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How to Measure Sexual Orientation Range and Why It's Worth Measuring

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First proposed by Epstein, McKinney, Fox, and Garcia (2012), sexual orientation range (SOR) is an objective continuous measure of the flexibility people have in expressing their sexual orientation. In the present article, three formulas for computing SOR are compared using data obtained from a sample of 54,834 people in 57 countries. A number of statistical measures suggest that SOR is best measured simply as the smaller of two raw scores indicating opposite-sex and same-sex sexual inclinations. In other words, if one's strongest inclinations are same-sex, one's sexual orientation range is best indicated by the strength of one's opposite-sex inclinations, and vice versa. SOR, in combination with mean sexual orientation, another continuous variable, provides a reasonable and useful characterization of sexual orientation, which is and always has been a continuous rather than a categorical phenomenon. The SOR concept also puts the rancorous "choice" debate into an objective, non-inflammatory context.

KEYWORDS sexual flexibility, sexual orientation range, SOR, sexual choice, Epstein Sexual Orientation Inventory, sexual orientation continuum, sexual orientation, ESOI

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INTRODUCTION

Probably no aspect of sexual orientation has provoked more public debate and discussion than the "choice" issue (Epstein, 2006; Friedman, 1990; Haldeman, 1994; Hegarty, 2002). Do gays have a choice? This question mistakenly presupposes that homosexuality is a discrete category and, more generally, that sexual orientation is a dichotomous variable (cf. Rust, 2000). A more reasonable assumption, evident and obvious since the days of the landmark research conducted by Alfred Kinsey and his colleagues, is that homosexual and heterosexual tendencies exist in virtually everyone; what varies from one person to another is the mix (cf. Baumeister, 2000; Chivers, Seto, Lalumiere, Laan, & Grimbos, 2010; Ellis, Burke, & Ames, 1987; Epstein, McKinney, Fox, & Garcia, 2012; Kinsey, Pomeroy, & Martin, 1948; Klein, 1993; Klein, Sepekoff, & Wolf, 1985; Lippa, 2012; Mock & Eibach, 2012; Moore & Norris, 2005; Ross, Daneback, & Mansson, 2012; Sell, 1997; Vrangalova & Savin-Williams, 2010, 2012; Weinrich & Klein, 2002).

Although it can reasonably be argued that same-sex (SS) and opposite-sex (OS) sexual inclinations are somewhat independent of each other and should be measured separately (Sell, 1997), Kinsey and others have typically characterized sexual orientation (SO) as a unidimensional trait lying on a single continuum, the so-called Sexual Orientation Continuum (SOC). In an online study with 17,785 respondents from 48 countries, Epstein et al. (2012) showed how separate measures of SS and OS inclinations can be combined on a single continuum without any loss of information about the separate inclinations. They accomplished this by marking separate points on the SOC for SS and OS scores. They designated the midpoint between these points as an individual's mean sexual orientation (MSO), a rough indicator of where an individual's SO inclinations are "centered" on the SOC (Figure 1).

More important for purposes of the present discussion, they designated the interval between the SS and OS points as an individual's sexual orientation range (SOR)—a measure of the flexibility a person has in expressing his or her sexual inclinations (cf. Bem, 1974, 1975; Moore & Norris, 2005; Zinik, 1985). Consistent with the findings of Kinsey and his colleagues, Epstein

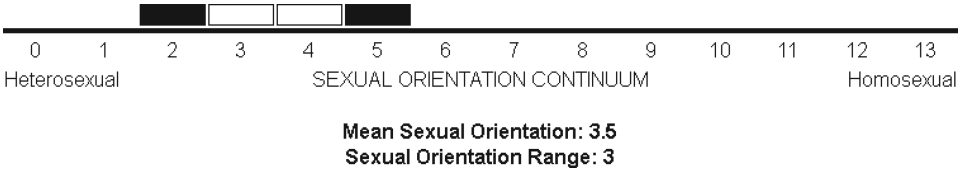

FIGURE 1 Epstein Sexual Orientation Inventory scores shown on a 14-point sexual orientation continuum.

