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A review of measurement methods for social preferences

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What motivates people when they make decisions, and how those motivations are potentially entangled with concern for others, are central topics for the social sciences. Narrow self interest is one postulate about people's preferences that serves to simplify and clarify theory, as well as facilitate model building. In this scheme, decision makers have the straightforward goal of maximizing personal payoffs, wholly indifferent to the consequences for others. The postulate of narrow self interest is foundational for rational choice theory and has found its most extensive application in economics, although it is also strongly influential in psychology and sociology. This assumption is exceptionally useful– it is both exact and powerful, but often it is simply wrong. Its inadequacy is well known and efforts have been made over the recent decades to develop reliable and valid measurement methods to quantify the more complex social preferences that real people have. We provide here an overview of the literature of existing measurement methods that have been used to asses individual variations in social preferences, and highlight these different measurement methods' strengths and weaknesses. We conclude with a comparative evaluation of the different measures and provide suggestions regarding their constructive use in building psychologically realistic theories of people's social preferences.

No man is an island, entire of itself; every man is a piece of the continent, a part of the main. If a clod be washed away by the sea, Europe is the less, as well as if a promontory were, as well as if a manor of thy friend's or of thine own were.

–John Donne
Devotions Upon Emergent Occasions
Meditation XVII

Introduction

To illustrate the notion of social preferences, consider the following choice (Table 1) between two options. In this example the decision maker (DM) is selecting between certain distributions of resources, some amount to herself, and some amount to be allocated to some other randomly determined person. The DM and the other person will remain mutually anonymous during and after the decision is made, and there is nothing the other person can do to affect the DM in any way. Hence this is not a strategic decision (i.e., not within the purview of game theory, as only one DM influences the payoffs for both people) but rather this is a one-shot individual decision under certainty, free of potential repercussions or reprisals. Nonetheless this choice has a social dimension, as the DM will have an effect on another person and the DM is aware of this potential effect. Choices in this austere context can reveal a great deal about a decision makers' social preferences. It is these preferences that affect behavior in situations of interdependence (Kelley & Thibaut, 1978), and choices like this can provide some insight into how much (if at all) a DM cares about her own payoff in conjunction with the payoff for another person.

The "rational" solution to this choice is trivial; a payoff-maximizing DM (Homo economicus) would select Option 2 as it results in a larger individual payoff. That, by choosing Option 2 over Option 1, an extra $15 is gained at a cost of $35 to another person is inconsequential from the normative vantage point – the only pertinent consideration is the DM's individual payoff, irrespective of the payoff to the other. In this instance, the normative account clearly diverges from actual behavior. We find that about 65% of incentivized DMs from a large representative sample, in an anonymous one-shot decision context, choose the prosocial option, a finding that is consistent with other empirical results (Van Lange, Otten, De Bruin, & Joireman, 1997; Au & Kwong, 2004; Bogaert, Boone, & Declerck, 2008; Balliet, Parks, & Joireman, 2009).

Table 1
A simple binary choice between two allocation options.

Option 1	Option 2
$85 to the DM	$100 to the DM
$85 to another person	$50 to another person

Clearly these choice results are incongruent with the postulate of narrow self interest. Social preferences however are often more complex than those assumed under this rubric. The individual difference of how much concern a person has for others has been of interest to a wide range of researchers in different fields. This construct has been studied in parallel under a variety of different names, including: social preferences,[1] other-regarding preferences, social motives, welfare trade-off ratios, altruism, collective interest, and social value orientation (SVO). The rich lexical variety for the same concept is on one hand heartening (as there is widespread interest in the idea of human non-selfishness) but disheartening as well (as different cliques of active researchers operate largely unbeknownst to each other, all the while sharing common intellectual interests). One

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[1] In this paper, we will use the term social preferences or SVO for the sake of consistency when referring to this important transdiciplanary construct.

of our intentions here is to bring together these related but independent lines of research by examining the different ways the elemental construct of social preferences has been measured. The persistent balkanization of research on this topic can in part be attributed to measuring the same thing in different ways; we hope to bridge existing divides by suggesting common measurement methods to establish commensurability. The structure of the paper is as follows. First we briefly discuss the historical developments that resulted in a well established theoretical framework for considering social preferences and subsequently describe this framework in detail. Then we offer a broad review of different literatures from across the social sciences, discussing different existent measurement methods of social preferences, roughly in chronological order. Strengths and weakness of each of the methods are discussed and the measures are evaluated according to a predefined set of criteria. We conclude with a brief discussion of how a reliable metric of social preferences can inform and support psychologically realistic and descriptively accurate theories of social decision making with an emphasis on the use of high resolution measures.

Theoretical Background and the Emergence of the SVO Concept

Early theoretical work on interdependent decision making either had primarily focused on characterizing situations of social encounters in terms of their potential to provoke cooperation or competition (e.g. Deutsch, 1949), or had focused on how peoples' attitudes and emotions shape the relationships they are involved in (e.g. Heider, 1958). It was a natural next step to analyze both the situation and intrapersonal processes when examining the behavior of interdependent decision makers, consistent with Lewin's (1936) suggestion to conceptualize behavior as a simultaneous function of both person and situation. With the emergence of game theory (see Von Neumann & Morgenstern, 1944; Luce & Raiffa, 1957), a formal way to describe situations of interdependent decision making, normative predictions of rational behavior in a given situation became possible. Nonetheless, this precision came at the cost of often unrealistically strong assumptions about people's preferences.

Strongly influenced by the concepts and approach of game theory, researchers have built theories of social interactions that take into account the incentive structures that characterize situations of interdependence while also - at least implicitly- assuming that people may vary in how they perceive and evaluate a given incentive structure (e.g. Homans, 1961; Thibaut & Kelley, 1959). The explicit assumption that people enter situations of interdependence with individual goals and that different goals may lead to different behavior in the same interdependent situation was stated and studied by Deutsch (1960), who proposed three different motivational orientations: cooperative, individualistic, and competitive. This terminology was later adopted by Messick and McClintock (1968) in their motivational theory of choice behavior in experimental games which was stimulated by a series of studies showing that people do not strictly endeavor to maximize own payoffs when making choices in experimental games, but rather tend to take into account the other player's payoff as well (McClintock & McNeel, 1966a, 1966c, 1966b, 1967; Messick & Thorngate, 1967). In this theory, the three motivations mentioned by Deutsch were operationally defined as the goals to maximize joint gains (cooperative), maximize own gain (individualistic), and maximize relative gain (competitive). Messick and McClintock further showed that choice options in formal games may dominate others with respect to one or more of the three stated motivational orientations, and that it is possible to assess a person's primary motivational orientation by observing her choices in a series of what they called *decomposed games* (see also Pruitt, 1967). Basically, any unilateral choice among different allocations of resources for the self and another person is a decomposed game. If two DMs would each make such a choice and each would receive both what he allocated to the self and what the other person allocated to the other, the situation would constitute a proper (i.e. recomposed) game. The purpose of presenting people with decomposed games is that the element of direct interdependence is removed from the situation such that options chosen in these tasks express peoples' social preferences alone rather than their preferences confounded with strategic considerations.[2] Hence, Messick and McClintock's seminal work has both led to a conceptualization of social preferences (McClintock, 1972; Griesinger & Livingston, 1973) that was later termed Social Value Orientation (SVO) and the use of decomposed games with a few discrete options as a method for assessing these preferences.

The general notion that individual differences are both noteworthy and crucial for explaining behavior in situations of interdependence was also adopted in broader theoretical frameworks. For example, in the goal/expectation theory by Pruitt and Kimmel (1977) it is assumed that the choices people make in experimental games depend both on their motives and their beliefs about the behavior of their interaction partner.[3] Highlighting the importance of both of these determinants of behavior, Pruitt and Kimmel recommended that "measures of goals and expectations should be routinely introduced into gaming studies" (Pruitt & Kimmel, 1977, p. 385). The assumption that social preferences affect choices in experimental games is also inherent to the theory of interdependence by Kelley and Thibaut (1978) in which people are postulated to vary in their perceptions of a given situation due to individual differences in the goals they attempt to pursue. Concretely, when a person decides which strategy to use when engaged in an interdependent situation represented by a matrix game, she is hypothesized to transform the *given matrix* into a subjective *effective matrix*, which then serves as the basis for her final choice. For instance, if a person had the goal to maximize joint payoffs - thereby expressing a cooperative motivation - she would sum up the payoffs for the self and for the other per outcome from the *given matrix*, then internally represent the *effective matrix* containing the computed sums of payoffs as outcomes, and finally choose an option based on this subjective representation of the joint payoffs. Thus, the SVO concept is implicitly embedded in Kelley and Thibaut's theory as the driver of payoff matrix transformation.

Subsequent theoretical work on SVO has focused on issues such as: linking the SVO concept with rules of fairness (McClintock & Van Avermaet, 1982); integrating it into an evolutionary perspective on behavior in situations of interdependence (McClintock, 1988); and embedding it into a broader context of social interactions in general (Van Lange, De Cremer, Van Dijk, & Van Vugt, 2007). However, many theoretical advancements regarding SVO have been promoted and achieved on a more basic level, that is refining the concept itself (e.g. Van Lange, 1999) and developing and testing theories of its formation (Van Lange et al., 1997) or its relation with other concepts, such as beliefs, perceptions, or attitudes concerning others (see, for instance, Bogaert et al., 2008; Kelley & Stahelski, 1970; Liebrand, Jansen, Rijken, & Suhre, 1986; Van Lange &

[2] This only holds, of course, if people are not directly paired with each other when making decisions in a decomposed game. Otherwise the situation is a proper (recomposed) game.

[3] This assumption is also fundamental to comprehensive theories of rational action which model behavior as a function of preferences, beliefs, and constraints (e.g. Gintis, 2007; Hedström, 2005).

Liebrand, 1991).

Although there are several excellent reviews of SVO and substantial findings associated with it (Au & Kwong, 2004; Bogaert et al., 2008; McClintock & Van Avermaet, 1982), to date there is no unified, overarching *Theory of SVO* that combines the micro with the macro level and provides an extensive and coherent set of general hypotheses. Besides the fact that the investigation of relations between SVO and other variables is still in process and yields interesting discoveries even recently (e.g. with respect to non-verbal behavior, see Shelley, Page, Rives, Yeagley, & Kuhlman, 2009; Shelley, Page, & Kuhlman, 2010; Shug, Matsumoto, Horita, Yamagishi, & Bonnet, 2010), another reason why such an ambitious endeavor has not been undertaken so far may be that there is still ambiguity about how to measure this basic construct well.

From an early version of this paper, a reviewer suggested that "theories do not depend on measures." We disagree and contend that the relationship between theory and measurement is bilateral and dynamic. Measurement methods can feedback and influence how theories develop (or devolve as is the unfortunate case sometimes). SVO is a continuous theoretical construct. It is the degree to which a DM will choose to sacrifice their own resources to benefit another. However this continuous construct has often been diminished and reduced by the stubborn use of categorical measurement methods that yield only nominal data. This low resolution treatment of evidence has, in our opinion, constrained the way in which the construct has been considered, discussed, and developed. It has also limited the statistical power of studies looking for the interrelations between SVO and other factors, leading to a likely expanded set of Type II errors that may have undermined the evidence for the importance of non-selfish motivations in human decision making. The intertwined history of theory about SVO and the measurement of SVO provides an interesting example of a back and forth between measurement methods and theory, and we hope to shed light on this vacillating process by systematically delineating the development of different measurements of this important construct over time. Also, we agree with Bogaert et al. (2008, p. 472) that in light of the vast SVO literature, not much effort has been dedicated to a discussion and comparative evaluation of measurement methods for social preferences. The present paper is therefore not only intended to bridge between different scientific disciplines concerned with the investigation of social preferences, but also to contribute to filling a gap in the SVO literature and foster theoretical as well as methodological developments from a broad perspective.

Social Value Orientation Framework

SVO provides a framework for characterizing how a decision maker values joint outcomes (McClintock, 1972; Messick & McClintock, 1968; Griesinger & Livingston, 1973; Liebrand, 1984). A graphical representation of this framework, similar to the one provided by Liebrand (1984, p. 246) is depicted in Figure 1 and shows different motivations associated with different joint outcomes.

A point in the Cartesian plane corresponds to a specific joint outcome. The x-axis corresponds to the value of the DM's individual payoff. The y-axis corresponds to the other person's payoff. Although there are an infinite number of possible joint outcomes, those along the ring, intersecting one of the eight cardinal directions, provide clear and unique exemplars of different joint outcomes that correspond to idealized social preferences. For example, the unique point on the ring that maximizes individual earnings is at $x = 100$ and $y = 50$ (i.e. individualistic or narrow self interest); the point on the ring that maximizes joint earnings is at $x = 85$ and $y = 85$ (i.e. prosocial). These points and their respective archetypical motivations are listed in Table 2. The values presented in Table 2 are consistent with Figure 1 and correspond to different idealized SVOs.[4]

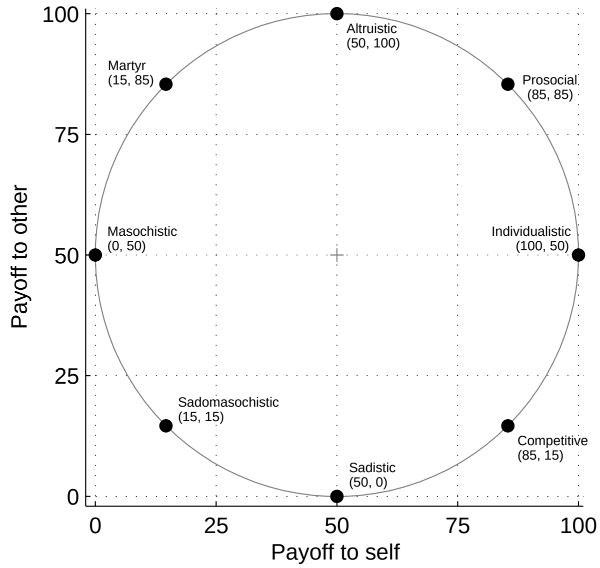

Figure 1. A graphical representation of the SVO framework.

