levels (e.g., notable increases or decreases in sexual or affectional feelings, initiation of a new romantic relationship or termination of an existing one, change in social networks), identity changes serve to bring women's self-concepts back into alignment with these new circumstances. For example, lesbians who gave up their lesbian labels in any given 2-year period reported that, on average, 30% of their sexual partners were men during that period. In contrast, lesbians who maintained their labels reported that only 7% of their sexual partners were men. This is consistent with the findings of Rust (1992), who found that although lesbian women perceived periodic other-sex attractions to be consistent with a lesbian label, they viewed other-sex *behavior* as more of a "boundary violation" that required giving up one's lesbian identity. Over the 10 years of my study, half of the 1995 lesbians who had any sort of sexual or romantic relationships with men ended up changing their identity label.

Changes in attractions beyond a certain threshold were also clearly perceived as boundary violations triggering identity change. Previous studies have suggested that sexual-minority women follow an implicit 75% boundary when identifying as lesbian versus bisexual. Specifically, those who are more than 75% attracted to women tend to identify as lesbian, whereas those who are less than 75% attracted to women tend to identify as bisexual (Rust, 1992). Sure enough, lesbians in the present study whose self-reported attractions fluctuated below this threshold tended to reidentify as bisexual, whereas bisexuals whose attractions fluctuated above this threshold tended to reidentify as lesbian. Considering all of the cases in which women's attractions crossed this implicit boundary between successive interviews, these "boundary crossings" were accompanied by identity transitions 60% of the time. In contrast, when women's attractions did not cross this implicit boundary, they were observed to change their identity label only 23% of the time.

Becoming Unlabeled

The specific nature of women's identity changes also indicates the salience—to women themselves—of dynamic variability in their sexuality. Surprisingly, the most common transition women undertook, observed 36% of the time, involved relinquishing a lesbian or bisexual identity for an "unlabeled" identity. In fact, by 2005, two thirds of women in the sample had considered themselves unlabeled for at least some period of time. Needless to say, this phenomenon poses a stark challenge to conventional linear models of identity development that posit uniform movement away from variability and ambiguity and toward stable and fixed identity categories. According to traditional identity models, the adoption of an unlabeled identity can only be interpreted as maladaptive, suggesting a generalized uncer-

tainty about one's "true" sexual orientation or an unwillingness to accept one's sexual-minority status.

From a dynamical systems perspective, however, the adoption of an unlabeled identity reflects the aforementioned notion of dynamic stability, in which a system coalesces around a temporarily stable and regular pattern yet nonetheless remains susceptible to additional transformations in response to parameter changes. This view is directly reflected in women's self-reports. They typically described adopting "unlabeled" identities to represent the fact that they could not predict the types of relationships they might desire and pursue in the future with women or men. An "unlabeled" status permitted them to acknowledge their sexual-minority status without rigidly fixing their future trajectories:

> I've been in a committed relationship for almost seven years, and I've never thought about anyone else. But I think I'm more comfortable now with the idea that I *could* be attracted to a man, and that's OK. . . . it's OK for it to be a little bit fluid.

> I think these days I'm much more comfortable just allowing myself to feel whatever I feel. Growing up, there was society around me telling me to date boys, or whatever, and then I came out as a lesbian and there was an equal pressure to date women. Now I am mainly going through life and seeing who I meet, and I'm much less panicked about the whole thing.

> Every time I feel comfortable with a label, something happens that makes me think that that's not an appropriate label. . . . I guess I went through a period where I thought I should probably label myself as lesbian and live according with that. Then I fell radically in love with a man. . . . I think labeling my sexuality is dangerous and I should just experience it.

> Among the people that I meet, I end up being attracted to women, but I could imagine some day some guy delivers my pizza and he's like the perfect person for me—I wouldn't send him away.