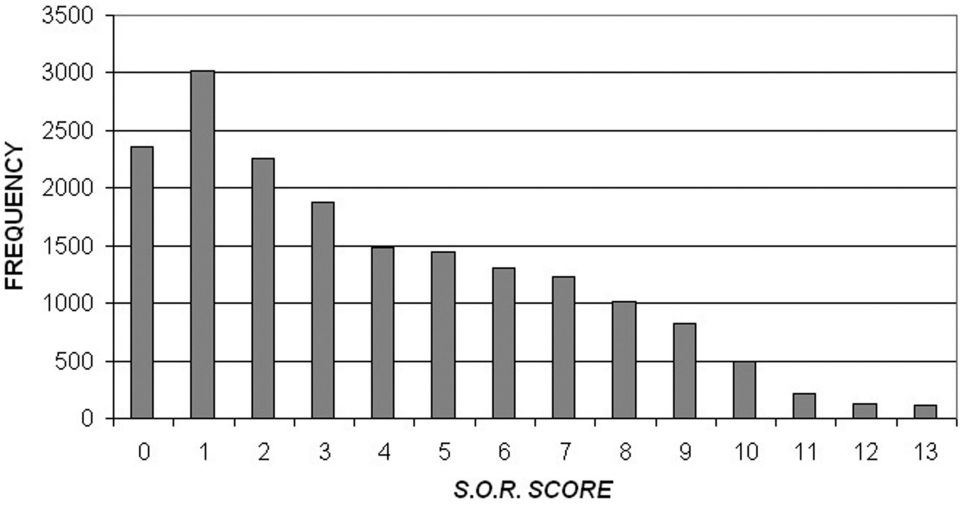

FIGURE 2 Frequency distribution of sexual orientation range (SOR) scores (N = 17,785). *Source*. Epstein, McKinney, Fox, and Garcia (2012).

et al. (2012) showed that MSO scores are distributed fairly smoothly across a continuum (the SOC). They also showed that the labels 'straight,' 'bisexual,' and 'gay' all correspond to broad, skewed, overlapping distributions of MSO scores—in other words, that these traditional labels are inaccurate for many people. They do not take into account the range of sexual inclinations many people experience over the course of their lives. More than 50% of the self-labeled gays and straights in the Epstein et al. (2012) study deviated from their label-implied inclinations by at least two points on a 14-point scale, and more than 33% deviated by at least three points.

Epstein et al. (2012) also showed that just as MSO scores vary among individuals, SOR scores also vary, with some people having little or no flexibility in how they express their sexual orientation and others having considerable flexibility (Figure 2). It goes without saying, for example, that people whose MSO scores are near either of the two extreme ends of the SOC have small sexual orientation ranges—little "choice," in other words, in how they can express their sexual orientation. Consistent with the findings of other researchers, Epstein et al. (2012) also found, among other things, that self-labeled females had, on average, a larger SOR than self-labeled males (cf. Baumeister, 2000; Chivers et al., 2010; Diamond, 2008a, 2008b; Lippa, 2012; Mock & Eibach, 2012; Peplau, 2001; Peplau & Garnets, 2000; Ross et al., 2012; Russell & Seif, 2001; Sell, 1997; Vrangalova & Savin-Williams, 2010, 2012; Weinrich & Klein, 2002) and that self-labeled bisexuals had a substantially larger SOR than that of self-labeled straights and gays (cf. Brooks & Quina, 2009; Klein, 1993; Klein et al., 1985; Lippa, 2013; Mock &

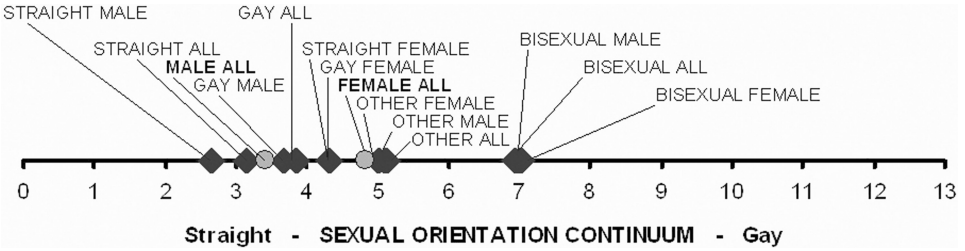

FIGURE 3 Mean sexual orientation range (SOR) scores shown by self-reported gender and sexual orientation. *Source*. Epstein, McKinney, Fox, and Garcia (2012).