One way to determine an individual's preferences across different joint distributions is to present a DM with a series of allocation decisions and ask her to select her most preferred apportionments (e.g. the binary choice presented in Table 1). These resource allocation decisions are sometimes referred to as *decomposed games* (Pruitt, 1967; Messick & McClintock, 1968). As noted before, the term *decomposed games* emerged from seminal work that used simple two-player binary option games (e.g. the Prisoner's Dilemma) to study choice behavior in social contexts. One problem with using a proper game to study intrinsic preferences is that a game is by definition a strategic interaction. Games require DMs to choose not only according to their own preferences, but with those preferences conditioned on their beliefs of what the other player(s) prefer and will choose, knowing that the other player(s) are likely thinking the same thing, and so on. These decisions are complex in that they draw upon personal preferences, beliefs about others' preferences, and beliefs about others' beliefs about preferences, and so on *ad infinitum*. As a method to measure preferences alone, the use of proper games is muddled and confounded by the strategic nature of the social interaction. A solution to this measurement problem is to decouple preference considerations from strategic considerations. This simplified choice task is called a *decomposed game*. Although

[4] One thing that is worth noting is that in the economics literature, the term *altruistic* encompasses *any* positive other regarding preferences, whereas in the psychology literature there is a distinction made between *prosocial* and *altruistic* orientations. For this paper we too will maintain the distinction between these two motivations, using *altruistic* to refer to the particular motivation of maximizing another's payoff, indifferent to one's own, and *prosocial* to refer to the preference of maximizing joint gain.

Table 2
The archetypal Social Value Orientations.

Self	Other	Orientation	Inferred Motivation	Weight on own outcome	Weight on other's outcome
85	85	Prosocial	Maximize the joint payoff *or* minimize the difference between payoffs	1	1
100	50	Individualistic	Maximize the payoff to self	1	0
85	15	Competitive	Maximize the positive difference between self and the other's payoff	1	-1
50	0	Sadistic	Minimize the other's payoff	0	-1
15	15	Sadomasochistic	Minimize the joint payoff *or* minimize the difference between payoffs	-1	-1
0	50	Masochistic	Minimize the payoff to self	-1	0
15	85	Martyr	Maximize the negative difference between the other's and self payoff	-1	1
50	100	Altruistic	Maximize the other's payoff	0	1

it is technically not a game, it does give an unconfounded measure of an individual's preferences for joint outcomes. For example, if a DM chooses Option 2 from the allocation choice presented in Table 1, we would infer that her motivation to maximize her own earnings is stronger than her motivation to maximize joint earnings; we would say she has a revealed preference consistent with an individualistic social value orientation.

Any individual choice task where a DM makes a selection among different allocations of resources to himself and others is a decomposed game. Decomposed games have been used extensively to study social preferences (e.g., Messick & McClintock, 1968; McClintock, Messick, Kuhlman, & Campos, 1973; Kuhlman & Marshello, 1975a, 1975b; Van Lange et al., 1997). The dictator game[5] happens to be a decomposed game too. For clarity, we refer to non-game contexts as *allocation decisions* in order to emphasize the non-strategic nature of the relevant choice tasks.

The framework presented in Figure 1 and Table 2 provides a taxonomy (Liebrand, 1984) of revealed social preferences but has several unusual categories that are rarely consistent with real DM's choices. Thus researchers have focused their attention on a subset of social preferences in a particular region of the joint allocation plane. According to Messick and McClintock (1968), a person can fulfill one of three different orientations. A person may be motivated to secure maximal resources for herself, indifferent to how much the other receives (i.e. maximizing own gain). Or a person may prefer to maximize the sum of the outcomes for both self and other (i.e. maximizing joint gain). Or a person may prefer to maximize the difference between her own outcome and the other's outcome (maximizing relative gain). These three motivational orientations have longstanding labels in the psychology literature as individualistic, cooperative (i.e. prosocial), and competitive, respectively (Deutsch, 1960). The most common current measure of social preferences, the 9-Item Triple Dominance Scale (see Van Lange et al., 1997), uses the same three categories. There are a variety of other approaches to the measure of social preferences which range from distinguishing simply between two categories (individualistic and prosocial) to differentiating among up to ten categories as proposed by MacCrimmon and Messick (1976).

How measures can shape theory: The case of SVO

Theory often precedes measurement. This is certainly true when something – be it an observable natural phenomenon, an inferable underlying force, or a hypothesized latent variable – is measured for the first time. The conceptualization of a measurement naturally requires the conceptualization of the object of measurement. However, once a measurement method exists and is employed, the data it produces has an impact back on how the object of measurement is theorized about. There can be significant interdependencies between theory and measurement since refinements of theories are often driven by data, data depend in part on the measures employed to obtain them, and the employed measures depend on the theories originally proposed. In this vein, the relation between theory and measurement is not exclusively unidirectional or one-way dependent (see, for instance, Gigerenzer, 1991; Gigerenzer & Sturm, 2007). Furthermore, the instruments we use to assess and process data can have an influence on our thinking in a broader context (see Sturm & Ash, 2005). As John M. Culkin noted, "we shape our tools and thereafter they shape us." We want to make the argument here that the bidirectional relation between theory and measurement has shaped the conceptualization of the SVO construct in ways that impaired progress in measurement quality. In the following section, we want to elaborate on the remarkable anomaly that a valuable continuous construct has commonly been measured on the nominal scale level for decades.

As discussed earlier in this paper, the emergence of the SVO construct was triggered by the observation that most people often do not attempt to maximize the experimenter-defined payoff when interacting with others in strategic situations (McClintock & McNeel, 1966a, 1966c, 1966b, 1967; Messick & Thorngate, 1967). The pattern of results obtained in these studies led Messick and McClintock (1968) to the elemental assumption of three distinct goals that guide behavior in experimental games: maximize own gain (in-

[5] This is an unfortunate name as it is technically not a game either, as only one DM can influence the joint payoffs.

dividualistic), maximize relative gain (competitive),[6] and maximize joint gain (cooperative). Hence, an early notion of SVO was categorical. However, Messick and McClintock also tested whether a utility model[7] (see Messick & Thorngate, 1967) that is not restricted to categorical assumptions is useful for describing observed choice patterns. Since they found that a particular utility model poorly fit their data, they abandoned it, and proposed a stochastic choice model instead. This stochastic model was based on the assumption that people are in one of the three suggested motivational states (or indifferent) at a particular point in time according to an individual probability distribution, and that their choices in a particular experimental game would depend on the state adopted at the moment of choice. Therewith, a categorical conceptualization of social preferences won, and in hindsight this had a substantially negative impact on future SVO measurement.

A continuous conceptualization could have emerged however. The thinking behind the use of decomposed games for assessing SVO as originated from Messick and McClintock's seminal work has typically been the following: Discrete options in a decomposed game may dominate each other with respect to certain predefined motivational goals. If an option is chosen by a decision maker, and this option must dominate other available options with respect to a particular motivation, the decision maker's motivation and preferences are revealed. The assumption of three different particular motivations was data driven but still arbitrary, and if the thinking would have been more in line with a utility maximization approach, a continuous conceptualization of SVO could likely have emerged. The three motivational orientations can be represented as three different parameterizations of the same utility function $U(x, y) = x + ay$, with $a = -1$ representing relative gain maximization, $a = 0$ representing own gain maximization, and $a = 1$ representing joint gain maximization. If such a representation had been salient to Messick and McClintock, it would have been obvious, perhaps, to assume a continuum for $a = [-1, 1]$ and therefore conceptualize SVO as a continuous construct, rather than assuming a rigid categorical typology $a = \{-1, 0, 1\}$. Despite the fact that a continuous conceptualization of social preferences already existed (see Sawyer, 1966) in the late 1960's, the more influential work of Messick and McClintock forged how SVO has been theorized and commonly measured thereafter. Currently the most commonly used SVO measures (the Triple-Dominance Measure and the Ring Measure) produce only categorical output consistent with how Messick and McClintock discussed SVO as informed by decomposed binary games.

We suggest that the persistence of the categorical SVO concept has been promoted by measures commonly employed to assess the SVO construct, and that in this way measurement methods have shaped theory. In order to elaborate on this claim, we focus on the development of the SVO concept and measures thereof following Messick and McClintock (1968). Two traditions of SVO conceptualization have evolved since then. One tradition followed the categorical approach described above, and the other tradition followed a utility model approach. In the utility model tradition, SVO was naturally conceptualized as a continuous, albeit not necessarily unidimensional, construct. The focus of research within this tradition was on postulating and testing different utility functions as representations of social preferences (see Grzelak, Iwinski, & Radzicki, 1977; Radzicki, 1976; Wyer, 1969). Since parameterization is essential for testing utility models, and parameters are usually not restricted to take on only a very limited number of values (such as only three), a continuous theory of SVO is inherent to this approach. Building on both the work of Messick and McClintock (1968) and Wyer (1969), Griesinger and Livingston (1973) showed how the two conceptualizations relate to each other by employing a geometric approach to represent motivational orientations as vectors in the Cartesian plane with the x-axis corresponding to payoffs to the self and the y-axis corresponding to payoffs to the other. This was a cornerstone in the history of SVO research, since the geometric representation supported visualization of how different motives corresponded to different combinations of weights in a simple utility function. A decision maker's choices could be modeled as if they make tradeoffs between the payoff to the self and the payoff to the other given the utility function $U(x, y) = ax + by$ (see Table 2). Hence, Griesinger and Livingston's framework helped clarifying that SVO is a continuous construct. However, this framework paradoxically promoted the categorical conceptualization of SVO thereafter. We claim this because work following and building on Griesinger and Livingston's framework focused on the motivational categories, rather than the underlying continuous motivations (see, for instance, Maki, Thorngate, & McClintock, 1979; MacCrimmon & Messick, 1976). Furthermore, the SVO measure that was constructed on the basis of the geometric framework and has become the second most commonly used instrument for assessing SVO, the Ring Measure (Liebrand, 1984; Liebrand & McClintock, 1988), has been proposed and used almost exclusively for categorizing subjects rather than eliciting continuous information.

We see a potential chain of reasoning responsible for why the geometric framework lead to a preference for simple categorical thinking. In the ring framework, the continuous SVO construct is two-dimensional, one dimension referring to the weight a person attaches to her own outcomes, and the other referring to the weight a person attaches to other's outcome. This is inconvenient since multidimensionality hinders the employment of simple statistical tests for evaluating individual differences within the construct and associations or interactions with other variables. However, the two dimensions can be translated into one in terms of an angle. This does not solve the problem since the interpretation of the angle is still not unidimensional. A statement, such as "the higher the angle, the higher the concern for others" does not hold when the full ring is considered. Augmentations in angular degrees beyond both plus and minus 90° imply decreasing concerns for the other, while the opposite is true for angles within this range. Hence, the angle has to be translated back into a corresponding particular motivational category in order to be readily interpretable. This frame of thinking, we speculate, is the reason why the categorical conceptualization finally predominated in SVO research. However, the problem of two-dimensionality could have been solved by simply disregarding one of the two dimensions, namely the dimension corresponding to the weight attached to the own outcome, by assuming that this weight is just equal to one. This assumption appears justifiable since we do not know of any evidence supporting the hypothesis that people ignore (pure altruism or pure aggression) their own payoffs or depreciate (martyrdom, masochism, or sadomasochism) own outcomes either. Evidence suggests that the utility function of own outcomes *per se* is monotonic increasing (Messick & Sentis, 1985), that is – everything else being equal – more is strictly preferred to less.

[6] It is interesting, in hindsight, to see that the emergence of the SVO construct was mostly driven by the observation that some people appear to maximize relative gain, while this particular preference is the least commonly observed compared to the other two prototypical motives in the vast majority of more recent studies.

[7] The model has the following general form: $U(x, y) = f(x) + g(x - y)$. According to (Messick & McClintock, 1968, p. 15), "joint gain is ignored in this model [...] also as a result of the data previously reviewed which indicate that relative-gain maximization is a more important choice determinant than joint-gain maximization."

Under this assumption, SVO becomes a unidimensional continuous construct defined as the weight a person attaches to outcomes of others in relation to the own, represented by parameter a in the utility function $U(x, y) = x + ay$. This continuous, unidimensional conceptualization excludes the possibility of particular pathological motives, yet allows for aggression and altruism when letting a approach positive or negative infinity, respectively, and includes competition ($a = -1$), individualism ($a = 0$), and cooperation ($a = 1$) as special archetypical cases.

Although such a continuos conceptualization is at least as old as the categorical one and was once applied for devising a measure of SVO (see Sawyer, 1966), it has apparently been abandoned for decades. Consequently, until the recent advent of a novel, continuous measure (Murphy, Ackermann, & Handgraaf, 2011), for about thirty years SVO has been assessed almost exclusively on the nominal scale. Concurrently, researchers have seemed to be aware that the construct is continuous in principle, but have chosen to apply categorical measures thereof, and then treated the categories as if they constituted the construct as a whole, rather than salient but arbitrary instantiations of an underlying continuum. Typically, in SVO research papers, the construct is introduced as "stable preferences for certain patterns of outcomes for oneself and others" and it is mentioned that "a variety of different social value orientations can be distinguished from a theoretical point of view," but that a "three-category typology" would be applied in the present work.[8] It is usually hard to justify why a continuous construct is categorized or even dichotomized in light of the obvious disadvantages such gross downsampling results in (see Cohen, 1983; Irwin & McClelland, 2003). For example, it would certainly appear as an odd idea – and for very good reasons – to measure intelligence with an instrument that only produced a rough categorization of people into the three groups "bright," "mediocre," and "dull." However, the same practice is carried out commonly when considering SVO. It is precisely this circumstance that lead us to claim that in the case of SVO, measurement has fedback and shaped theory. Although the construct is commonly acknowledged as continuous, it has been measured at the nominal level and therefore internally theorized as being categorical, simply because the measures commonly used to assess the construct produced categorical output.

For a surprisingly long time it had been a inauspicious convention in psychology to dichotomize continuous variables for analyses (see MacCallum, Zhang, Preacher, & Rucker, 2002). The most often cited reasons for such a procedure include convenience and simplicity of ANOVA methods contrasted with multiple regression. However, the adverse effects of discretizing continuous variables have been demonstrated clearly and repeatedly (e.g. Cohen, 1983; Fitzsimons, 2008; Irwin & McClelland, 2003; MacCallum et al., 2002; Royston, Altman, & Sauerbrei, 2006) and it has also been shown that there are trivial benefits but substantial costs associated with such a practice. Perhaps surprisingly, although the post-hoc degradation of continuous data had been quite common, it apparently has been very uncommon to measure a construct at a lower level of measurement than its theory permits. In fact, it seems to have been standard in psychology to measure constructs, especially personality variables, whenever possible on continuous scales. Apparently this standard has been so strong that hypothesizing about class variables in personality research has required extensive argumentation (for an example, see Gangestad & Snyder, 1985). Interestingly, methodology has been cited as one reason for the ubiquity of a continuous conceptualization of personality dimensions: "[...] Methods for test construction and evaluation generally assume underlying latent continua, and personality researchers adopt, without question, the underlying assumption of dimensionality" (Gangestad & Snyder, 1985, p. 319). In the case of SVO, we argue, methods too have shaped thinking in the same manner as in personality research, but in the opposite direction. The most commonly used SVO measures (the Triple-Dominance Measure and the Ring Measure) produce categorical output, and SVO researchers seem to have adopted, perhaps without deep reflection, a categorical conceptualization. This has resulted in the curious situation that, although in general continuous conceptualizations of individual difference variables have predominated in psychology, SVO has commonly been assessed and thought of as a nominal variable, even though it had been shown to be a continuous construct in principle shortly after its advent by Griesinger and Livingston (1973). To our knowledge, a curious situation of this type is unique in psychology, but it may serve as an important reminder of the need to deliberate on the coherence between theory and measurements methodology from time to time.