Notably, whereas traditional linear models of identity development would view such reluctance to adopt a fixed identity label as maladaptive, a dynamical systems approach would view such choices as laying the groundwork for positive growth. As Lewis (2000) argued, the transformation from one ordered pattern of behavior to another "necessarily spans a phase of relative disorder" (p. 40), and hence the temporary breakdown of order represented by "unlabeling" actually provides critical opportunities for altogether new and more adaptive patterns to emerge (Granic, 2005; Hayes & Strauss, 1998). From this perspective, identity change and relinquishment represent not regression or repression but a mature reconfiguration of sexual self-concept undertaken in response to inevitably changing individual and contextual parameters.

Reconciling Stability and Change

Importantly, this should not be taken to mean that, over time, women will tend toward endlessly increasing (and increasingly idiosyncratic) variability and ambiguity in their sexual experiences and self-concepts. Rather, one particularly important contribution of the dynamical systems approach is its capacity to reconcile both stability and change. Specifically, the diverse constellation of changing contexts faced by a particular individual is expected to produce local variability in his/her own specific developmental trajectory within short stretches of time, despite long-term "self-correction" toward behavioral regularity (Fogel, 1993). This is due to a variety of constraining influences, ranging from genetic factors to cultural norms to straightforward habits, which tend to channel individuals toward certain regular—but nonetheless flexible—pathways over the long term.

This is why the existence of fluidity in female sexuality does not mean that women's sexuality is altogether random and unpredictable. Consider, for example, the fact that although the majority of participants undertook identity changes over the 10 years of the study, their self-reported attractions proved much more stable (Diamond, 2000b, 2003b). Over the course of the study, approximately half of women reported changes of 15 percentage points or more (equivalent to about 1 point on the widely used 0–6 Kinsey scale) in their self-reported percentage of day-to-day attractions to women versus men, between any two successive assessments. Only a fourth of women reported changes of 30 percentage points, corresponding to 2 points on the Kinsey scale.

These findings are consistent with previous studies following changes in attractions over (smaller stretches of) time. For example, Weinberg, Williams, and Pryor (1994) collected 5-year follow-up data on a small sample of adult women ($n=27$) and men ($n=28$) recruited through a San Francisco bisexual organization in the early 1980s. They found that approximately two thirds of their respondents reported changes in their Kinsey ratings over the 5-year assessment period, yet only 19% of respondents reported changes of 2 points or more. Pattatucci and Hamer (1995) collected 18-month follow-up data from 175 lesbian, bisexual, and heterosexual women recruited from lesbian/gay/bisexual organizations. The authors averaged respondents' ratings of sexual attraction, fantasy, behavior, and self-identification at each assessment, thereby precluding isolation of changes in attraction only. Yet, again, the findings demonstrated that most changes are small in magnitude. Roughly 20% of women had different averaged Kinsey ratings at the baseline assessment than at the 18-month follow-up, and most of these changes were of 1 Kinsey point in magnitude. Hence, women tend to show long-term regularity in terms of their general placement on a hypothetical continuum ranging from exclusive heterosexuality to exclusive lesbianism, but nonetheless demonstrate considerable oscillation around these positions with regard to their interpretation and outward representation of these positions. Thus, in contrast to traditional, essentialist perspectives on same-sex sexuality, which can only attribute such oscillations to self-doubt, repression, or "measurement noise," a dynamical systems perspective contends that transi-

tions between stability and oscillation have an underlying order that can be systematically modeled. Below I suggest some possibilities for constructing and testing such models.

IMPLICATIONS AND FUTURE DIRECTIONS

As I indicated earlier, I am not suggesting that dynamical systems theory provides a tidy, complete answer to all of our unanswered questions about female same-sex sexuality. Rather, I am advocating dynamical systems as an investigative approach to this phenomenon that begins with fundamentally different—and, I would argue, more appropriate—premises about the nature, prevalence, and meaning of within-person variability than do traditional models of sexuality and sexual orientation. Yet, what would the application of a dynamical systems approach entail on a practical level? How would it alter our concepts, methods, and analyses, and how could such a model be empirically tested?

