

Measuring Interpersonal Behavior Intensively:

Social Behavior Inventory Manual

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Note. For the theoretical background of the SBI, see:

Moskowitz, D. S. (2021). A brief introduction to intraindividual variability and spin. *Canadian Psychology/Psychologie canadienne*, 62(2), 155–160. <https://doi.org/10.1037/cap0000275>.

Moskowitz, D. S. (2021) From stable traits to spinning vectors: A measurement driven journey. To appear in Christopher Hopwood (Ed.), *Personality Assessment in the 21st Century*. Routledge.

Abstract

It is difficult to measure a range of interpersonal behaviors, especially when behaviors are assessed in the laboratory. The purpose of the present manual was to present information about the Social Behavior Inventory, a measure of interpersonal behavior that has primarily been used with an event-contingent recording (ECR) methodology to study interpersonal behavior in naturalistic settings. For each person, the SBI can produce four mean-level person scores which measure dominant, submissive, agreeable, and quarrelsome behavior, four intrapersonal variability scores measuring dominant, submissive, agreeable, and quarrelsome flux, and two additional intraindividual variability scores, pulse, which measures variability in the extremity of scores, and spin which measures dispersion of interpersonal behavior scores. Spin has been found to be associated with problematic interpersonal behavior.

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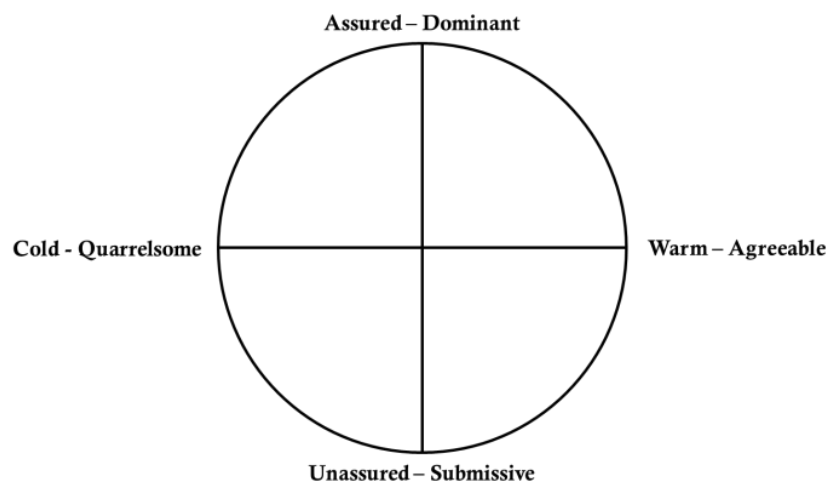
Measuring Interpersonal Behavior Naturalistically:

Social Behavior Inventory

The Social Behavior Inventory (SBI; Moskowitz, 1994) was developed to measure dominant, submissive, agreeable, and quarrelsome behaviors. The behavior scales were conceptualized to correspond with major dimensions of the Interpersonal Circle Model, also referred to as the Interpersonal Circumplex. There are several variations of this model, but across different versions is the shared idea that interpersonal characteristics can be represented as a circle with two independent and intersecting dimensions: (1) a control dimension that encompasses concerns for dominance, status, power, and autonomy for the individual, and (2) an affiliative dimension that is concerned with the connection of the individual to specific others and to groups. These broad dimensions have been referred to as agency and communion (Wiggins, 1991) or control and affiliation (Kiesler, 1983). The poles of the model have been referred to as assured-dominance, warm-agreeableness, passive-submissiveness, and coldhearted-quarrelsomeness. See Figure 1.

Figure 1

Interpersonal Circle



Decontextualized and Contextualized Scores

It is possible to examine interpersonal characteristics at a decontextualized level, such as with traits that transcend specific events (Mongrain, Vetteese, Shuster, & Kendal, 1998). It is also possible to rate decontextualized SBI items using a one-occasion questionnaire format in which information about situational cues has been removed or by aggregating across event-level scores.

The SBI has been used to obtain self-ratings ratings and also ratings by significant others such as close friends and boyfriends. Sometimes these ratings are specific to situations and sometimes the ratings of self- and others' behavior are more like traits (see Mongrain & colleagues, 1998; Sadler & Woody, 2007).

The SBI has primarily been used with event-contingent recording designs to construct contextualized scores using a form of intensive repeated measures known as event-contingent recording (ECR) (Moskowitz, Russell, Sadikaj, & Sutton, 2009; Moskowitz & Sadikaj, 2011).