The following review on SVO measurement methods is focused on evaluating the methods' strengths and weaknesses, and in addition is intended to guide the reader through the history of SVO measurement while highlighting how the different measures relate to different theoretical conceptualizations of SVO. The measures are evaluated on the basis of a set of predefined criteria, one of which is output resolution (e.g. scale of measurement). This feature is typically not central in evaluating the quality of a measure. However, in the case of SVO measurement, it is an important issue for the reasons elaborated above, and thus is given considerable weight in the following sections.

Existing Measurements of social preferences

In this section, existing approaches to the measurement of social preferences are described and discussed in approximate chronological order of publication. This provides a general overview of the history of social preference measurements and offers insight into how methods have changed and developed over time. In discussing different approaches to social preference measurement, the current paper focuses on methods that assess people's preferences for certain allocations of resources. These preferences are revealed by eliciting people's judgments or choice behavior when they are presented with options containing different distributions of outcomes for the self and for some other person. Questionnaires or Likert-type scale measures regarding verbally expressed altruistic or prosocial attitudes (e.g., Rushton, Chrisjohn, & Fekken, 1981; Crandall, 1975) are excluded from the present paper. The reason for this exclusion is twofold. First, attitudinal measures are rarely used in SVO research. Second, and more importantly, we think that having people making decisions with real consequences is the right approach to measuring social preferences. For example, we consider the abandonment of real payoffs for the benefit (or detriment) of another person as stronger evidence for social preferences compared to the mere indication of an intention to do so in a hypothetical situation, or the expression of degree of agreement with a qualitative statement. We think that the measurement of real behavior is superior to the measurement of intentions or attitudes given that the object of interest itself is behavior rather than inner processes (see also Baumeister, Vohs, & Funder, 2007). Hence we will only

[8] The phrases in quotes are taken from Van Lange et al. (1997) which is a well known and widely cited work regarding SVO. The phrases serve to highlight the divergence between measurement and theory that is common in SVO research.

consider measures that at least allow for having subjects make real decisions with real consequences.

In order to ensure a fair procedure and allow for comparative analyses of the different methods, the SVO measures are evaluated on the basis of a set of five predefined criteria. The first two criteria are standard psychometric ones, validity and reliability. However, we will restrict ourselves to only reporting on predictive validity, convergent validity among SVO measures, and test-retest reliability. The third criterion is output resolution for the reasons explicated earlier in this paper. The fourth criterion is efficiency in terms of the expenditure of time and effort associated with measurement completion and output evaluation. This criterion is included in order to give the reader who seeks the optimal measure for a particular research design some information about pragmatic aspects. The fifth and final criterion is particular advantages, that is, the existence of useful features of a measure that are not commonly shared by other measures. At the end of this review section, the reader is provided with a tabulation of the measures' scores per criterion. Since these scores are based on judgement, they can not be completely objective, and we want to emphasize that we do not purport that they are. Also, it is not the purpose of this review to choose one method as best, but to allow for a comparative evaluation to help selecting the method that best suits a particular research design. Furthermore, the evaluation of the measures is not the only target we aim for. We consider the provision of a historical review on SVO measurement and a statement of how theory and measurement interact as equally important as the evaluation of methods. Therefore, all the methods' individual discussions include, but are not restricted to the criterion-based evaluation.

The Altruism Scale

Early efforts to quantify social preferences can be traced to sociology. Sawyer (1966) devised a method for assessing the degree of concern a DM has for the outcomes for himself and others. He called this method the *Altruism Scale*. However it should be noted that Sawyer's method can assess a range of different orientations including prosocial, individualistic, and competitive motivations, and it would be more accurate to call it as *Social Preference Scale*. Within Sawyer's theoretical framework, the subjective attractiveness of a joint outcome was conceptualized as the linear combination $P_S + wP_O$ where P_S is the payoff for the self and P_O is the payoff for another person. The coefficient w represents how much weight a DM gives to the outcome for the other person, relative to his own outcome (there is an implicit coefficient of 1 in front of the P_S term). If a person is individualistic and therefore interested in only his own welfare, the coefficient w would be zero. If a person is prosocial and cares about both his own, and the other person's welfare, w would be greater than zero. Conversely, if a person is competitive and tries to maximize the difference between the own and the other's payoff, w will be less than zero. Hence, the theoretical conceptualization of social preferences underlying the Altruism Scale is continuous.

The Altruism Scale described. Sawyer's method uses a conjoint measurement technique to estimate an individual's weighting of outcomes for others (w). An index of altruism is computed based on the desirability rankings of own/other outcome combinations. Specifically, participants (college students in this case) were asked to imagine that they would take a seminar with only one other fellow student and that each would receive a grade of A, B or C at the end of the seminar. Participants were then asked to rank their preferences for the allocations of these grade combinations. After all nine of the rankings are made by a DM, the altruism index a can be calculated as follows:

$$a = \frac{\sum_{\text{ranks in row C}} - \sum_{\text{ranks in row A}}}{\sum_{\text{ranks in column C}} - \sum_{\text{ranks in column A}}} \tag{1}$$

The index a is a manifest variable and serves as a proxy for the latent variable w. The numerator in computing a corresponds to how much a person cares about the outcome for the other person. If, for example, a person cares about the other's welfare, the DM will assign high ranks to the options where the other person receives A grades and low ranks to the outcomes where the other person receives C grades. In this case, the numerator is positive, indicating positive altruism. Conversely, a negative result indicates competitiveness. If the result is zero, it implies that the person is indifferent to the other student's grade.[9]

According to Sawyer, w ranges continuously from -1 to $+1$, i.e. from perfectly competitive ($w = -1$) to perfectly prosocial ($w = +1$), with narrow self interest ($w = 0$) at the midpoint. It is worth noting that the coefficient a can take on values outside of this range given atypical motivations (e.g. masochistic). It is also worth noting that for Sawyer's Altruism scale, a is undefined (perfect altruism implies $w \to \infty$) if a DM provides a purely altruistic ranking (ranks that are consistent with maximizing the grade of the other student and indifferent to the DM's own grade).

Discussion of the Altruism Scale. The Altruism scale was an early innovation but as a means to measure social preferences it has limitations. First, the metric space of academic grades is not straightforward and further is obviously not amenable to incentive compatible research. This particular choice context may force DMs to take a zero-sum mentality if they are accustomed to curved grading systems or are concerned with their overall class ranking. However, the method per se does not require the employment of school grades as stimuli. Instead, any set of valuable goods containing three elements with transitive and strict preference ordering A $\succ$ B $\succ$ C could be used for eliciting preference indications in principle. Hence, the method could be used for measuring social preferences of individuals who are not experienced with alphanumeric representations, such as children, for instance. Nevertheless, there are other methods, such as utility measurement in general, or the Social Behavior Scale discussed later in this paper, which share this feature.

Second, a procedure for rank ordering preferences that presents participants with all stimuli at the same time runs the risk of yielding unreliable data because people usually are not very skilled at reliably ranking multiple items simultaneously (Saaty, 1980). Hence, as proposed by Sawyer himself, it would probably be beneficial to let participants make sequential pairwise comparisons in order to reduce complexity of the judgment task and therefore yield more accurate rank orders. How one would elicit global rankings based on sequential pairwise rankings is not an issue Sawyer addresses. However, since a rank ordering of nine outcomes can be produced

[9] Sawyer used a second method to directly assess a by asking the DM to choose 1 out of 21 scale values, which corresponded to values of a ranging from -1 to $+1$ in increments of 0.1. The scale is anchored by statements at the values -1, -0.5, 0, $+0.5$ and $+1$. For example, the statement reflecting an a value of $+1$ indicates agreement with the following statement: "I am equally interested in how good his grade is and in how good my grade is," whereas the statement reflecting an a value of 0 indicates agreement with: "I am only interested in how good my grade is; how good or poor his grade is makes no difference to me."

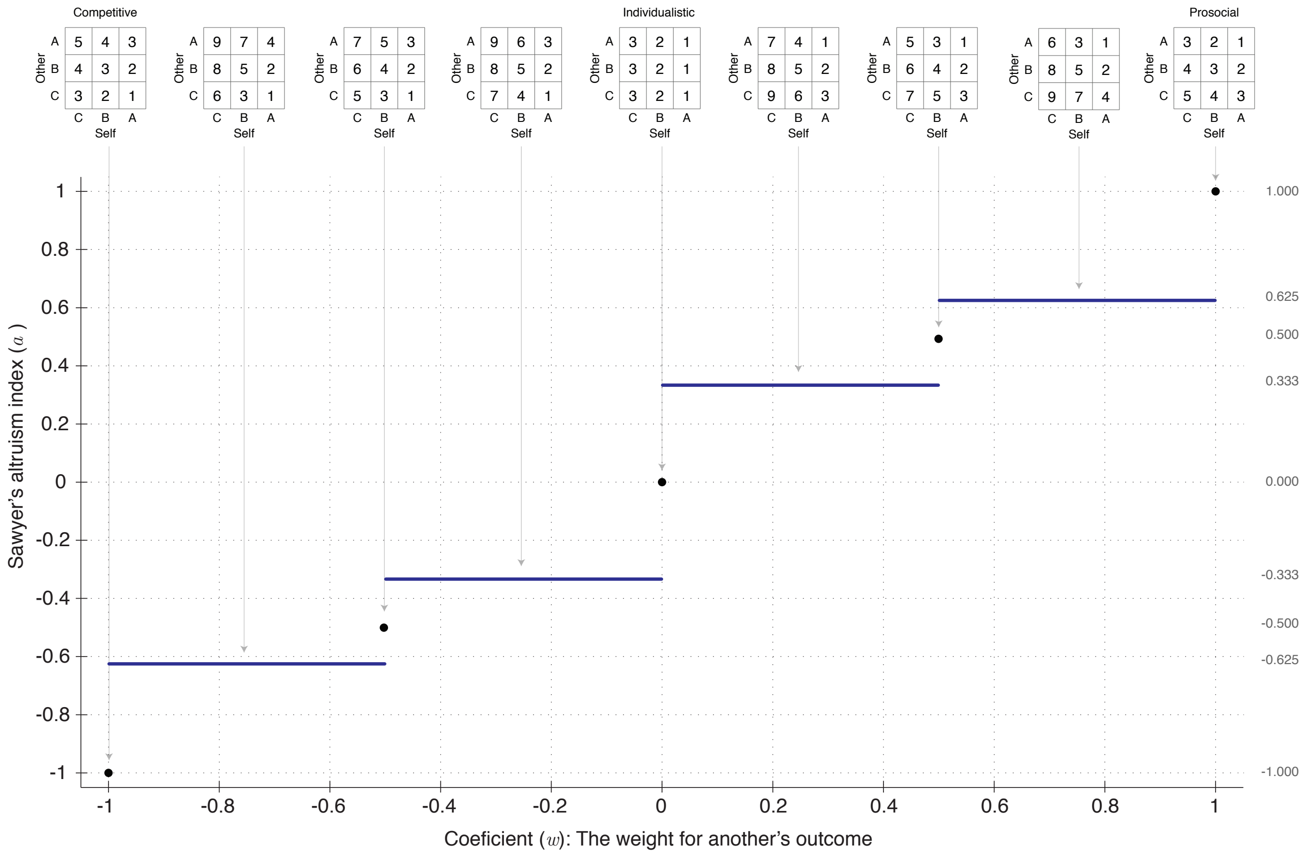

Figure 2. Sawyer's Altruism Scale, preference rankings, and the *a* index. Examples of different preference rankings (the 3 × 3 matrixes at the top of the figure) are displayed here. Further, the relationship of these rankings to the underlying utility weight (*w*, shown on the *x*-axis) for another's outcome, and Sawyer's altruism index *a* are shown. The ranking of 1 indicates that this allocation of grades is the DM's most preferred joint outcome. As can be seen, ties in ranking outcomes are allowed. Particular rankings are consistent with underlying utility weights, and further each ranking matrix corresponds to an *a* index. Although *w* is continuous, the resulting altruism index *a* is a step function that can take on only one of nine values given *w* between -1 and 1 inclusive. Some rankings correspond to a single point of *w*, whereas other rankings are consistent with a range of *w* values.

relatively quickly and the computation of output variable *a* is trivial, the method can be termed efficient with respect to time and effort.

Third, the altruism scale cannot differentiate between the prosocial motivations of joint gain maximization and inequality aversion. It also yields an undefined *a* index for a DM with a purely altruistic motivational orientation.

Fourth, the process of reducing a set of rank orderings into a single index may be problematic. Each *a* value at one of the three anchors (-1, 0, +1) has a clear interpretation, whereas values in between are not readily interpretable. Further, the index *a* is an ordinal variable at best (Stevens, 1946, 1950) and is limited to 9 particular values (see Figure 2). Moreover, the mapping from underling utility *w* to the index *a* has a "many-to-one" structure which necessarily results in the loss of information.

With respect to psychometric properties of his measure, Sawyer reported weak validity and reliability. For example, the correlation between values obtained by the direct scale estimation measure and the values obtained by the ranking method was only $r = 0.32$, hence challenging the measure's convergent validity. Sawyer reasoned that the discrepancy between the two measures was probably due to differences in task complexity and to multidimensionality in the rankings (i.e., the direct estimation measure promotes unidimensional judgments whereas the conjoint method allows for more complicated preferences to manifest themselves).

The 9–Item Triple–Dominance Measure

Decomposed games have their roots in two-option two-player games (e.g. the Prisoner's dilemma) that have been the "fruit flies" of social decision research. In psychology, Messick and McClintock (1968) and Pruitt (1967) devised what have been termed decomposed games by deconstructing two-player binary social dilemmas into individual decision problems. The reason for this simplification is to disentangle intrinsic motivations for joint outcomes from strategic concerns. Allocation choices can be constructed that differentiate between archetypal motivations. Messick and McClintock (1968) focused their attention on the three common social preferences, namely prosocial, individualistic, and competitive, ignoring other less common motivations.