Eibach, 2012; Rosario, Schrimshaw, Hunter, & Braun, 2006; Savin-Williams, Joyner, & Rieger, 2012; Sell, 1997; Weinrich & Klein, 2002) (Figure 3, Table 1).

They concluded that the three traditional SO labels were misleading for many people and that SO was best characterized by two relatively simple and objective continuous measures: MSO and SOR. They also suggested that the concept of SOR had the potential to put the "choice" debate onto fairly objective, scientific, and noninflammatory grounds.

MSO and SOR data reported by Epstein et al. (2012) had been collected by the first author at websites such as http://MySexualOrientation.com since he developed the Epstein Sexual Orientation Inventory (ESOI) in 2006. In the context of analyzing data from a much larger validation study which was presented at the 2013 meeting of the Society for the Scientific Study of Sexuality (Epstein & Robertson, 2013a, 2013b), the authors of this article discovered that the formula that had long been used to compute SOR yielded

TABLE 1 Formula Comparisons ($N = 54{,}834$)

		Means				
Distinguishing gender differences						
Formula	Kruskal-Wallis *H*	Male	Female	Other		
SOR_1	1,079.7***	4.3	5.2	5.4		
SOR_2	1,322.9***	4.6	5.6	5.4		
SOR_3	1,466.0***	5.3	6.5	6.6		
Distinguishing sexual orientation differences						
Formula	Kruskal-Wallis *H*	Straight	Bisexual	Gay	Other	Unsure
SOR_1	7,848.5***	3.9	6.9	3.7	5.3	5.0
SOR_2	11,382.9***	4.0	7.5	4.1	5.5	5.7
SOR_3	15,482.1***	5.2	8.8	4.6	6.8	7.0
Distinguishing sexual orientation change						
Formula	Mann-Whitney *U*	Changed	Never changed	Difference		
SOR_1	$2.38 \times 10^{8***}$	5.8	4.2	1.6		
SOR_2	$2.03 \times 10^{8***}$	6.4	4.3	1.9		
SOR_3	$1.82 \times 10^{8***}$	7.6	4.9	2.7		

***signifies a significance level < .001.

All Possible SOR Values – Original 2006 Formula (SOR_1)

SS Raw \ OS Raw	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	12	11	10	9	8	7	6	5	4	3	2	1	0	1
2	11	10	9	8	7	6	5	4	3	2	1	0	1	2
3	10	9	8	7	6	5	4	3	2	1	0	1	2	3
4	9	8	7	6	5	4	3	2	1	0	1	2	3	4
5	8	7	6	5	4	3	2	1	0	1	2	3	4	5
6	7	6	5	4	3	2	1	0	1	2	3	4	5	6
7	6	5	4	3	2	1	0	1	2	3	4	5	6	7
8	5	4	3	2	1	0	1	2	3	4	5	6	7	8
9	4	3	2	1	0	1	2	3	4	5	6	7	8	9
10	3	2	1	0	1	2	3	4	5	6	7	8	9	10
11	2	1	0	1	2	3	4	5	6	7	8	9	10	11
12	1	0	1	2	3	4	5	6	7	8	9	10	11	12
13	0	1	2	3	4	5	6	7	8	9	10	11	12	13

FIGURE 4 Matrix of possible sexual orientation range scores for the first formula: SOR_1. *Note.* OS = opposite sex; SS = same sex.

meaningless or misleading values for some test takers. In this article, we show how that formula was flawed, how a second formula proved to be superior to the first, and, finally, how a third method of reporting SOR—which, as you will see, we aptly call a "nonformula"—proved statistically to be far superior to the other two methods. The nonformula proved, in fact, to yield reasonable, meaningful values of SOR for all possible combination of SS and OS inclinations.

A Flawed Measure

The original formula used to compute SOR, which we will call SOR_1, was simple and basic—quite literally the distance between the points on the 14-point SOC that marked the positions of an individual's raw SS and OS scores:

$$SOR_1 = SSRawScore - (13 - OSRawScore)$$

Each raw score can vary from 0 to 13, where 0 means no inclination and 13 means the highest possible inclination. Given that the SOC is a composite scale, with high OS inclinations indicated at the left end of the scale and high SS inclinations indicated at the right end of the scale (Figure 1), the raw OS score is reverse scored—that is, subtracted from 13—before it is graphed. According to this formula, then, SOR is simply the difference between the raw SS score and the reversed OS score.