In the event-contingent recording methodology, data are recorded subsequent to the occurrence of a specified event. This method is suitable for data collection about social interaction events. The methodology identifies the event with respect to contextual characteristics such as the participant's social role in the event and the participant's perceptions of the other person in the event. Sample instructions for preparing participants to complete the ECR procedure are provided in Appendix A.

Social Behavior Inventory Items

The SBI items used with the ECR method are phrased to focus specifically on behaviors. The behavior items for each scale can be found in Table 1.

Versions

Pilot work indicated that when participants are asked to complete the same form every day, they quickly adopt response sets and answer items very similarly across days. To avoid the formation of

response sets, multiple forms were developed (See Table 2). The items for each dimension of behavior, dominant, agreeable, submissive, and quarrelsome, were divided equally. There were three items for each of the scales, approximately balanced for frequency of item endorsement.

Table 1*Social Behavior Inventory Items (Moskowitz, 1994)*

Dominant Behavior Scale

I set goal(s) for the other(s) or for us.
 I gave information.
 I expressed an opinion
 I criticized the other(s).*
 I took the lead in planning/organizing a project or activity
 I asked for a volunteer.
 I spoke in a clear firm voice.
 I asked the other(s) do something.
 I got immediately to the point.
 I tried to get the other(s) to do something else.
 I made a suggestion.

Agreeable Behavior Scale

I listened attentively to the other.
 I went along with the other(s).*
 I spoke favorably of someone who was not present.
 I compromised about a decision.
 I complimented or praised the other person.
 I smiled and laughed with other(s).
 I showed sympathy.
 I exchanged pleasantries.
 I pointed out to the other(s) where there was agreement.
 I expressed affection with words or gestures
 I made a concession to avoid unpleasantness.
 I expressed reassurance.

Submissive Behavior Scale

I waited for the other person to act or talk first.
 I went along with the other(s).*
 I did not express disagreement when I thought it.
 I spoke softly.
 I let other(s) make plans or decisions.
 I gave in.
 I spoke only when I was spoken to.
 I did not say what I wanted directly.
 I did not state my own views.
 I did not say how I felt.
 I avoided taking the lead or being responsible.

Quarrelsome Behavior Scale

I did not respond to other(s)' questions or comments.
 I criticized the other(s).*
 I raised my voice.
 I made a sarcastic comment.
 I demanded that the other(s) do what I wanted.
 I discredited what someone said.
 I confronted the other(s) about something I did not like.
 I gave incorrect information.
 I stated strongly that I did not like or that I would not do something.
 I ignored the other(s)' comments.
 I withheld useful information.
 I showed impatience.

Note. * = Item loads on two behavior scales.

Table 2*Four Versions of the SBI items Used in an ECR Study**Version 1*

1. I listened attentively to the other.
2. I tried to get the other(s) to do something else.
3. I let other(s) make plans or decisions.
4. I did not say how I felt.
5. I confronted the other(s) about something I did not like.
6. I expressed affection with words or gestures.
7. I spoke in a clear firm voice.
8. I withheld useful information.
9. I compromised about a decision.
10. I took the lead in planning/organizing a project or activity.
11. I avoided taking the lead or being responsible.
12. I ignored the other'(s) comments.

Version 3

1. I waited for the other person to talk or act first.
2. I stated strongly that I did not like or that I would not do something.
3. I assigned someone to a task.
4. I exchanged pleasantries.
5. I did not say what was on my mind.
6. I did not respond to the other(s) questions or comments.
7. I made a suggestion.
8. I showed sympathy.
9. I did not say what I wanted directly.
10. I discredited what someone said
11. I asked the other(s) to do something.
12. I spoke favorably of someone who was not present.

Version 2

1. I criticized the other(s).*
2. I smiled and laughed with the other(s).
3. I spoke softly.
4. I made a sarcastic comment.
5. I expressed an opinion.
6. I complimented or praised the other person.
7. I did not express disagreement when I thought it.
8. I gave incorrect information.
9. I got immediately to the point.
10. I made a concession to avoid unpleasantness.
11. I did not state my own views.