For example, the allocation decision presented in Table 1 is designed to differentiate between prosocial and individualistic motivations.[10] A prosocial person would choose Option A and an individualist would choose Option B. However, a competitive type would also select Option B, as it has a greater relative difference between the payoffs. So with this particular allocation decision it is not possible to differentiate between individualists and competitors as both types would choose the same option.

There are two general approaches which solve this discrimination problem and can distinguish between the three most common social preferences. First, a researcher can examine the complete set of choices made in a series of two-option, double dominance allocation decisions. The set of choices that pits each of the common social preferences against each of the other common social preference types is necessarily exhaustive and can isolate a DM's primary social motivation. This method would also identify an individual's least preferred social outcome, as well as yield a ranking of preference over the joint options. A second method to differentiate between the three most common social preferences uses a single allocation decision that has three particular options (as proposed by McClintock et al., 1973) such that each option dominates *both* the other two allocations with respect to one particular motivational orientation. These types of items have the property of triple dominance, as they can differentiate between three social orientations. Triple-dominance items were adopted by Kuhlman and Marshello (1975a) who also used other decomposed game classes (double-dominance and single-dominance) for assessing social preferences. Building on this work, the 9-Item Triple-Dominance Measure of SVO (see Van Lange et al., 1997) has evolved and has become a widely-used measurement method for social preferences in social psychology (e.g. applied by, Joireman, Van Lange, & Van Vugt, 2004; Utz, 2004; Utz, Ouwerkerk, & Van Lange, 2004; Van Dijk, De Cremer, & Handgraaf, 2004; Stouten, De Cremer, & Van Dijk, 2005; De Kwaadsteniet, Van Dijk, Wit, & De Cremer, 2006; Van Lange, Bekkers, Schuyt, & Van Vugt, 2007; Declerck & Bogaert, 2008; Van Prooijen et al., 2008; Van Den Bos, Van Dijk, Westenberg, Rombouts, & Crone, 2009; Haruno & Frith, 2009), in part due to its straight forward structure and ease of use (Van Lange, De Cremer, et al., 2007).

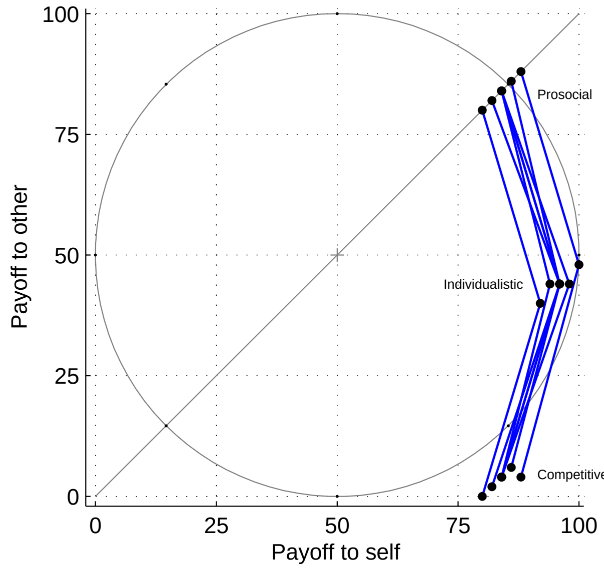

Figure 3. The 9-Item Triple-Dominance Scale. Each item is represented in the self/other allocation plane as three points connected by a line. Notice the high degree of similarity among the items. It may be more accurate to say this is a scale with one item repeated nine times.

The 9−item Triple−Dominance Scale described. The Triple-Dominance SVO items can be seen in Table 3. For each item there is one allocation option that is prosocial, one that is individualistic, and one that is competitive.

The scoring rule for this scale is to count the number of individualistic, prosocial, and competitive options a DM selects. If a DM chooses six or more options from a particular category, then the DM is designated as being that type. If a DM does not choose at least six options from one category, then she is not categorized (e.g. McClintock & Allison, 1989; Platow, McClintock, & Liebrand, 1990; Van Lange & Kuhlman, 1994). In other variants of the Triple-Dominance measure, only six items are used and participants are classified when at least five of the six choices are consistent with one of the three social value orientations (e.g. Van Lange, 1999). However, the method of counting choices made in several decomposed games and classifying participants into respective SVO categories according to their choice pattern with respect to a particular consistency criterion is exemplary for the general evaluation procedure used in decomposed game measures. This holds for the 9-Item Triple-Dominance Measure as well as for other variants using mixed dominance classes (e.g. Kuhlman & Marshello, 1975a, 1975b).

Discussion of the 9−item Triple−Dominance Scale. Although the 9-Item Triple-Dominance Measure is the most commonly used measure of SVO to date, it has some shortcomings. First, it can assign individuals to only one of three categories: prosocial, individualistic, or competitive, and provides no information beyond this basic categorization. This result is only at the nominal scale level (Stevens, 1946, 1950), the lowest level of measurement. However social motivations are conceptualized as a continuous construct (Griesinger & Livingston, 1973; Wyer, 1969) and one practical result of forced categorization is low statistical power (Cohen, 1983). Attempts have been made to extract continuous information from a set of choices in the Triple-Dominance Measure. For example, the number of cooperative choices has been used as an SVO score (e.g. Hilbig & Zettler, 2009), or the sum of payoffs allocated to the other or the self (see Sheldon, 1999).[11] These scoring methods are similar, since both are based on aggregating prosocial choices, with one method simply being to count the number of prosocial choices, and the other method summing the corresponding payoffs. However, we see several problems with procedures of this kind as they confuse the reliability of a preference with the magnitude of a preference. Although these two things may be related, they are not the same. Hence, an SVO score resulting from a counting procedure is confounded between intensity and reliability and thus its meaning is obfuscated. Consider, for instance, a comparison between a person *A* who chose the cooperative option eight times and a person *B* who chose it nine times in the Triple-Dominance Measure. How

[10] In Messick and McClintock's terminology, this type of item is referred to as a *double-dominance* item as either of the two options can dominate the other one with respect to a particular motivation.

[11] To be precise, Sheldon (1999) used the Kuhlman-Teta Measure, which can be seen as a precursor of the 9-Item Triple-Dominance Measure.

Table 3
Triple-Dominance items. Note that these values have been standardized to range between 0 and 100 in order to facilitate comparison with the other measures presented in this paper. The original items ranged between 80 and 580 and were presented in the units of points (examples of the original form are shown in Van Lange et al., 1997; Van Lange, De Cremer, et al., 2007).

	Prosocial		Individualistic		Competitive	
Item	Self	Other	Self	Other	Self	Other
1	80	80	92	40	80	0
2	84	84	96	44	84	4
3	88	88	100	48	88	4
4	82	82	96	44	84	4
5	84	84	96	44	82	2
6	84	84	98	44	84	4
7	86	86	96	44	86	6
8	84	84	94	44	84	4
9	82	82	92	44	80	4

much weight do *A* and *B* attach to the outcome of others in relation to the own? This question can not be answered with these choice data. Further we can not determine that *B*'s weight is greater than *A*'s. The 9-Item Triple-Dominance Measure is designed to detect whether a person's choice pattern is more consistent with a weight of 1, 0, or -1, and to categorize a person accordingly given a particular consistency criterion. A more fine-grained estimation of a person's weight is not possible with this method. SVO scores resulting from a counting procedure thus purport informational richness that is not really there. Moreover, we find evidence that neither of the two counting procedures improves the Triple-Dominance Measure's test-retest reliability, or convergent validity with other SVO measures.[12] Hence, for both conceptual and empirical reasons, we are skeptical that more useful continuous information can be extracted from the Triple-Dominance measure.

Second, the Triple-Dominance Measure cannot discriminate between joint payoff maximization and inequality aversion. All of the prosocial options in this measure happen to both maximize joint outcomes and also minimize inequality. Although these preferences may be related, they are not the same. There is evidence that persons classified as prosocial are concerned with both the maximization of joint gain and equality in outcomes (Van Lange, 1999). However there is conflicting evidence (Eek & Gärling, 2006) that prosocial DMs prefer equal outcomes over maximizing joint outcomes. It is not possible to clarify this issue with the Triple-Dominance Measure.

Third, the 9-Item Triple-Dominance Measure can only establish a DM's first preference, not her lesser preferences. Take for example an individual who has a rank order of preferences as individualistic, prosocial, and competitive. Contrast this individual to someone who ranked preferences of individualistic, competitive, and then prosocial. These individuals may approach the world very differently than each other. Furthermore, knowing what an individual's least preferred allocation is would be informative, as an avoidant personality or *prevention focus* (Higgins, 1997) can serve as a motivational foundation. People who are strongly motivated to avoid their least preferred option, rather than focusing on their most favored option, would make different choices depending on the full ranking of their preferences. It is thus important to know not just a DM's most preferred outcome, but also the entire rank ordering of her social preferences.

Fourth, three-option choice sets are more complicated than binary choices. The simplest choice is between two options and this setting only requires the DM to make one comparison in the process of making a decision. Increasing to three options requires the DM to make three comparisons. The inclusion of one particularly unattractive option has been shown to have an effect on revealed preferences (Huber & Puto, 1983; Simonson, 1989) in surprising ways.

Fifth, it seems to have become quite a common practice that the two categories of individualistic and competitive orientations are merged to form one group which is then compared to DMs in the prosocial category (see e.g. Joireman et al., 2004; Utz, 2004; Stouten et al., 2005; De Kwaadsteniet et al., 2006; Cornelissen, Dewitte, & Warlop, 2007; Van Prooijen et al., 2008; Van Den Bos et al., 2009). Obviously such a procrustean approach sacrifices valuable information. This collapsing across categories is not an intrinsic limitation of the Triple-Dominance SVO measure, but rather a regrettable convention that has evolved with it when the number of participants per category is considered to be too low (see e.g. Van Lange & Liebrand, 1991) to support certain types of statistical analyses.

Sixth, offering the nearly identical choice nine times may induce participants to vary their responses in unexpected ways. In some cases, this variation may be a reflection of their honest preferences. For example we had one participant from pretesting explain during debriefing that he answered about half of the items individualistically and the other half prosocially. His goal, he explained, was to be nice, but not *too nice*. This participant treated the scale holistically and made a set of answers that, when considered in total, were sensible. But this sensible set of responses would have resulted in an uncategorizable result using the standard scoring rule. In other cases, participants may become bored or suspicious of answering the same item repeatedly and thus vary their answers. Ironically, this high degree of redundancy in the Triple-Dominance Measure

[12] The data from Murphy et al. (2011) allow for a comparison between the different scoring procedures. In order to facilitate a comparison, the categorical data from the normal scoring procedure are treated as ordinal, or dichotomous (combining competitors and individualists). The test-retest reliability of the Triple-Dominance measure is $r_{spearman}$ = 0.801, or r_{phi} = 0.798, respectively. However, the Pearson correlation between the number of cooperative choices at time one and time two is only r = 0.692, and between the sum of payoffs allocated to the other at time one and time two it is r = 0.621.

may undermine its ability to classify participants. For example, in the study conducted by Kuhlman and Marshello (1975a), the percentage of unclassifiable participants was 25% (42 out of 167), Kuhlman, Brown, and Teta (1992) report 29.3% (41 out of 140) unclassifiable participants, and Sheldon (1999), who made use of the Kuhlman and Teta measure, even applied an alternative, and problematic, scoring method after having lost 27% (25 out of 90) of the participants for analysis because they were not classifiable.

The greatest advantage of the Triple-Dominance Measure is probably its high efficiency. The measure focuses on only the three most commonly observed archetypal SVOs, and can be completed by a subject in less than five minutes. Furthermore, data evaluation is straight-forward and not time-consuming. Due to these features, the method can be regarded as a quick and simple way to assess SVO.

With respect to the psychometric properties of the measure, results indicate medium quality. The measure shows satisfying test-retest reliability. Usually, about 70-75 per cent of subjects are categorized into the same SVO category at two different points in time (see, for instance, Murphy et al., 2011; Van Lange & Semin-Goossens, 1998). In terms of convergent validity with other SVO measures, results are scarce and less consistent. While Murphy et al. (2011) report satisfying convergent validity (in terms of categorical agreement with the Ring Measure [67%] and the Slider Measure [74%]), Parks (1994) found no association at all between a variant of the Triple-Dominance Measure and the Regression & Clustering approach (discussed later in this paper) by Knight and Dubro (1984). Data on the predictive validity of the 9-Item Triple Dominance Measure are plenty and usually show small to medium effect sizes in a variety of domains (see, for instance, De Cremer & Van Lange, 2001; Van Lange, Bekkers, et al., 2007; Van Vugt, Van Lange, & Meertens, 1996), although counterexamples of lacking predictive validity exist as well (see Joireman et al., 2004; Parks, 1994). In sum, we regard the psychometric properties of the Triple-Dominance measure as sufficiently strong but with room for improvement (see also Au & Kwong, 2004; Bogaert et al., 2008).

Rank correlation technique with decomposed games. Another measurement technique that relies on decomposed games for assessing SVO was introduced by Iedema and Poppe (1994a, 1994b, 1995). Iedema and Poppe presented DMs with pairwise comparisons of eight (or nine) different own/other payoff allocations, resulting in a total of 28 (or 36, respectively) allocation decisions. Then, ranks were assigned to the payoff allocations for each participant according to how often each of these alternatives had been selected. Prior to this assessment, Iedema and Poppe had compiled ideal rank orders of the alternatives with respect to six different idealized social orientations (individualism, altruism, equality, cooperation, competition, and maximin). The assessed rank orders were then correlated (Spearman's rank order correlation) with each of the six ideal rank orders for each participant, yielding six correlation coefficients per participant, each of which was indicative of the relation between the participant's rank order and the corresponding ideal rank orders of the six social orientations. These coefficients were then transformed into Fisher Z-scores ranging from -3 to $+3$ and participants were classified to a particular SVO category matching their highest Z-score, provided that this score was greater than a predetermined threshold. In one instance a threshold of 0.55 (which corresponds to a correlation coefficient of 0.50) (Iedema & Poppe, 1994a, 1994b) was used. In another instance, a threshold of 0.881 (corresponding to a correlation of 0.707, reflecting the threshold of 50% explained variance) (Iedema & Poppe, 1995) was required.