Figure 4 shows the SOR scores generated by SOR_1 given all possible combinations of values of raw SS and OS scores. The shaded area shows where scores were questionable—the darker the shading, the more misleading the score. As long as SOR_1 was greater than or equal to 0 (lower-right triangle), the scores were fairly meaningful—the larger the score, the better. Thus, a raw SS score of 9 and a raw OS score of 11 (suggesting a broad sexual orientation range) yielded an SOR of 7, and a raw SS score of 11 and a raw OS score of 12 (suggesting an even broader sexual orientation range) yielded an SOR of 10—a range covering almost the entire width of the SOC.

Unfortunately, the ESOI reported negative values of SOR_1—most often generated whenever SS and OS scores were low—as absolute values; so the larger the negative value, the more meaningless the score. Thus, a raw SS score of 2 and a raw OS score of 3 (suggesting low sexual interest) yielded an SOR of 10, and, absurdly, a raw SS score of 0 and a raw OS score of 0 (suggesting asexuality) yielded an SOR of 13.

Fortunately, test takers were not evenly distributed throughout the matrix of possible SOR scores. Only 2.6% of the respondents in the Epstein et al. (2012) study had SS and OS scores under 7 (upper-left quadrant of Figure 4) and only 1.3% of the respondents had SS and OS scores under 4, so the impact of the misleading scores on SOR statistics was relatively small; we know from the more recent analysis that more accurate SOR statistics differ only slightly from the published 2012 values. The more disturbing issue is that between 2006 and 2012 hundreds of ESOI test takers were presented with SOR scores that could not possibly have made sense to them. In retrospect, it is astonishing that over this long period not even one person wrote to complain about his or her odd SOR score.

A Better Measure

In December 2012, we replaced the faulty formula with one that produced meaningful scores for a larger proportion of test takers—in particular, for most individuals with low SS and OS raw scores. The new formula expressed SOR as the product of the larger raw score and the proportion of the scale occupied by the smaller raw score, rounded to the nearest whole number:

$$SOR_2 = \text{Round}\left((\text{SmallerRawScore} \,/\, 13) * \text{LargerRawScore}\right)$$

This measure yielded a much higher proportion of meaningful SOR scores but still produced some meaningless ones (see the shaded area in Figure 5). For example, a raw SS score of 5 and a raw OS score of 3 (suggesting a small to moderate range of sexual inclinations) yielded an SOR of 1 (suggesting virtually no sexual orientation range).

All Possible SOR Values – New 2012 Formula (SOR_2)

SS Raw \ OS Raw	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1	1	1	1	1	1	1
2	0	0	0	0	1	1	1	1	1	1	2	2	2	2
3	0	0	0	1	1	1	1	2	2	2	2	3	3	3
4	0	0	1	1	1	2	2	2	2	3	3	3	4	4
5	0	0	1	1	2	2	2	3	3	3	4	4	5	5
6	0	0	1	1	2	2	3	3	4	4	5	5	6	6
7	0	1	1	2	2	3	3	4	4	5	5	6	6	7
8	0	1	1	2	2	3	4	4	5	6	6	7	7	8
9	0	1	1	2	3	3	4	5	6	6	7	8	8	9
10	0	1	2	2	3	4	5	5	6	7	8	8	9	10
11	0	1	2	3	3	4	5	6	7	8	8	9	10	11
12	0	1	2	3	4	5	6	6	7	8	9	10	11	12
13	0	1	2	3	4	5	6	7	8	9	10	11	12	13

FIGURE 5 Matrix of possible SOR scores for the second formula: SOR_2. *Note.* OS = opposite sex; SS = same sex.

The Third and Best Measure: A Case for Simplicity

Finally, in December 2013, we replaced SOR_2 with what can hardly be called a formula at all—our "nonformula." The best measure, it turns out, of the range of an individual's sexual orientation is the lesser of his or her raw SS and OS scores:

$$SOR_3 = \text{Lesser value (SSRawScore, OSRawScore)}$$

All possible combinations of SS and OS scores produced by this measure are meaningful (Figure 6), and a number of statistical analyses suggest the measure's validity. The non-formula also makes good sense. If your strongest inclinations are same-sex, your range is indicated by the strength of your opposite-sex inclinations, and vice versa. If your SS and OS inclinations are equally strong (however strong or weak they may be), your range is indicated by the strength of either one.