Version 4

1. I showed impatience.
2. I asked for a volunteer.
3. I went along with the other(s).*
4. I raised my voice.
5. I gave information.
6. I expressed reassurance.
7. I gave in.
8. I demanded that the other(s) do what I wanted.
9. I set goals for the other(s) or for
10. I pointed out to the other(s) where there was agreement.
11. I spoke only when I was spoke to.

In a typical study, participants are given Version 1 on Day 1 to complete for all interactions on that day, Version 2 on Day 2, Version 3 on Day 3, Version 4 on Day 4, and the rotation is repeated for 20 days, for example. Other strategies for using the forms are possible. When using an online or

smartphone format, the version the participant is requested to complete on each occasion of measurement could be selected randomly (cf., Franzen, de Jong, Veenstra, & aan het Rot, 2021).

Scores

Event-specific scores can be analyzed for the effects of various contextual variables, such as interpersonal qualities (e.g., social roles, relationship closeness), physical qualities of the environment (e.g., brightness of light exposure), and health-relevant behaviors (e.g., smoking) (aan het Rot, et al., Moskowitz, Suh, & Desaulniers, 1994; Moskowitz & Fournier, 2015). The event-specific scores for each behavior scale are calculated following several steps. Four behavior scores representing each pole of the interpersonal circle are constructed for each event. First, frequencies (0 to 3) of item endorsement for each behavior scale are calculated. Second, mean frequency (frequency/3) scores are calculated for each behavior scale. Third, ipsatized scores are constructed by subtracting the mean frequency for all behaviors across all four scales (frequency/12) from each behavior scale score (mean frequency behavior scale – mean frequency of all behaviors). An ipsatized behavior score reflects the frequency with which a behavior occurs for the person adjusting scores using the mean at the level of the event. A communal behavior score for each event is constructed by subtracting the event-specific quarrelsome behavior score from the event-specific agreeable behavior score, and an agentic behavior score for each event is constructed by subtracting the event-specific submissive behavior score from the event-specific dominant behavior score.

Within Person Variability Scores

When using a repeated measures method, I recommend using the event-level scores with the appropriate multilevel statistics. For an example, see Sadikaj, Moskowitz and Zuroff (2011). Examples of how to construct scores using code from SAS and from R are presented in Appendix C and Appendix D, respectively.

In addition to using the data to calculate mean-level scores, the repeated measures data obtained from event-contingent records can be used to calculate intraindividual variability scores. Deviations across events are used to calculate these scores which are referred to as flux scores: dominant flux, submissive flux, agreeable flux, and quarrelsome flux.

Communal and agentic behavior scores for each interaction are treated as Cartesian coordinates and then transformed to polar coordinates from which an angular position score expressed in radians is calculated. For the formula for the circular standard deviation, see Mardia, 1972.

Pulse is the standard deviation of the extremity scores.

Spin is the standard deviation of the angular position scores dispersed across events.

Development of the SBI: Items, Reliability and Validity

The initial development of the SBI was described by Moskowitz (1994). The pool of items was assembled based on a review of prior measures of dominance, submissiveness, agreeableness, and quarrelsomeness. As prior scales had primarily been used with samples of university students, additional items relevant to work settings were generated in interviews with staff at a large telecommunication firm. Potential items were stripped of any information referring to a situation so that the behavior items could be examined with respect to the situational features recorded concurrently with the behavior items. Selected items referred to behaviors that were neutral or slightly positive with respect to social desirability, so that people would feel comfortable responding to the measure.

The English SBI has been translated into two languages, French and Dutch. For translated items, see Appendices B and C, respectively (aan het Rot, Hogenelst, & Moskowitz, 2013; D'Antono, Moskowitz, & Nigam, 2013; Rappoport, Moskowitz, & D'Antono, 2017).

Reliability Score

As an ECR procedure that focuses on social interactions of 5 minutes or longer duration, considerable evidence has accumulated supporting the reliability and validity of the four SBI scales.

There is internal consistency among the items on each scale. Interitem reliability has been examined for each of the behavior scales by calculating Cronbach's coefficient alpha for the items selected for each scale. Among a sample of community adults, Brown and Moskowitz (1998) found internal consistency to be high, with coefficient alphas ranging from .77 to .88 for the four dimensions.

Stability was assessed by calculating Cronbach coefficient alpha for events that occur over time. The scales had high stability when scores were aggregated over at least a 12-day period, ranging from .75 for dominance to .84 for quarrelsomeness (Brown & Moskowitz, 1998). In a different sample of community participants, stability of spin scores was found to be high; coefficient alphas were .76, .71, and .86 (Moskowitz & Zuroff, 2004).