Iedema and Poppe's rank correlation method allows for the detection of particular motives that originally were not part of the SVO concept as proposed by Griesinger and Livingston (1973), but were introduced later by MacCrimmon and Messick (1976), namely inequality aversion (or egalitarianism) and the maximin orientation. However, this is not a unique advantage of this method since other measures, such as Schulz and May's Sphere Measure (discussed later in this paper), can assess these motives as well. One advantage of the measure is that a person's rank order of preferences can be estimated, since Z-scores are obtained for all of the six predefined social motives and can thus be compared to each other. Nevertheless, the method is not very efficient. It employs more than three times as many items as the Triple-Dominance Measure for assessing only twice as many motivational orientations, yet the output is still categorical. Moreover, the data evaluation procedure for computing the categorical output is fairly complicated, which further diminishes overall efficiency. Also, to our knowledge, there are no data available on the method's psychometric properties, which precludes a direct comparison with other methods in terms of measurement quality.

Utility measurement

Utility measurement in general refers to the systematic estimation and mapping of how subjectively valuable payoffs, goods or outcomes are to a DM. Utility is an abstract construct that is inferred from the revealed preferences of DMs as they make choices among available alternatives. These alternatives can include "bundled outcomes," sets of discrete goods that are considered and evaluated as a whole set. Obviously, the utility of these bundled outcomes results from the constituent parts therein. However, the way a DM integrates information about the items and makes tradeoffs between them may not be so obvious. Early studies of these kinds of choices by Thurstone (1931) involved participants making paired comparisons between sets of goods (e.g. [2 hats, 4 pairs of shoes] vs. [3 hats, X pairs of shoes]) where X was varied systematically by the experimenter. This approach yielded an estimated value of X where a DM was indifferent between the sets. Given fungibility and an indifference point, the relative contribution of the discrete items to the bundle's overall utility could be inferred and a personal exchange rate could be estimated between disparate objects.

With respect to social preferences, joint allocations are viewed as "bundled outcomes" that have at least two distinct potential outcomes for a DM – the payoff for the self and the payoff for another. Individual differences emerge because different people place different subjective values upon these sources of utility and make different subjective tradeoffs when evaluating the bundle as a whole. Although the notion of utility is most closely associated with microeconomics, this framework is consistent with functional measurement (Anderson, 1970), specifically in the context of information integration theory (Anderson, 1968). Revealing preferences from finding indifference, and subsequent utility estimation also has a long history in psychology, including Thurstone (1931), Luce and Raiffa (1957), and Kahneman and Tversky (1979).

Utility measurement described. The approach of using utility estimation in the context of own-other-outcome bundles is not a new idea. Francis Edgeworth conjectured that between pure selfishness and pure prosociality (or in his words - *Pure Universalistic*) there are a wide range of middle orientations. He wrote:

> For between the two extremes Pure Egoistic and Pure Universalistic there may be an indefinite number of impure methods; wherein the happiness of others as

> compared by the agent (in a calm moment) with his own, neither counts for nothing, nor yet "counts for one," but counts for a fraction. (1881, p.16)

From this, one can readily see that the idea of utility in social contexts as being affected not only by one's own welfare, but also by the welfare of others, is not new to economics. Edgeworth postulated that the welfare of others does not have the same impact on one's happiness as one's own welfare, but instead has some lesser fraction of that impact. The magnitude of this fraction is an index of prosociality. The coefficients or weights attached to the outcomes of others as specified in utility functions is a modern interpretation of what Edgeworth discussed when using the term *fraction* in this context. Narrow self interest is just the special case where an individual's coefficient for other's outcomes is equal to exactly 0.

The employment of utility functions for representing social preferences is standard in economics, and a multitude of different other-regarding utility models have been posited to date (e.g. Bolton & Ockenfels, 2000; Charness & Rabin, 2002; Cox, Friedman, & Gjerstad, 2007; Dufwenberg & Kirchsteiger, 2004; Falk & Fischbacher, 2006; Fehr & Schmidt, 1999; Geanakoplos, Pearce, & Stacchetti, 1989; Levine, 1998; Loewenstein, Bazerman, & Thompson, 1989; Rabin, 1993). However, in economic research, model parameters are estimated or inferred mainly from behavior in strategic situations. This is problematic since behavior in these situations is a function of both preferences and beliefs, and distinguishing between these two factors *ex post* is impossible. Decomposed game techniques were introduced precisely for the reason to overcome this problem by eliminating the possibility of strategic considerations as co-determinants of behavior in interdependent situations. Non-strategic own-other payoff allocation tasks, such as Dictator Games, have also been used for studying social preferences in economics, though. For example, by employing a set of such allocation tasks, Andreoni and Miller (2002) showed that the vast majority of peoples' choice patterns can in principle be represented by a utility function which incorporates payoffs for others, and thus social preferences are rationalizable in a rigorous axiomatic framework.

In psychology, the framework of using joint utility evaluations was chosen by Wyer (1969) who used it to successfully predict choice behavior in particular classes of strategic games. His approach transformed preferences for outcome allocations into utilities. Wyer, as well as Griesinger and Livingston (1973), modeled the utility of joint allocations as a linear combination of the weighted outcomes for the self and for another. Wyer used a utility function with the form

$$u(P_S, P_O) = (\mathbb{1} w_1 P_S) + ((1 - \mathbb{1})\, w_2 P_S) + (w_3 P_O) \qquad (2)$$

where P_S represents the outcome for self, P_O represents the outcome for other, coefficients $w_{1,2,3}$ represent weights of the respective outcomes and $\mathbb{1}$ is an indicator function which yields the value of 1 if $P_S > 0$ and 0 if $P_S \leq 0$. In his experiment, Wyer used a 21-point rating scale to assess the desirability of allocation outcomes. Participants were asked how much they would like, for example, a distribution of 2 points for themselves and −3 points for another. The scale ranged from between −10 and +10 in interval steps. These desirability ratings were then inserted into the above formula as an estimated utility value, conditional on that particular allocation (in this example $P_S = 2$ and $P_O = -3$). After a series of ratings were obtained from a research participant, the weights $w_{1,2,3}$ were estimated by ordinary least-squares fitting.

Different sets of weights indicate different social orientations. Considering instances of positive outcomes, a person with an individualistic orientation would have a high positive w_1 weighting and a w_3 weighting close to zero. Prosocial individuals would have positive values for both w_1 and w_3 that are similar in magnitude. Wyer showed that the competitive orientation would be reflected by a positive w_1 and a negative w_3.

More complex utility models have been posited. For example, second order polynomials have been used to account for joint utilities. Radzicki (1976) used a conjoint measurement technique to identify a best fitting utility function. Participants were asked to make rankings of 25 joint allocations from the most preferred to the least preferred distributions. These rankings were then analyzed and linear programming methods were used to determine the form of the utility function that fit the particular rankings best. This method yielded a particular utility function, along with weighting coefficients, for each of the DMs. Radzicki found that simple linear functions fit 41% of the participants' rankings best, whereas for 8% of the participants' rankings, none of the considered functions fit the ranking data sufficiently. In many cases though, non-linear functions exhibited a significantly better fit to the data than simple linear models. For example, for people with non-linear joint preferences who were concerned with equality in outcomes, the six parameter function which best fit was of the form

$$u(P_S, P_O) = aP_S + bP_O + cP_S^2 + dP_O^2 + e(|\, P_S - P_O \,|^q) \qquad (3)$$

where $0 \leq q \leq 1$ and the other parameters are unrestricted. Although the simplicity of linear models is convenient and in many cases sufficient to describe choice behavior with respect to joint allocations, non-linear models allow for more sophisticated descriptions of choice behavior and are able to account for more complicated patterns in data. Non-linear approaches are suggested by MacCrimmon and Messick (1976), and Wyer (1969) noted that non-linear relations between given outcomes and their utilities could well be possible, if not probable, when payoff amounts exceed a certain range of values under consideration. For example, the increase of a payoff amount from one dollar to two dollars is probably not equally valued as an increase from 500 dollars to 501 dollars with respect to utility. From this point of view, non-linear models are justifiable when the values of outcomes presented to decision makers vary widely in the amounts under consideration.

Discussion of utility measurements. As McClintock and Van Avermaet (1982) noted, the approach of using utility functions for the evaluation of social preferences as performed by Wyer (1969, 1971) or Radzicki (1976) and others (e.g. Messick & Sentis, 1985; Loewenstein et al., 1989) is focused on building simple models that adequately describe the assumed combinatory rules underlying preferences within the framework of own-other-outcome allocations and theoretically allows for an infinite number of possible social value orientations. Therefore, these models do not state particular SVOs *a priori*, but rather let SVOs be inferred from the weight values provided by the resulting fitted utility functions. By contrast, methods following the line of Messick and McClintock (1968) – such as the Triple-Dominance Measure or decomposed games in general as well as the Ring Measure – are more concerned with the "substantive nature" (McClintock & Van Avermaet, 1982, p. 59) of SVO. That is, the existence of a number of predefined SVOs is assumed *a priori* and the emphasis is placed upon measuring them directly by letting people choose between two or more outcome allocations that are indicative of particular archetypical social orientations.

Nevertheless, there are certain problems with the use of utility measurement for assessing SVO. First, when SVOs for different persons are expressed using different functional forms, each representation potentially containing a different number of parameters, it

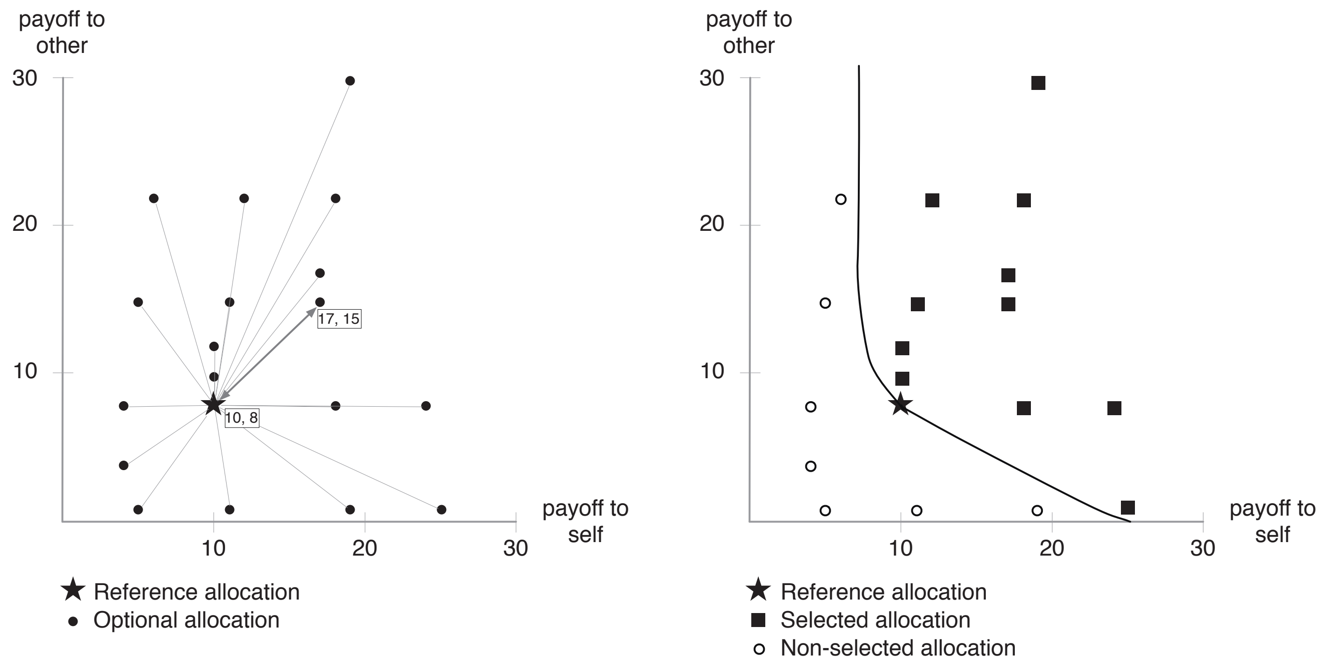

Figure 4. An example of the indifference curve method. The left panel shows 18 pairs of potential allocation choices that a participant would consider. Each of them has in common the Reference Allocation. Each of the Optional Allocations is either chosen over the Reference Allocation or not. The resulting pattern of preferred options can be used to identify an indifference curve which necessarily intersects the Reference Allocation point.

is difficult to compare or aggregate results. For example, Radzicki's method is likely too flexible to be useful and certainly over-fits rating data that are at least in some part measurement error. However, the problem of interpersonal comparability can be solved by employing only one functional form for model fitting. This way, all subjects can be described in terms of individual best fitting values of the same model parameters, which allows for interpersonal comparisons.

Second, DMs are not making choices in the utility estimation methods described above, but rather judging the attractiveness of different hypothetical allocations. Rating procedures, such as the one applied by Wyer (1969), make strong linear assumptions of the response scale which are likely not met, especially given the scale's structure (a 21-point rating scale!). Eliciting judgments rather than choices introduces a level of abstraction that does not offer clear benefits. Moreover, inducing participants to honestly report their preferences by incentive compatible methods is not easily accommodated with judgment tasks like the ones suggested above. However, this limitation is, of course, not inherent to the method of utility measurement in general.

Since utility measurement is a whole methodology class – which is not restricted to the assessment of social preferences – rather than a particular SVO measurement instrument, its evaluation on the basis of our predefined set of criteria is complicated. The criterion of psychometric properties, in particular, is not readily applicable here. However, the approach can be partially evaluated in terms of the remaining three criteria. With respect to output resolution these methods facilitate continuous, and even multidimensional, data. Nevertheless, the generation of this high resolution output is costly. Model fitting procedures require the use of sophisticated quantitative tools and their application can be quite demanding and time-consuming for researchers. Whether the method can be regarded as more or less efficient depends on the purpose of its use. While it can be considered as highly efficient when employed for the purpose of investigating the nature of social preferences itself, it is quite inefficient when SVO is assessed in an experiment in order to explore its simple linear relationship with other variables. The greatest advantage of utility measurement is its flexibility, which is unique in comparison with the other methods discussed in this paper. All that the method requires is data on preference orderings, that is, choice data, rating data, or data on comparative preference judgments. Hence, the data could be based on option sets involving gains and losses, or tangible objects rather than money. Due to this flexibility, the method can be used in basically any experimental context.

Indifference curves: **Measuring SVO graphically**. In addition to utility functions as representations of different SVOs, indifference curves too can be used as a representation of preferences for different joint outcomes. Consider a set of curves plotted on a two-dimensional plane defined by the payoff to self on the x-axis and payoff to another on the y-axis. Radzicki (1976) depicted indifference curves resulting from a utility function corresponding to the best fit of participants' rating data.

Another innovative approach along these lines was developed by Harrison (1998) who conducted what he termed an "indifference curve experiment" based on a procedure described by economists MacCrimmon and Toda (1969) and similar to the approach by Thurstone (1931). Harrison requested participants make several pairwise choices between various joint allocations of money. For example, participants chose between an allocation of \$10 to themselves and \$8 to another, or say \$17 for themselves and \$15 to another.