Conceptual and Methodological Shifts

One notable shift would concern the long-running debate about whether sexual orientation is a fixed, biologically-based predisposition or something that is amenable to sociocultural or interpersonal influence (reviewed in Mustanski et al., 2002). A dynamical systems approach would hopefully direct attention away from attempts to "split" sexuality into its biological and social-environmental determinants and toward a broader range of questions about the integration of these domains. For example, Thelen (2005) argued that instead of asking whether particular behaviors are hardwired versus learned, we should focus instead on understanding each behavior's distinctive patterns of short-term and long-term stability and change, investigating "which parts of the person or the environment engender the loss of old patterns and the discovery and maintenance of new ones" (p. 265). Additionally, a dynamical systems approach highlights the fact that, although various biological traits and predispositions may set the stage for certain trajectories of sexual development, such predisposing factors can only be understood to produce complex behaviors through a long cascade of dynamic interactions with a changing array of contextual factors.

Of course, such a conclusion is not in itself novel. An emphasis on interactions between biological and contextual-environmental factors, in lieu of biological determinism, is now arguably the dominant theoretical perspective within developmental psychology as a whole (Partridge, 2005). Yet specifying the precise forms and mechanisms of such person–context interactions is a difficult project. One of the unique contributions of a dynamical systems approach to such endeavors is its emphasis on *transition points* as primary sites of analysis. By investigating how diverse person–context interactions generate abrupt transformations in experience and behavior at different stages of life, we can better discern their underlying dynamics more generally.

Yet this requires different types of data than we typically collect about same-sex sexuality. In particular, it requires a greater emphasis on within-person variability in same-sex and other-sex sexuality over time, as opposed to the traditional emphasis on identifying between-person factors that differentiate heterosexual from gay/lesbian/bisexual individuals. Although the latter approach has yielded important insights about the sexual-minority life course, it has allowed us to overlook the dynamic nature of sexuality over time that I have documented. It has also contributed to the gradual bifurcation of research on sexuality, given that research findings and theoretical models focusing on sexual minorities are rarely applied to heterosexuals, and those focusing on heterosexuals are rarely applied to sexual minorities (Diamond, 2003a). In light of increasing evidence that many heterosexually identified individuals experience meaningful same-sex attractions and relationships at some point in their lives, just as many gay/lesbian/bisexual-identified individuals experience meaningful other-sex attractions and experiences (Diamond, 2005; Laumann et al., 1994; Rust, 1992), researchers should strive to develop models of these diverse experiences that apply across the board. Over 15 years ago, Gagnon (1990) pointedly noted, "One might ask if there is nothing interesting to be said about the origins, acquisition, maintenance, transformation, and disappearance of *heterosexuality* in person's lives" (p. 203, emphasis added), and Money (1990) similarly argued that any successful account of variability in same-sex sexuality should also explain parallel variability in heterosexuality. Thus, a thoroughgoing dynamical systems account of within-person variability in sexuality should explain stability and change in both same-sex and other-sex sexuality over an individual's life course.

Another critical component of a dynamical systems approach is longitudinal observation over both short and long stretches of time. As Fogel (2006) noted, the hallmark of a dynamical systems approach is the study of change as it takes place, rather than simply comparing specific outcomes before and after a presumed shift. Hence, in-depth longitudinal observation plays a fundamental and irreplaceable role. As the data presented here attest, prospective observation has greatly challenged our preconceptions about women's diverse developmental trajectories, and it has the potential to do the same for our understanding of men. Currently, although several short-term follow-up studies of sexual-minority men have been conducted (Rosario et al., 2006; Stokes, Damon, & McKirnan, 1997), along with one 5-year follow-up of male bisexuals (Weinberg et al., 1994), there have been no long-term longitudinal investigations of male sexuality. Such investigation might reveal men's trajectories to be far more nonlinear and fluid than is commonly assumed. Similarly, long-term longitudinal observation of sexual development among heterosexual youths might similarly challenge our assumptions about the normative course of sexual matura-

tion. Whether researchers focus on women or men, same-sex sexuality or other-sex sexuality, or a range of other sexual phenomena, longitudinal observation over both short stretches of time (for example, intensive, closely-spaced observations during transition points themselves) and long stretches of time (for example, more widely spaced observations that cut across several successive transitions) is critical for modeling the underlying dynamics of stability and change over time.