In a study with university students in a management program, data were collected using smartphones. Clegg, Moskowitz, Sadikaj, Miners, and Andrevski (2021) examined the stability of behavioral dispersion (spin), and found that these students exhibited moderate stability in their spin scores over a 20-day period; coefficient alpha approximately = .65.

In summary, using several samples, high internal consistency has been found for the behavior scales. Moderate to high stability has been found over time periods of approximately three weeks.

Validity

The combination of the SBI measure and the ECR design has demonstrated convergent validity and discriminant validity when compared with one-occasion personality questionnaires. For example, in samples of working adults, the patterns of correlations among the behavior scales corresponded to structural predictions based on the Interpersonal Circle Model (Côté & Moskowitz, 1998; Moskowitz, 1994). When working with university students, Clegg et al. (2021) found significant correlations

between SBI Agreeableness and NEO-FFI Agreeableness (Costa & McCrae, 1993) and between IAS-R Agreeableness (Wiggins, 1995) and SBI Agreeableness.

The SBI and ECR combination has been effective at detecting the effects of psychopharmacological interventions on interpersonal behavior in daily life. In a study of paroxetine treatment with individuals with Social Anxiety Disorder who completed the SBI, Rappaport, Russell, Hedeker, Pinard, Bleau, and Moskowitz (2018) demonstrated reduced intraindividual variability in these individuals' own interpersonal behavior and in their perception of others' behavior. The results suggest that the SBI and ECR combination is sensitive to improvements in the interpersonal behavior of individuals with social anxiety disorder during paroxetine treatment. A study using a double blind design provided additional rigorous evidence that a psychopharmaceutical agent, tryptophan, could change interpersonal behavior. Using crossover designs in which participants served as their own controls, Moskowitz, Pinard, Zuroff, Annable, and Young (2001) found that the administration of tryptophan, a precursor of the neurotransmitter 5HT, changes a person's mean level and variability of interpersonal behavior.

Interpreting Scores

When interpreting an individual's score on a psychological test, it is customary to compare a person's score to some other set of scores. Typically, a person's score is compared to a normative group which we try to make representative of the people to whom we would like to compare the person's score. For example, when interpreting an adult's IQ score on the WAIS-3, we compare the person's IQ score to a representative group's scores on the WAIS-3. It is, however, difficult and expensive to construct and maintain norms. Normative scores go out of date over time, and new norms have to be established as the representative group changes, Timmerman, Voncken, & Albers (2021). An alternative approach to the interpretation of scores has been developed by Roche and Pincus (2016) and Hopwood

and associates (Hopwood, Zimmerman, Pincus, & Kreuger, 2015). In this approach, an individual's scores are compared to other scores the person has achieved on that measure. Thereby, it is possible to take advantage of this approach by using the repeated measurements to compare individuals to themselves.

There are additional ways to exploit the information provided by multiple measurements beyond averaging a set of scores to produce a person's mean score. A clinician might apply the standard deviation to scores to examine a person's variability and changes in variability while controlling for changes in measurement error. Rappaport, Russell, Hadeker, Moskowitz, and colleagues (2018) have found a reduction in spin when assessing a person on multiple occasions despite controlling for measurement error. The SBI and ECR combination may also be useful for providing a model that permits systematic sampling of both behavior and situation, allowing examination of contingencies in how a person's behavior changes in response to changes in the perceptions of significant others. For example, does a person display more or less submissive behavior contingent on perceptions of another's warmth and agreeableness.

It may also be informative to evaluate differences in change in variability (Rappaport, Russell, Hedeker, Pinard, Bleau, & Moskowitz, 2018). A person may make change in different qualities on different timescales. For example, timescale differences in change in affect and behavior may engender explanations of which came first, change in behavior or change in affect for a particular individual (McKee, Neale, Rappaport, Boker, & Moskowitz, 2018). The SBI and ECR combination makes it possible to measure cycles in a person's behavior and the length of time it takes the person to reach equilibrium when a disruption in cycles has occurred. Having the SBI and ECR combination helps to formulate new research questions and generate novel information about the individual.