The first optional distribution was referred to as the “reference allocation” and for a set of choices was always the same bundle. After multiple choices are made, the researcher can infer an indifference curve running through the reference point and the boundary between those allocations that were preferred over the reference allocation and those allocations which were not preferred over the reference allocation (see Figure 4).

By repeating this procedure and using a different reference allocation point, an arbitrary number of indifference curves can be discerned, resulting in a contour map consistent with a DM’s SVO. This measurement procedure can be done to an arbitrary level of precision depending on the number of choice sets presented to a DM. The example depicted in Figure 4 shows how one indifference curve can be inferred from 18 distinct pairwise choices; these are stimuli from Harrison (1998).

It is worth noting that such a procedure has some advantages. First, participants are presented with pairwise comparisons rather than multiple comparisons or abstract rating scales. Furthermore, no *a priori* assumption about the existence of a number of predefined social value orientations is needed, while the indifference curve patterns resulting from the procedure allow for interpretations regarding the extent to which they are consistent with respective SVOs. This method can also quickly identify intransitive choice sets or random responding from particular participants, as no indifference curve can be inferred from their allocation decisions. It can also readily accommodate incentive compatible choices.

This approach, however, also has some limitations. First, the resulting indifference curves are identified heuristically and not analytically. This means that a curve is “eye-balled” into place in order to divide the chosen points from the non-chosen points. An undeterminable number of bivariate functions could yield a curve that separates the chosen options from the non-chosen options while intersecting the reference allocation. Identifying the best fitting curve is impossible given the low resolution of the choice data and the heuristic method of curve fitting does not lend itself to parameterization. In order to address this issue, a researcher could specify a functional form for the joint utility equation (similar to Radzicki, 1976), and then roughly estimate an underlying utility function with parameters that are consistent with the choices. Although this would quantify the heuristic indifference curve to some degree, the resulting joint utility function and parameters are not easily comparable between participants given the variety of functional forms that may be used to rationalize the underlying set of binary choices. Another shortcoming with this approach is the relatively large number of choices a DM is required to make in order to infer one indifference curve. In the example shown in Figure 4, which is based on stimuli from Harrison (1998), 18 binary choices were used to approximate just one indifference curve. With respect to our predefined set of criteria, the indifference curve approach has the same properties as utility measurement in general.

The Social Behavior Scale

The Social Behavior Scale comes from developmental psychology and was devised as a measure that controls for individualism by keeping the payoff to the DM constant and varying only the payoff to the other. Consequently, decision makers are not given the opportunity to maximize their own gain by choosing a particular alternative, but only have control over the outcome for another.

The Social Behavior Scale described. The Social Behavior Scale is a choice task with four alternatives as shown in Figure 5. The alternatives are: rivalry & superiority; superiority; equality; and altruism & group enhancement. Outcomes for self and other are depicted as small squares and labeled as valuable “chips.” This measure was devised by Knight and Kagan (1977) in an effort to study the social behavior of young children from different ethnic groups. In their experimental study, children were told that the more chips they acquired, the more toys they would receive. This “currency” is easily comprehensible and can be presented without any numerical abstraction, ideal for use with children, especially when there may be differences with respect to their formal educational experience. Participants were asked to choose one out of the four alternatives according to their preferences.

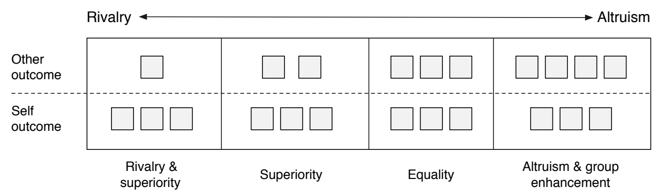

Figure 5. The Social Behavior Scale showing potential distributions of valuable items between the DM and some other person.

Discussion of the Social Behavior Scale. As a result of its properties, especially with regard to assessing individualistic orientations, the Social Behavior Scale is too restricted to be an appropriate measure for SVO in general. Of course, one can readily imagine an alternative form of the Social Behavior Scale, where individualism is not strictly controlled. In fact, a variant of the Social Behavior Scale called the Social Orientation Choice Card with a classical triple-dominance structure is available (Knight, 1981). We can imagine numerous alternative forms of that kind which present allocation decisions across a range of different outcomes with simplified stimuli. Such methods can be advantageous when conducting studies with children or populations not accustomed to quantified information, as was the case in Knight and Kagan’s research. Since the Social Behavior Scale can be regarded as a nonmonetary payoff variant of a decomposed game measure, it receives a similar evaluation as the Triple-Dominance Measure with respect to our predefined criteria. The measure consists of only one item which subjects answer several times, and the subjects are categorized according to their modal choice. Hence, the method is efficient in terms of time required for completion and output computation. However, output is categorical. To date, the measure has been used exclusively to study the development of SVOs in children, such that no data on its predictive validity with respect to other variables are available. However, there is some data on the measure’s convergent validity with the Regression and Clustering approach (see Knight & Dubro, 1984, discussed later in this paper) showing 66.7% categorical agreement. Also, Knight and Kagan (1977) report on data hinting at the measure’s test-retest reliability. They report a correlation of 0.72 between the total number of chips allocated to other at two points in time separated by 2-5 days[13]. As discussed earlier in this paper, the scoring rule of counting the payoffs allocated to the other is problematic, though, and complicates interpretation of results. From the data available, we can only infer that the measure’s psychometric properties are satisfying at best.

[13] The conditions at the two points in time varied slightly. In one condition, the receiver was imaginary, and in the other condition there was a real and visible, but passive receiver.

The Ring Measure

The Ring Measure is a method from social psychology for assessing SVO that uses a series of dichotomous allocation decisions and derives an SVO score from the combined results of the choices. This value is then used for assigning that participant to one of the archetypical SVO categories. The method is based on the notion that joint payoffs can be represented on a Cartesian coordinate system where payoffs to the DM are represented on the *x*-axis and payoffs to another person are represented on the *y*-axis (see Figure 1). This idea is consistent with the geometrical model which was devised by Griesinger and Livingston (1973), who stated that a person's SVO can be conceptualized as a vector with a certain direction and magnitude in the joint payoff plane. The utility of a particular payoff allocation can then be expressed as the scalar product of the motivational vector with the vector of the given choice, or in other words, the projection of the given choice vector on the motivational vector. Consequently, a person will always choose the payoff allocation with the greatest projection on his or her motivational vector. Further, the angle of the motivational vector is indicative of a person's social preferences. For example, a motivational vector at the angle of $\theta_M = 45°$ represents a prosocial orientation, whereas an individualistic motivation is represented by a vector at $\theta_M = 0°$ (see Figure 1). Following this conceptualization, Liebrand (1984) developed and established the Ring Measure as a novel method for categorizing participants into the archetypical SVO classes (see Table 2).

The Ring Measure described. The Ring Measure presents DMs with a set of *N* dichotomous allocation decisions that are defined by *N* equidistant points on a circle centered at the Cartesian origin ($x = 0, y = 0$). Each pair of adjacent points (defining a chord on the circle) serves as the two distribution options, and the DM makes a series of choices over these different allocations. Researchers have set the value of *N* at both 24 (Liebrand & McClintock, 1988) and 16 (Liebrand, 1984).[14] To date, the Ring Measure has generally been implemented by a defining center point at $(0, 0)$, yielding both positive and negative allocation values. However, to facilitate comparison with other measurement methods presented in this paper, the distribution values have been standardized to range between 0 and 100 (see Figure 6). This is equivalent to defining a ring with a center at $(50, 50)$ and a radius of 50 units.

After a research participant has made her *N* allocation choices, a vector is computed by adding her chosen options together, thus yielding two numbers (the sum of money the participant allocated to herself, and the sum of money the participant allocated to the other person). The resulting point can be interpreted as a vector (using the center point of the ring as its origin). The angle of this vector corresponds to a person's SVO and can be computed by

$$\theta = \arctan\left(\frac{(\sum P_O)}{(\sum P_S)}\right) \tag{4}$$

where $\sum P_O$ is the sum of payoffs selected for the other person and $\sum P_S$ is the sum of payoffs allocated to the self. The length of the vector from the center of the ring indicates the internal consistency of the DM's allocation decisions. If a person makes inconsistent choices, the result is a shorter vector. Perfectly consistent choice sets have the property of having one option being chosen twice (the most preferred distribution in the whole set), one option never being chosen (the least preferred allocation), and the remaining allocations being chosen exactly once (see Figure 6 for an example of a perfectly consistent choice pattern). The vector resulting from a perfectly consistent set of choices will have a length equal to twice the radius of the circle used to generate the items, conditional that the center of the circle is fixed at the Cartesian origin. Because of the structure of items in a Ring Measure, the more rigorous property of preference *transitivity* can rarely be evaluated for a participant's set of choices as there is only one possible Hamiltonian cycle in the set of items. Only the weaker condition of *consistency* with a single underlying motivational vector can be evaluated with any fidelity.

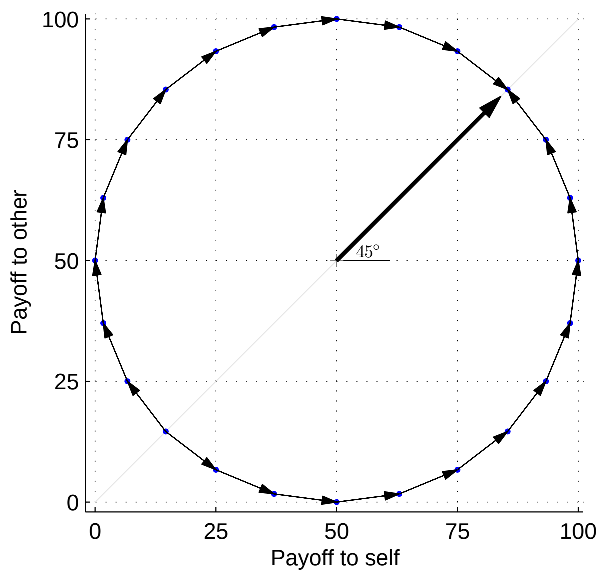

Figure 6. Here the 24 allocation choices on a Ring Measure are represented graphically. The smaller arrows correspond to a set of hypothetical choices by a prosocial DM and the points to the joint allocation options. For each set of options, the DM selected the option that maximized joint gain, as indicated by an arrow pointing toward the more preferred joint allocation. This pattern of results reveals an underlying preference vector that is represented by the large arrow. Its angle (in this case +45°) serves as an elegant summary of the DM's social preferences as revealed by her choices of resource allocations.

When the angle of a person's vector is determined, that person is assigned to one of the eight SVO categories listed in Table 2. In order to prevent invalid classifications, DMs were typically only classified if the consistency of their choices was at least 60%. However, there is some variety regarding the standards for establishing a classification. For example, some classifications are made with a 50% consistency level (e.g. Van Lange, 1999) or, in other cases, only if a vector is not shorter than a quarter (e.g. McClintock & Liebrand, 1988) or even a fifth (e.g. Dehue, McClintock, & Liebrand, 1993) of the maximum possible vector length.

Discussion of the Ring Measure. Upon first consideration, the Ring Measure's agnostic method of defining items evenly over the complete circle may appear to be a sensible approach. However

[14] Liebrand (1984) employed 16 equally spaced pairs of outcomes on each of two circles (A and B) with radii of $7.00 (circle A) and $8.50 (circle B), resulting in a total of 32 outcome pairs as choice allocations.

there is overwhelming evidence demonstrating that SVOs are not uniformly distributed among people and that the vast majority of DMs do not appear to attach negative weight to their own payoffs. Therefore, using items uniformly from the whole space of possible preferences is inefficient. The structure of the Ring Measure assigns equal value to all of the items, including the following two: (1) Is a person more prosocial or more individualistic? (2) Is a person more of a martyr or more of a masochistic? Clearly the first question is more useful in trying to understand the motivations of typical DMs. But, because of its blanket approach, the majority of items contained in the Ring Measure provide no useful information about the motivations of the person answering them. The only items that offer any useful diagnostic information are those with slopes that are nearly perpendicular to the underlying motivational vector of the decision maker. This agnostic approach results in a highly inefficient research tool.

Second, the Ring Measure fails to classify a significant number of participants due to inconsistent choice behavior. In their analysis of several studies that applied the Ring Measure, Au and Kwong (2004) reported up to 20% unclassifiable participants and in two experiments performed by Liebrand (1984), the percentage of unclassifiable participants across the two experiments was 15%. In analyzing these percentages, one has to take into consideration that Liebrand (1984) used a 60% consistency criterion, whereas in at least some studies analyzed by Au and Kwong, a 50% consistency criterion was chosen (e.g. Van Lange, 1999). Part of this inconsistency could be the result of asking for people's preferences across such a wide range of potential allocations, some of which the DMs may have only weak preferences about. For example, we have evidence that people show less consistent choice behavior in the items located in quadrants two and three of the Cartesian plane (i.e. the left side of the ring) compared to items located in quadrants one and four (i.e. the right side of the ring). Using the ratio $\frac{(\sum P_O)}{(\sum P_S)}$ as unit of analysis, we found a test-retest reliability of 0.617 for the left half of the ring compared to 0.702 for the right half of the ring.[15] These results indicate that the Ring Measure could be improved by cutting it in half with a vertical line, and only using the items located in quadrants one and four of the Cartesian plane. The resulting Half-Ring Measure has been used in the past (e.g. Balliet, 2007; Joireman, 1996), but with only limited success.

Third, inequality aversion would manifest itself as inconsistency in the Ring Measure. The 45° diagonal line from the origin intersects the ring in two places; the point in the northeast part of the ring corresponds to both minimizing inequality as well as maximizing joint gain, whereas the point in the southwest part corresponds to minimizing inequality but minimizing joint gain. If a DM were sufficiently motivated by inequality aversion, she would produce an inconsistent set of allocations which would result in a shorter vector. The Ring Measure does not address this limitation. And a further complication is that in some studies, the Ring Measure had both positive and negative outcomes. Given the evidence of how losses loom larger than gains (Kahneman & Tversky, 1979), it is possible that DMs make different tradeoffs when considering positive outcomes versus negative (or mixed) outcomes. Lastly, the presence of losses makes it a challenge to implement the Ring Measure in an incentive compatible way as taking money from research participants is generally verboten.