Analytical Shifts

Once such data is available, what do we do with it? As I noted, a number of dynamical systems theorists have developed sophisticated mathematical models of nonlinear change and development (Boker & Nesselroade, 2002; Butner et al., 2005; Erlhagen & Schöner, 2002; Schutte & Spencer, 2002; van Geert & Steenbeek, 2005). Such models may, in the future, be fruitfully applied to sexual-developmental phenomena, once sufficient longitudinal data is available. Yet a dynamical systems approach need not always entail this degree of mathematical complexity. We can begin to test dynamical systems models of same-sex sexuality using more conventional statistical methods, once we appropriately reframe the variables of interest. Below I suggest some analytical possibilities based on the dynamical systems concepts of *control parameters* and *attractors*.

Control Parameters

A control parameter is any systemic factor capable of producing change in the system of interest. In the case of sexuality, likely control parameters include biological predispositions, early sexual experiences, sex drive, cultural norms, opportunities for same-sex versus other-sex contact, and so on. According to dynamical systems theory, when a certain control parameter varies too far outside of its typical range, it can trigger abrupt reorganization within the system, generating novel and abrupt behavioral and psychological transitions. Of course, some parameters may prove more influential than others or may have lower thresholds for triggering change.

Thus, one way to model the abrupt emergence of new forms of sexual experience and expression is to investigate the relative influence and variability of different control parameters, as well as their interactions with one another. Consider, for example, the phase transitions in sexual identification I discussed. Because such transitions often accompany abrupt changes in women's emotional and sexual relationships, we can plausibly posit both same-sex relationship involvement and other-sex relationship involvement as control parameters for sexual identification. Another relevant parameter, obviously, would be a woman's overall degree of same-sex attraction.

The task, then, is to examine how changes in different parameters interact with one another to produce different identity transitions. For example, we might expect that, for women who have similar degrees of sexual attraction to men and women, involvement in any one particular relationship might not "nudge" her into an identity transition. But for a woman whose attractions lean strongly in one direction or another, a single relationship with "the wrong gender" can be interpreted as falling outside the expectable range for this parameter and might consequently trigger the emergence of new desires and behaviors and perhaps a reorganization in sexual identity. In other words, the control parameters of other-sex involvement and those of same-sex involvement would be expected to have different thresholds for triggering reorganization, depending upon a woman's initial status with respect to other relevant parameters. Worthwhile directions for future empirical research, then, would be (a) charting the most influential control parameters for same-sex and other-sex sexuality and (b) testing specific hypotheses about the conditions under which experiences falling within certain ranges of variability for these parameters precipitate stability or change.

Attractors

A related concept that may prove useful for modeling both variability and stability in same-sex sexuality is that of attractors. Attractors represent coordinated patterns of thought and behavior that tend to "pull" subsequent thoughts and behaviors toward them, producing consistency and regularity in experience over time. As described by Nowak, Vallacher, and Zochowski (2005), a system that is governed by an attractor "will consistently evolve to a particular state. . . . and it will return to the state even when perturbed by outside influences" (p. 355).

Attractors develop as a result of the actions of one or more control parameters. To clarify this process, Thelen (2005) suggested the metaphor of rivulets of water gradually carving out a ditch through a flower garden. With each rainfall, the ditch gets deeper, attracting more and more water through it. Dynamical systems theorists speak of "deep" attractors as having a strong attractive force, so that once a pattern of thought or behavior comes under its influence it is difficult to disrupt it. Thelen's ditch provides a straightforward example: If the ditch is shallow, then water running into it might easily run out again. Yet if the ditch is deep, then water channeled into it is unlikely to escape. Dynamical systems theorists also speak of the *basin of attraction*, or the range of values surrounding the attractor that are susceptible to its influence. Attractors with a broad basin have a broad range of influence. Consider again the metaphor of the ditch. If the ditch is fairly broad, it will end up attracting raindrops from all over the garden, pulling them into its channel. But if the ditch is very narrow, then it will only capture raindrops that fall immediately around it.