Based on an analysis of data obtained from a new sample of 54,834 people in 57 countries, the superiority of SOR_3 is suggested by several statistical comparisons. (This new data set is analyzed more broadly by Epstein and Robertson, 2014; in this article, these data are utilized solely for the purpose of evaluating SOR formulas.) For example, SOR_3 appears to be the most sensitive of the three measures ($SD_{SOR1} = 3.2$, $SD_{SOR2} = 3.1$, $SD_{SOR3} = 3.4$). Of the three measures, SOR_3 is the most highly correlated with the level of uncertainty people report regarding their sexual orientation (Spearman's $\rho_{SOR1} = 0.26^{***}$, $\rho_{SOR2} = 0.36^{***}$, $\rho_{SOR3} = 0.43^{***}$) and with the level of

SS Raw \ OS Raw	All Possible SOR Values – The Non-Formula (SOR_3)													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
2	0	1	2	2	2	2	2	2	2	2	2	2	2	2
3	0	1	2	3	3	3	3	3	3	3	3	3	3	3
4	0	1	2	3	4	4	4	4	4	4	4	4	4	4
5	0	1	2	3	4	5	5	5	5	5	5	5	5	5
6	0	1	2	3	4	5	6	6	6	6	6	6	6	6
7	0	1	2	3	4	5	6	7	7	7	7	7	7	7
8	0	1	2	3	4	5	6	7	8	8	8	8	8	8
9	0	1	2	3	4	5	6	7	8	9	9	9	9	9
10	0	1	2	3	4	5	6	7	8	9	10	10	10	10
11	0	1	2	3	4	5	6	7	8	9	10	11	11	11
12	0	1	2	3	4	5	6	7	8	9	10	11	12	12
13	0	1	2	3	4	5	6	7	8	9	10	11	12	13

FIGURE 6 Matrix of possible sexual orientation range scores for the third formula: SOR_3. *Note.* OS = opposite sex; SS = same sex.

distress people report regarding their sexual orientation (Spearman's $\rho_{SOR1} = 0.06^{***}$, $\rho_{SOR2} = 0.15^{***}$, $\rho_{SOR3} = 0.20^{***}$).[1]

SOR_3 also does the best job of distinguishing SS raw scores from OS raw scores for self-labeled straights ($\rho_{SOR1\text{-}SS} = 0.73^{***}$ vs. $\rho_{SOR1\text{-}OS} = 0.16^{***}$, $\rho_{SOR2\text{-}SS} = 0.94^{***}$ vs. $\rho_{SOR2\text{-}OS} = 0.24^{***}$, $\rho_{SOR3\text{-}SS} = 0.98^{***}$ vs. $\rho_{SOR3\text{-}OS} = 0.07^{***}$) and self-labeled gays ($\rho_{SOR1\text{-}OS} = 0.80^{***}$ vs. $\rho_{SOR1\text{-}SS} = 0.27^{***}$, $\rho_{SOR2\text{-}OS} = 0.95^{***}$ vs. $\rho_{SOR2\text{-}SS} = 0.20^{***}$, $\rho_{SOR3\text{-}OS} = 0.99^{***}$ vs. $\rho_{SOR3\text{-}SS} = 0.01^{***}$). Finally, SOR_3 does the best job of distinguishing people who have changed their sexual orientation label from those who have not, as well as distinguishing people by both gender label and sexual orientation label (Table 1).

In short, SOR_3 is moderately or highly predictive of a number of variables in a pattern that suggests that it is a valid measure of the construct of sexual orientation range. In a society that is not only *homomisic* (from the Greek verb "to hate," an alternative to the misnomer "homophobic"—Epstein, 2003) but that is also particularly intolerant of self-labeled bisexuals (Alarie & Gaudet, 2013; Callis, 2013; Elia, 2014; Galupo, 2011; Klein, 1993; Lourea, 1985; Macalister, 2003; Moore & Norris, 2005; Nichols, 1988; Rapoport, 2009; Rust, 1993, 2000; See & Hunt, 2011; Weinberg, Williams, & Pryor, 1994; Zinik, 1985), it is reasonable to assume that the larger one's sexual orientation range, the more distress one might feel regarding one's sexual orientation, and it is self-evident that SOR should be positively correlated with the level of uncertainty one feels regarding one's SO. SOR_3 performs best in both respects.