Fourth, although the Ring Measure produces scores in terms of angular degrees, its final output is categorical. As discussed earlier in this paper, one reason for discarding the continuous information may have been that the conceptual interpretation of a Ring Measure angle is two-dimensional, rather than unidimensional. That is, the angle summarizes the weight one attaches to the other one's outcomes as well as the weight one attaches to own outcomes. If only the right half of the ring is used, an angle's interpretation is unidimensional, referring to the weight one attaches to the outcomes of others in relation to the own, such that the angle can be used as a continuous SVO score as employed by Balliet (2007), for instance. Nevertheless, the Ring Measure in its original form predominates, and so does the practice of categorization.

The psychometric properties of the Ring Measure are marginal to weak. In terms of agreement with other SVO measures, Liebrand and van Run (1985, p. 94) report that only 52.54 percent of 236 subjects were categorized into the same SVO category by both the Ring Measure and another decomposed game procedure (see Kuhlman & Marshello, 1975a). Only when altruists and cooperators were combined, the categorical agreement reached a satisfying level (73%). Murphy et al. (2011, p. 775-776) report satisfying categorical agreement of 67% with the Triple-Dominance Measure and 75% with the Slider Measure (discussed later in this paper). In terms of test-retest reliability, Murphy et al. (2011, p. 775) report that the Ring Measure categorized 68% of the subjects into the same SVO category at both of two points in time separated by two weeks. This result is consistent with findings from Dehue et al. (1993, p. 280), who report 70% consistency across a two month period. Although SVO as assessed with the Ring Measure has often been shown to be significantly associated with cooperative behavior in social dilemmas (e.g. Liebrand, 1984; Liebrand & van Run, 1985; Offerman, Sonnemans, & Schram, 1996; Smeesters, Warlop, Van Avermaet, Corneille, & Yzerbyt, 2003; Sonnemans, Schram, & Offerman, 1998), effect sizes are rarely reported, which hinders the proper estimation of the method's predictive validity.

Circle−test: **A one−item version of the Ring Measure**. Sonnemans, Van Dijk, and Van Winden (2006) conducted a study in economic psychology which required that participants complete an SVO measure four times within the context of an ongoing public goods game. To these ends, the researchers modified the Ring Measure so that participants had to make only one allocation decision to yield an SVO score. They termed this modified Ring Measure the "Circle Test." In the Circle Test, participants were provided with a graphical representation of the SVO Ring on a computer screen (similar to Figure 1). Participants were then requested to make their joint allocation decision by clicking on the arc of the circle somewhere. Once a position was tentatively chosen, the corresponding vector appeared on the screen as an arrow. Participants then could, if they wanted to, change the angle of the vector while seeing how these changes affected the payoff allocations for themselves and the other person. Once a participant found her most preferred joint allocation, she confirmed her decision and this completed the measurement.

The Circle Measure is a highly efficient measure of SVO, requiring only one allocation choice be made in order to yield a continuous score for a person (see also Van Winden, Van Dijk, & Sonnemans, 2008). But one disadvantage of this brevity is that no information about measurement reliability can be gained. As the circle measure has only one item, it is not possible to check whether the choice is transitive or consistent with respect to other choices. The measure does not provide any possibility to assess the magnitude of measurement error, and at the extremes cannot asses if a participant responded veridically or randomly. Another limitation is that the changes in payoffs that correspond to movements on the arc are non-linear. The visual representation is straight forward but the underlying tradeoffs that occur as a DM moves between different

[15] These results are obtained with data from Murphy et al. (2011).

points on the arc are non-intuitive. The arc defining the joint payoffs is necessarily curved (its second derivative is non-zero), thus not only are the joint payoffs changing as a DM adjusts the allocation vector, but the rate of change for each of the payoffs is also changing. DMs may mitigate this complexity by selecting cardinal points on the circle rather than points consistent with their more nuanced actual preferences. Lastly, secondary preferences about different allocation options remain unknown when using the circle measure and inequality aversion remains indistinguishable from joint gain maximization.

In contrast to typical practice, Sonnemans et al. (2006) used the SVO angle as the dependent variable, rather than categorizing subjects according to it. Since 98% of their subjects' angles ranged between -45° and +45°, using the angle as a unidimensional continuous scale can be justified and is sensible. To our knowledge, there are no data available on the Circle test's psychometric properties. With respect to the criterion of particular advantages, we acknowledge that the Circle test is the briefest method yielding high resolution output. However, since no data are available on measurement reliability and validity, it is not possible to estimate the drawbacks associated with the method's high efficiency.

Regression and clustering approach

Consistent with judgment (e.g. Wyer, 1969, 1971) and conjoint measurement techniques (e.g. Luce & Tukey, 1964; Sawyer, 1966; Radzicki, 1976), Knight and Dubro (1984) developed another method for assessing social preferences that applies regression and cluster analysis to a set of well structured preference judgments.

Regression and clustering approach described. To obtaining preference data, Knight and Dubro had participants rate the desirability of joint allocations on a 7-point scale, where the possible allocations were composed of all combinations of payoffs ranging from 0¢ to 6¢ in increments of 1¢, resulting in a total of 49 possible allocations and the same number of ratings. Then, for each person's ratings, a multiple regression equation was used to model the desirability ratings, while three predictors were used in the analyses: own gain (number of cents for self), other's gain (number of cents for the other) and equal gains (difference between the own gain and the other's gain). The resulting regression coefficients were then used in a cluster analysis which yielded six general clusters. These clusters were interpreted as different categories of SVO: *equality*; *group enhancement*; *superiority*; *individualism*; *equality & individualism*; and *individualism & superiority*.

Discussion of regression and clustering approaches. The similarities between the utility measurement approach as proposed by Wyer (1969), and this regression analysis method are clear. In both methods, preference data are elicited and used to compute parameter values by a least squares estimation technique. The weights attached to outcome values in the utility functions are conceptually equivalent to the regression coefficients. The novelty of Knight and Dubro's approach is the use of regression coefficients in a cluster analysis in order to classify people into SVO categories. Given the relatively high median squared multiple correlation coefficients for each of the six clusters, ranging from 0.609 to 0.858, it is clear that participants exhibited substantial consistency in their judgments of the attractiveness of different joint distributions.

One minor drawback with respect to the feasibility of the measure is that Knight and Dubro's procedure, like the utility measure approaches, makes use of more sophisticated statistical tools that may be a barrier to adoption for some researchers, especially if SVO is assessed as only one among several independent variables, for instance. Moreover, the result of this approach is still a categorization of participants into different SVO classes, while the derivation of a unidimensional, continuous scale of SVO which would facilitate analyses is not feasible through this procedure since SVO here is represented by a combination of three parameters. Therefore, the results of this technique (a simple categorization of participants) may not be worth the effort of running regression and clustering analyses. Other approaches, discussed previously in this paper, yield a similarly resolved output by means of much simpler techniques, challenging this method's efficiency. Also, we do not see any particular advantage of this method when compared to others.

With respect to the method's convergent validity with other SVO measures, Knight and Dubro (1984, p. 103) report that 66.7% of the time the subjects' cluster membership was consistent with their choice patterns in the Social Behavior Scale (Knight & Kagan, 1977, discussed earlier in this paper) and its triple-dominance variant called Social Orientation Choice Card (Knight, 1981). To our knowledge, no data on the measure's predictive validity or test-retest reliability are available.

Schulz and May′s Sphere Measure

The Sphere Measure described. On the basis of previous work on methods for assessing SVO such as utility measurement (e.g. Wyer, 1969, 1971; Griesinger & Livingston, 1973; Radzicki, 1976), the Ring Measure procedure (Liebrand, 1984), and the regression and clustering approach (Knight & Dubro, 1984), an additional way of determining people's social motivations was devised by Schulz and May (1989). They differentiate between simple linear SVOs (individualism, sacrifice, altruism, aggression, cooperation, competition), non-simple linear SVOs (all possible mixtures of simple linear SVOs), simple conditional linear SVOs (maximin and egalitarianism) as proposed by MacCrimmon and Messick (1976), and non-simple nonlinear SVOs (all possible mixtures of simple conditional and non-conditional linear SVOs). For assessing these different SVO types, Schulz and May applied two measurement methods with the goal of comparing results from each of them. First they used a ranking procedure and second they used a pairwise comparison procedure. Concretely, participants first made pair-wise comparisons between all possible combinations of 15 own-other-payoff distributions, resulting in a total of 105 comparisons per participant. After completing the pair-wise comparison task, participants were asked to rank order the same 15 payoff allocations without ties using a graphic presentation of the allocation options. The data from both methods were then analyzed by using a utility model with the general form

$$u(P_S, P_O) = aP_S + bP_O + c|P_S - P_O| \tag{5}$$

which is flexible enough to contain all of the archetypical SVO types as special cases. Roughly speaking, while the Ring Measure uses the parameters a and b for calculating the SVO angle on a two-dimensional plane, Schulz and May extend the model with parameter c, thus yielding a three-dimensional model. The third dimension is useful in accounting for conditional SVOs (e.g. egalitarian or maximin). In order to restrict the model, the authors set the condition such that $a^2+b^2+c^2 = 1$, giving the model a spherical geometric representation. Similar to the Ring Measure procedure, participants are then categorized according to their vector directions. In contrast to the Ring Measure, the Sphere Measure vector extends into 3-space and yields a point on the unit sphere rather than a point on a two dimensional circle.

Discussion of the Sphere Measure. Although Schulz and May make use of more sophisticated mathematical tools, and use a more complicated geometric representation than is reflected in previous methods, the measure still yields results at only the nominal scale level. Richer results could be extracted from the data of Schulz and May (e.g. transitivity of individual's choice sets; the angle of the projection of the inferred motivational vector on the self/other plane) but are unfortunately not. Further, this measurement method places substantial demands upon participants, requiring them to make 105 pair-wise decisions about joint payoff allocations, as well as rank order 15 different self/other allocations. Considering the resolution of the results, these demands are hard to justify. Therefore, we judge the method's efficiency as low.

To our knowledge, there are no data available on the Sphere Measure's predictive validity or test-retest reliability. Also, the Sphere Measure's convergence with other SVO measures has not been tested so far. However, Schulz and May (1989, p. 53) report 75.9% agreement between the subjects' categorization as derived from the ranking procedure and the pair comparison procedure. Hence, there is some – albeit limited – evidence in favor of the Sphere Measure's psychometric quality.

The SVO Slider Measure

Murphy et al. (2011) aimed at constructing a measurement method which combines the strengths of existent techniques while avoiding, when possible, some of their weaknesses. Concretely, they posited that a good measure of social preferences should have the following properties: 1) For pragmatic reasons, a measure should be *easy to administer*. Since SVO is often assessed as only one variable among a variety of individual differences, the measurement procedure should be time efficient, straightforward, and the measurement evaluation should not require the application of sophisticated mathematical techniques. 2) An SVO measure should be *efficient*, i.e. able to assess the empirically most relevant SVOs as reliably as possible while neglecting pathological SVOs which are hardly ever observed in the wild (e.g. sadistic, masochistic, sadomasochistic, etc.). 3) A measure should yield a *unidimensional scale of SVO at the ratio level* which facilitates further analyses and manageability. 4) A measure should be highly *sensitive to inter- and intra-individual differences*, which demands high resolution of data. 5) *Inequality aversion* has to be detectable and distinguishable from a preference for joint gain maximization. 6) A measure should allow for checking the consistency of a DM's choices in terms of *detecting intransitive choice patterns* as indicators of random responses. 7) An SVO measure should have good psychometric properties, i.e. *high reliability and validity*.

The SVO Slider Measure described. The SVO Slider Measure can be administered as an online or a paper-pencil assessment (see Figures 7 and 8, respectively). It consists of six primary and nine optional secondary items, which all have the same general form. That is, each item represents a specific continuum of own-other payoff allocations that can be explored by sliding across the options within the continuum's boundaries. The DM registers her choice by selecting the most preferred outcome. The six primary items reflect the six lines which fully interconnect the coordinates of the empirically most relevant idealized SVO types (altruistic, prosocial, individualistic, and competitive) in the cartesian SVO framework with the circle having a radius of 50 and its center at 50, 50 as shown in Figure 9. This item configuration allows for obtaining a unidimensional SVO score, determining the rank order of social preferences, and checking for transitivity in a DM's responses.

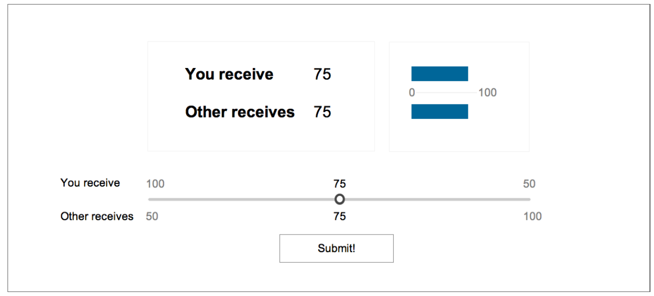

Figure 7. A screenshot of one item from the SVO Slider Measure online version. For this item, the DM is choosing between the individualistic distribution on the left and the altruistic distribution on the right. This item is unique in that there is a constant sum (150) that the DM is allocating between himself and the other person. This kind of choice is a dictator game and it is worth noting that it is embedded as part of the Slider Measure.

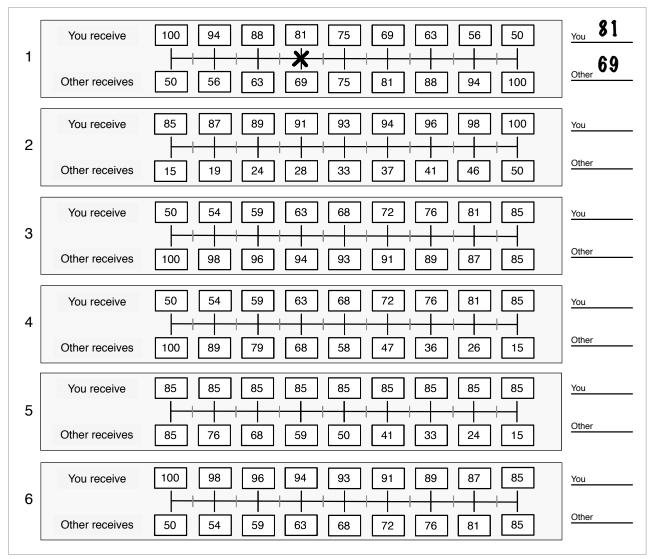

Figure 8. The six primary items of the SVO Slider Measure's paper based version as participants saw it.