The notion of attractors provides a useful framework for developing and testing hypotheses about variation in same-sex sexuality. Specifically, we might imagine that any particular woman's sexuality involves two different attractors: one representing erotic interest in the other sex and one representing erotic interest in the same sex. For the average heterosexual

individual, the same-sex attractor will be so weak as to be potentially nonexistent and the other-sex attractor will consistently motivate her to seek out exclusively other-sex relationships. Yet, as noted above, attractors have different depths and basins. In the case of sexuality, we can imagine that these dimensions vary not only as a function of biological and cultural factors (for example, genetic predispositions for heterosexuality and cultural support for heterosexuality), but also an individual's own idiosyncratic history of other sex experiences (for example, having a long pattern of satisfying other-sex romances). Thus, we might hypothesize that some individuals are, in fact, generally heterosexual, but *weakly so*. In other words, perhaps their attractor for heterosexuality is relatively narrow and/or shallow.

This might have little effect on their behavior unless they develop a competing attractor for same-sex sexuality that is strong enough to pull them away from the heterosexual attractor. The likelihood of an individual's developing a competing same-sex attractor can be thought to depend upon biological factors (for example, a predisposition for nonexclusive attractions), cultural factors (exposure to the idea of same-sex sexuality, and particularly bisexuality), opportunity (the availability of any desirable same-sex partners), and the person's degree of fluidity (capacity to flexibly respond to same-sex ideas or opportunities once they are available).

Hence, a same-sex attractor might develop regardless of whether the individual ever actually pursues same-sex behavior and regardless of her underlying sexual predisposition. This provides a way of understanding the experiences of heterosexual women who pursue periodic same-sex contact, perhaps in the context of one intimate emotional bond, but "drop" that behavior once the bond dissolves (Diamond, 2006b). That single emotional bond can be thought to have triggered the initial formation of a same-sex attractor, albeit a shallow and narrow one. If the bond persists over time, or if the woman in question ends up pursuing similar relationships with other women, then the same-sex attractor can be expected to grow deeper and broader, making it progressively more likely that she will pursue such relationships in the future.

Although I have lumped together the notions of an attractor's depth and breadth in the foregoing example, it is important to remember that these are separate dimensions. This is particularly useful when it comes to generating and testing hypotheses about the conditions promoting stability and change in same-sex sexuality. Perhaps, for example, a generally heterosexual woman who finds herself experiencing periodic same-sex desires or fantasies can be thought of as possessing a "broad but shallow" same-sex attractor. In other words, her same-sex desires may be triggered by a wide range of experiences and stimuli but the attractions themselves are readily displaced by competing other-sex attractions and relationships. Alternatively, a heterosexually identified woman with a "one time only" same-sex love affair might be thought of as possessing a "narrow but deep" same-sex attractor. In other words, it takes an unusually intense, emotionally intimate bond with a specific woman to trigger her same-sex desires, yet once such desires are triggered, they might prove longstanding, robust, and resistant to change during the course of the affair.

Hence, if future research successfully charts the multiple control parameters influencing women's same-sex and other-sex sexuality, it can use this information to develop systematic models of interindividual variation in the depth and breadth of women's same-sex and other-sex attractors. This can yield probabilistic predictions about conditions promoting stability and change in different women's same-sex and other-sex sexuality. One advantage to modeling sexual variability in terms of attractor dynamics is that it provides a way to conceptualize and systematically account for (a) the coexisting biological, cultural, and situational influences on sexual experience and behavior; (b) the fact that the dynamics governing and motivating same-sex sexuality can vary independently of the dynamics governing and motivating other-sex sexuality and do not simply operate in inverse relation to one another; (c) the fact that these dynamics undergo progressive change over the life course, as a function of women's changing context and experiences; and (d) the fact that oscillations *between* attractors can take place suddenly and abruptly, with no prior warning, and can be triggered by a variety of factors across the entire life course.