SOR should also distinguish certain demographic groups in a way that is consistent with relevant research, and SOR_3 performs best here as well (Table 1). Most important, a measure of sexual orientation range should make intuitive sense given all possible combinations of SS and OS inclinations. Although our nonformula may seem simplistic, we believe it meets this last criterion well (Figure 6).

Why SOR Is Worth Measuring

Although misconceptions persist, evidence has long existed that shows that SO is fluid to some extent over time and that at any point in time people have some degree of flexibility in how they express their SO (Blumstein & Schwartz, 1977; Brooks & Quina, 2009; Diamond, 2008a, 2008b; Kinsey et al., 1948; Mock & Eibach, 2012; Peplau & Garnets, 2000; Rosario et al., 2006; Ross et al., 2012; Savin Williams et al., 2012). Fluidity and flexibility are rarely considered in the persistent and often rancorous debate about whether gays have a "choice"; when these phenomena are considered, it is typically in a negative context, the main issue often being whether self-labeled gays can truly be changed by so-called reparative therapy (e.g., Haldeman, 1994; Spitzer, 2003, 2012).

Meanwhile, the debate rages on, with two extreme viewpoints now mainstream in many cultures: The dominant view, propelled by verses from the Bible and the Koran, is that everyone is naturally straight and that homosexuality is a pathological aberration that should not be tolerated (Siker, 2007). The minority view, also prominent, is that homosexuality has a genetic basis—that some people are "born gay" and should therefore not be discriminated against (Halley, 1994; Hegarty, 2002; Weinrich, 1995). Where self-labeled bisexuals fit into this picture is unclear, but at one extreme people have suggested bisexuals are literally "in conflict," struggling to decide which of the two traditional categories fits them best (see Zinik, 1985).

We believe that the turmoil and confusion that have long surrounded sexual orientation in many cultures derive from a fundamentally faulty characterization of the concept. Sexual orientation is not and has never been a categorical phenomenon. SS and OS inclinations exist in virtually everyone at some point in their lives, although in different degrees and proportions in different individuals; in other words, sexual orientation is and always has been a continuous phenomenon.

The shift from categorical to continuous thinking has marked progress in many areas of science, which often begin the study of some phenomenon using categories from common language (e.g., Curtis, 1966; Hanson, 2000; Luce & Narens, 1987; Shriver et al., 2005). Evidence suggests that many organisms have evolved to impose categories on a continuous world, because categorization allows organisms to respond to varying stimuli more efficiently and effectively (Levitin, 2014; Rosch, 1978). With humans, the

development of language may have heightened this tendency, making categorization an irresistible phenomenon which, unfortunately, often clouds our thinking (Epstein, 1982, 1996; Levitin, 2014; Macalister, 2003).

SS and OS inclinations are continuous phenomena in at least three respects: they sometimes change gradually over time; they vary in degree among individuals; and, in combination, they produce a continuous range of different tendencies in individuals. We believe these tendencies can be measured objectively with two continuous variables: MSO and SOR. Our data suggest, moreover, that the categorical approach to characterizing sexual orientation does great harm. It casts debates about sexual orientation into unrealistic and simplistic terms which guarantee endless conflict. It also forces many people to wrestle with the discrepancy they see between their SO label, with all that it implies, and their actual sexual attractions, behaviors, and fantasies, many of which will inevitably be inconsistent with their label.

Can the general public—and, for that matter, the scientific community—be taught to abandon categorical thinking about sexual orientation in favor of the more objective and accurate continuous perspective? This remains to be seen.

NOTE

1. Because scores on the ESOI are based on yes/no and multiple-choice answers—in other words, numbers on ordinal scales—nonparametric statistics such as Spearman's rho, the Mann-Whitney U, and the Kruskal-Wallis H are used throughout this article instead of statistics such as the t test and Pearson's r, which are more suitable for use with numbers on ratio scales. Three asterisks denote statistical significance at the 0.001 level.

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