After a DM has chosen her most preferred payoff allocation in each of the six primary items, her SVO angle can be calculated as follows:

$$\text{SVO}^\circ = \arctan\left(\frac{(\bar{P}_O - 50)}{(\bar{P}_S - 50)}\right) \tag{6}$$

where $\bar{P}_S$ is the mean payoff allocated to the self and $\bar{P}_O$ is the mean payoff allocated to the other. The amount of 50 is subtracted from these means in order to shift the center of the ring $(50, 50)$ to the origin of the cartesian plane such that the inverse tangent of the ratio between $\bar{P}_S$ and $\bar{P}_O$ yields a readably interpretable index, i.e. the individualistic orientation is represented by the angle $\text{SVO}^\circ = 0$. A participant's computed angle is a unidimensional, continuous scale of SVO where higher angular degrees indicate greater concern for the welfare of others, with a lower limit at -16.26° reflecting perfect competitiveness and an upper limit at 61.39° reflecting perfect altruism. If desired, participants' scores can be reduced to one of the four SVO types (altruistic, prosocial, individualistic, or compet-

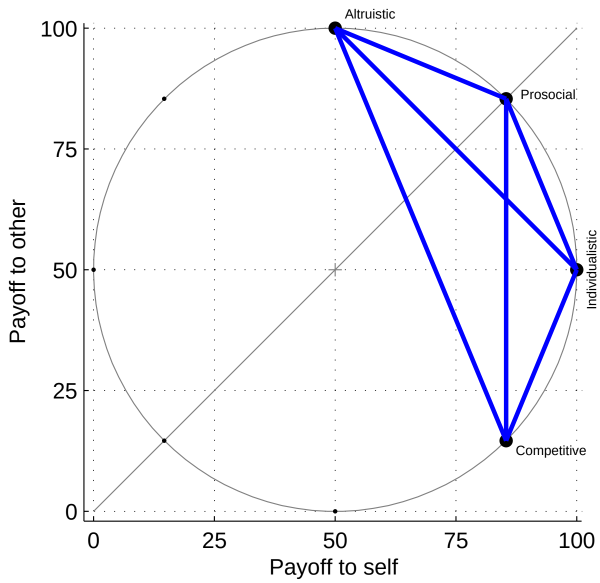

Figure 9. A graphical representation of the Slider Measure's six primary items. These items can be scored to yield an index of social preference on a continuos scale ranging from Competitive to Altruistic. The vast majority of people score in the areas of Prosocial and Individualistic but there is pronounced and reliable variance within these categories.

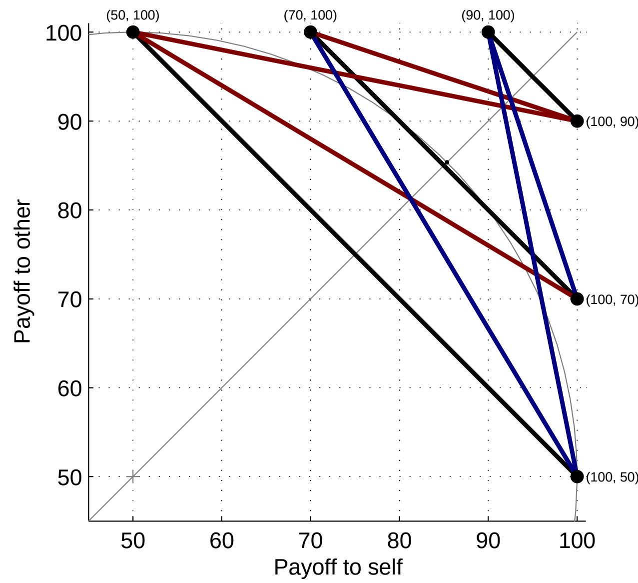

Figure 10. A graphical representation of the Slider Measure's nine secondary items. These items are designed explicitly to disentangle the prosocial motivations of *inequality aversion* and *joint gain maximization* and like the primary items yield a score on a continuum between these distinct prosocial motivations.

itive) by means of their SVO angles' values (for the details of this procedure, see Murphy et al., 2011). The categorical output may facilitate comparisons of new results with previous findings, but using the continuous scale is strongly recommended for any other data analysis.

The nine secondary items of the Slider Measure are constructed for the purpose of detecting inequality aversion and distinguishing it from a preference for joint gain maximization. Both are prosocial preferences but they are different motivations that may represent different goals for a DM. A graphical representation of these items is shown in Figure 10. The rationale behind the construction of the secondary items is the idea that inequality aversive participants will choose allocation options close to the 45° line, since these allocations minimize inequality. In contrast, joint gain maximizers will choose the options that maximize the sum of the payoffs; these points are located each at one of the endpoints of the items with a slope other than −45°. Prosocial participants can then be scored along a continuum from perfectly inequality averse to perfectly joint gain maximizing. The results from non-prosocial individuals on the secondary items are not additionally informative and typically confirm their results from the primary items. For example, an individualistic DM will answer the secondary items in such a way as to maximize their own payoff which is neither inequality averse nor joint gain maximizing. The secondary items are maximally informative regarding the more nuanced preferences of prosocial DMs.

Discussion of the SVO Slider Measure. With respect to the SVO Slider Measure's psychometric properties, Murphy et al. (2011) report a test-retest reliability of $r = 0.915$ (or 89% categorical agreement) over a one-week period, and they could show that the Slider Measure outperformed both the 9-Item Triple-Dominance Measure and the Ring Measure on that metric. Moreover, the Slider Measure exhibited good convergent validity with these two other measures, categorizing the same participants into the same SVO category as did these measures at least 70% of the time. The Slider Measure also shows moderate but significant predictive validity with respect to the binary choices in a Prisoner's Dilemma game ($r_{pb} = .24$, Murphy et al., 2011) and excellent predictive validity with respect to contributions in a linear Public Goods Game ($r = 0.47$, Murphy, Ackermann, & Handgraaf, 2012). Since the Slider Measure requires subjects to complete only six items for computing a continuous score, and because the computation of this score is straightforward, we judge the method as efficient.

An additional feature of the Slider Measure is that the data it yields (for both primary and secondary items) are amenable to mathematical modeling. Also, the data can be checked for violations of transitivity and rank orderings of SVOs can be computed. Hence, the data produced by the Slider Measure facilitate utility model fitting analyses. Several utility models of other regarding preferences have been developed in behavioral economics (see, for instance, Fehr & Schmidt, 1999; Bolton & Ockenfels, 2000; Charness & Rabin, 2002) that include constructs like efficiency maximizing, inequality aversion, fairness, and reciprocity. The psychological literature related to these same issues has developed in parallel but largely done so independently. Perhaps one reason for this schism is the lack of a common measurement method between the two fields. The SVO Slider Measure could act as a bridge to connect these two related but estranged research streams.

One drawback of the SVO Slider Measure is that it does not use a symmetric set of allocation options around the entire ring. As a result the angular boundaries used for determining which SVO category a person is assigned (when reducing data from the ratio level to the nominal level of measurement) are not at intuitive locations. For example, a perfect altruist is represented by an angle of 61.39°, and not 90°. This asymmetry is a consequence of the measure only using a subset of possible items rather than using items allocated symmetrically over the whole ring. However, while efficiency is improved, the measure's validity is unaffected by this asymmetry. It would be possible to extend the Slider Measure in such a way that it would have a symmetric set of items and thus have a rotationally symmetric convex hull of possible scores. This extended measure certainly would be more aesthetically pleasing and would have intuitive angles as boundaries between the categories. However, this extended measure would require about five times as many primary items (6 vs. 28) and would likely not yield significantly better estimations of DM's social preferences. A second related drawback of the new Slider Measure is that it does not accommodate DMs with atypical social preferences (e.g. a masochistic DM– someone with the preference to minimize his own payoff, wholly indifferent to the payoff of the other). In situations where destructive kinds of social preferences (e.g. vengefulness, rage, or spite) are of interest, the SVO Slider Measure in its current form is also likely an inadequate tool. One could imagine an extended version of the Slider Measure that spanned a greater portion of the self-other allocation plane, but such a scale has not been developed nor normed. Furthermore, the Slider Measure can not readily be used for assessing the social preferences of people unexperienced with numeric representations. The method in its original form is therefore likely not suitable for studying the development of social preferences in young children, for instance.

Summary of SVO measure evaluations

Table 4 shows an overview of the different SVO measurement methods discussed in this paper. The overview is supplemented with information about the measures' performance according to our predefined set of criteria. In the table, minus signs (–) indicate unsatisfactory performance, zeros (0) indicate satisfactory or medium performance, and plus signs (+) indicate good performance. If no or insufficient information is available to judge about a measure with respect to a certain criterion, this is indicated by a "not-available / not-applicable" sign (n/a). Regarding special features, the sign indicates a lack of particular or noteworthy comparative advantages. It is also used for evaluating output resolution of the indifference curve assessment technique, since this method produces visual output the quantification of which is possible but would require further complex computation. We are aware that the assignments of performance indications in this table are subjective to a certain degree. However, the information in this table should not be regarded as a substitution of the detailed measure discussions provided throughout this paper. Rather, it is intended to help the reader quickly assess the different measures' relative strengths and weaknesses at one glance. Also, special features of the measures are highlighted to facilitate choosing a method which is best suited for addressing a particular research question or employing a particular experimental design. However, as a general rule, we strongly suggest to use methods that produce continuous output whenever possible. This way, it is not only ensured that the SVO construct is measured as it is theorized, but also that statistical power is not unnecessarily diminished, undermining evidence for an important individual difference.

Discussion

The arc of scientific knowledge is bound by our ability to measure things. This paper is about measuring social preferences, a fundamental concept in the social sciences. We have described the concept of SVO and discussed how this construct's theory has been shaped by measurement. Further, we have provided an overview of different ways social preferences have been measured to date across a variety of different disciplines and highlighted the strengths and weaknesses of existent measures. We have also discussed a new measure of social preferences called the SVO Slider Measure that overcomes many of the limitations of previous measures and aims to bridge different research streams by establishing a common language for both theory and testing.

Social preferences are critical to understanding how interrelated DMs allocate scarce resources among themselves and others. The postulate of narrow self interest is a point conjecture, namely that *all* DMs have *exactly zero* interest in the outcomes of other people and only try to maximize their own payoffs. Although this is a useful baseline assumption in that it facilitates tractable models with precise predictions, and in many cases works remarkably well as an "as if" model (Erev & Rapoport, 1998) of decision making, there are numerous examples where it fails to account for, or even roughly approximate, real DM's choice behavior. Real people's preferences are often much richer, more nuanced, and complex than narrow self interest (see, for instance, Camerer & Fehr, 2006). Although simplifying assumptions are useful as starting points for model development, and this conjecture can serve as a very useful starting point, descriptive accuracy and theoretical insight are better supported by the development of empirically accurate descriptions of people's real preferences and motivations. High resolution measurement methods can serve to provide rich data that can be brought to bear on debates of human motivations, which are fundamental to understanding and predicting behavior in a wide variety of social settings. For example, knowing DM's individual preferences for prosocial outcomes can explain, in part, peoples' willingness to cooperate in social dilemmas (Balliet et al., 2009; Murphy et al., 2012).

A review of the literature highlights that social preferences is a rich theoretical construct that can be measured in a variety of different ways. Moreover this construct is of great interest across disciplines in the social sciences. Currently the 9-Item Triple-Dominance Measure is the most popular method for measuring social preferences and it yields at best a nominal level of measurement, often then in practice reduced further to a simple binary result (prosocial vs. individualist). This measurement method constraints thinking and theorizing about social preferences and can hamper the development of better theories to account for how people make tradeoffs when outcomes are interdependent. Paraphrasing Maslow,[16] if the only tool you have is a hammer, then everything looks like a nail. Along the same lines, if the only measurement method one has for social preferences yields a categorical outcome (prosocial or individualistic), then thinking about social preferences veers toward thinking in terms of either/or. This binary approach to contemplating individual differences and preferences is profoundly limiting. First it limits statistical power, likely contributing to the file drawer problem (Cohen, 1983; Rosenthal, 1979), which undermines our understanding of the importance of non-selfish preferences in human behavior. Secondly, it limits our ability to work with this valuable theoretical construct in a continuous way. The misfit between the theoretical conceptualization of a continuous individual difference and the predominant measurement method (which in standard practice is dichotomous), yields theories

[16] Maslow's (1966, p. 15) well known quotation: "I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail."

Table 4
Summary of SVO measure evaluations

SVO Measure	Psychometric Properties	Output Resolution	Efficiency	Special Features
Altruism Scale	–	0	0	No numerical requirements
Triple-Dominance Measure	+	–	+	n/a
Rank correlation technique	n/a	–	–	Rank ordering of SVOs
Utility measurement	n/a	+	–	Flexibility
Indifference curve assessment	n/a	n/a	–	Flexibility
Social Behavior Scale	0	–	+	No numerical requirements
Ring Measure	+	–	–	Assessment of pathological SVOs
Circle test	n/a	+	+	Brevity
Regression and Clustering	0	–	–	n/a
Sphere Measure	n/a	–	–	n/a
Slider Measure	+	+	+	Transitivity check and rank ordering of SVOs

and experiments which tend to be binary when the reality is continuous. Simply put, we all can do better.

Moreover it is worth recognizing that any point conjecture about social preferences is inadequate, not only in accounting for different people having different tastes, but also inadequate to address the variance of these preferences for the same people in different situations and contexts. Moreover, how people's preferences change, and what factors affect interdependent decision makers's willingness to make tradeoffs, is of central importance to unraveling the roots of cooperation and conflict (Pennisi, 2005). How social preferences are malleable is a deep question and efforts to address it empirically requires high fidelity measurement methods.

The notion that a DM's utility is not exclusively a function of his own material well being, but is also affected by the well being of others (No man is an island…) is not a new idea. Edgeworth (1881) explicitly postulated this notion and anticipated a wide range of social preferences along a continuum. A substantial body of evidence has been built (e.g. Cameron, Brown, & Chapman, 1998; De Dreu & Boles, 1998; Declerck & Bogaert, 2008; Eisenberger, Kuhlman, & Cotterell, 1992; Joireman, Van Lange, & Van Vugt, 2004; Kanagaretnam, Mestelman, Nainar, & Shehata, 2009; Kuhlman & Marshello, 1975a, 1975b; Roch & Samuelson, 1997; Van Lange, Bekkers, Schuyt, & Van Vugt, 2007; Van Lange, De Cremer, Van Dijk, & Van Vugt, 2007; Van Lange & Visser, 1999) showing the pervasiveness and importance of social preferences and the descriptive inadequacy of narrow self interest. A current challenge is to transcend *Homo economicus* by quantifying Edgeworth's fraction by using valid, reliable and efficient methods to measure the degree of entanglement in DM's utilities, and thus constructively expand theories of social decision making that can accommodate the richness and dynamics of real people's social preferences.

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