The analytical possibilities sketched above are only starting points; dynamical systems theorists have advanced a range of provocative, generative models of stability and change in different psychological and behavioral phenomena that offer much promise for applications to same-sex sexuality. My aim in highlighting control parameters and attractors is show that the application of a dynamical systems approach to female same-sex sexuality does not mean abandoning the generation and testing of empirically based hypotheses. Rather, it entails conceptual, methodological, and analytical shifts toward lifespan-developmental models of stability and change that emphasize altogether different sets of "predictors" and "outcomes" than have characterized previous research on this topic.

CONCLUSION

It should come as no surprise that developmental psychologists were among the first to fully appreciate the potential applications of dynamical systems models to social, cognitive, emotional, and behavioral phenomena (Camras & Witherington, 2005; Fogel & Thelen, 1987; Granic, 2005; Lewis, 2000; Nowak et al., 2005; Smith & Thelen, 1993; Thelen et al., 1987; Thelen & Smith, 1994; Vallacher, Nowak, & Zochowski, 2005; van Geert & Steenbeek, 2005). Developmental psychology is, at heart, the study of change, and developmentalists quickly saw the promise of dynamical systems approaches for modeling both sudden and gradual changes over time in infants' and children's skills, abilities, traits, and experiences.

Inattention to change, then, might represent the key shortcoming of conventional perspectives on same-sex sexuality. Historically, change in attractions, behavior, and identity has been presumed to occur only during the initial process of sexual-identity development, and only in a linear, deterministic fashion. Once an individual achieves full awareness and expression of his/her same-sex sexuality, stability is presumed to be the natural state of the system. As I have shown, this is not the case. Although many sexual-minority individuals do follow relatively linear developmental pathways that lead to stable patterns of attraction, behavior, and identity, this trajectory is far from universal, particularly among women. "Exceptional" cases involving within-person variability in sexuality over the life course are not so exceptional after all. Accordingly, in order to develop models of female same-sex sexuality capable of representing all of its diverse manifestations, we must set aside the assumption of normative stability and instead place processes of change at the center of our analyses. This, at the most basic level, is what a dynamical systems approach entails. By moving away from an emphasis on parsing out biological and social-environmental contributions and toward an emphasis on dynamic person–context interactions involving a wide range of endogenous and exogenous factors, we stand a much better chance of developing systematic explanations for all forms of female same-sex sexuality that emerge over the life course.

Yet do we really need a dynamical systems approach to reach this goal? If biosocial, interactionist models are already winning the day (Partridge, 2005), might this be sufficient? It depends on what we want to explain. Certainly, models that provide integrative accounts of multifactorial influences on sexuality (such as Baumeister, 2000; Peplau et al., 1999) have already made important strides in documenting the existence of within-person variability in same-sex sexuality and highlighting some of the factors that give rise to it. Yet the critical next step is to understand the form and process of change and transformation itself. How exactly does a single relationship redirect a woman's "intimate career?" How do gradual, linear increases or decreases in certain parameters produce emergent experiences and nonlinear transformations? Because dynamical systems models seek to understand the multiple processes responsible for stability and transformation over time, they can enhance existing interactionist models by guiding our attention to change and stabilization processes in and of themselves. As noted above, the key to applying this approach is to set aside longstanding assumptions about progressive development and instead begin to systematically assess phenomena that might otherwise be dismissed as "noise" in our data: nonlinear development; abrupt phase transitions; and instances of emergence, self-organization, and reorganization. As Lewis argued, developmental change can be "indeterminate as well as principled, self-augmenting as well as unfolding, and creative as well as responsive" (Lewis, 2000). Models of sexual expression and development that take this into account will undoubtedly prove to be the most generative, meaningful, and scientifically accurate.

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