The SBI and ECR combination has been used to investigate a wide variety of phenomena, including the effects of context on interpersonal behavior (Moskowitz, 2018; Moskowitz, Suh, & Desaulniers, 1994; Moskowitz, Moon-ho, & Turcotte-Tremblay, 2007). It has also been used to calculate novel variables such as spin (Moskowitz & Zuroff, 2004; 2005). Spin has been found to characterize and differentiate the behavior of individuals with psychopathology, specifically Depression, Borderline Personality Disorder, and Social Anxiety Disorder (Russell, Moskowitz, Zuroff, Sookman, & Paris (2007). Rappaport, Moskowitz & D'Antono, 2014). Moreover, the SBI and ECR combination has been used to examine the within-person relation between interpersonal behavior and affect (e.g., Moskowitz & Côté, 1995) and the within-person relation between interpersonal perception and behavior (i.e., reactivity) (Sadikaj, Moskowitz, & Zuroff, 2011; Clegg, Moskowitz, Miners, Andrevski, Sadikaj, & Zuroff, 2020).

Concluding comments

The Social Behavior Inventory has three features that make this measure eminently suitable for measuring dimensions of interpersonal behavior. First, the SBI provides assessments that are closely aligned with theory associated with the Interpersonal Circumplex. It provides carefully-constructed measures of four behaviors: dominance, submissiveness, agreeableness, and quarrelsomeness. Second, the SBI provides items that are suitable for use in repeated-measures designs. These repeated measures make use of novel statistics and permit the simultaneous examination of both within-person and between-person processes. Third, the SBI-ECR combination permits the development of scores which promote the use of situational features and contingencies. Together, these three features strengthen the SBI's position as a primary choice for studying interpersonal aspects of personality.

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APPENDIX A

Induction Script to be administered to prospective participants

Note. This Induction Script example includes instructions for the collection of additional variables beyond the behaviors assessed by the Social Behavior Inventory. It is typically administered alongside a Powerpoint presentation, at a ~1.5 to 2 hour ECR training session. This particular example is drawn from a recent study in which the SBI (and other items) were administered via a mobile application.

slide 1

Hello everyone and thank-you for coming! We are very excited about this project and appreciate your interest.

**RAs introduce selves – name, education, position*

slide 2

Here's what's on the agenda for today's meeting:

- First, we will go over the project in its entirety. We will discuss what it is about and why we are doing it.
- Next, we will discuss the meaning of *social interaction* within the context of this study and will guide you through the procedure and the forms that you will be asked to fill out.
- At this point, you will be given the opportunity to sign the consent form.
- Finally, we will be asking you to complete two brief questionnaires.

Please feel free to ask questions or voice concerns throughout the meeting, and don't worry about trying to remember everything that we talk about- most of what we discuss is in the information booklet in front of you and you can always call or e-mail us with questions (our contact info is on the back of the handout).

slide 3

We are conducting this study as the first stage of a larger project examining human behavior over time. We will be looking at patterns in how people behave and feel during every day social interactions, and how their environment, including their perceptions of others, how they behave and how they feel.

1) The first stage will take place over 20 days. Over the 20 days, you will be asked to keep track of your social interactions and record information about them on forms which you will access using a smart phone application.

- The forms that you fill out will ask you about the duration of the interaction, where it took place, who was present, what you did, how you felt and how you perceived the person interacting with you to be behaving.
- The forms are not very complex and each should take five minutes or less to complete.
- The number of forms that you fill out each day will depend on how many interactions you have; however, we do ask that you fill out no more than 10 a day and in past studies, the average has been 6-7.
- You will be identified only by an ID number, all data will be kept on a secure, private server and all information will be kept strictly confidential.
- You will be able to contact us throughout the 20 days.
- Finally, we will ask you to come in for a debriefing session in which we will address any questions or concerns that you may have, ask you to provide feedback and fill out a few brief questionnaires and then provide you with \$160 compensation.

Please note that you can withdraw from the study at any point.

Does anyone have any questions?

slide 4

Let's get into the details of the study and how to fill out the forms.

- As we mentioned, this first study is about your social interactions.
 - We are interested in how you act and feel and how you perceive the person with whom you are interacting to be behaving.
 - We're looking to try and capture how people actually feel and behave in social interactions during their every-day lives, rather than in an artificial setting such as a lab.
 - We've run social interaction studies using this method with many participants and we generally receive very positive feedback. (I think b/c we don't actually reflect on our social interactions so people tend to find that they learn a lot about themselves)
- We used to do this with paper forms & people had to mail them to us every night so this is a lot more convenient!

slide 5

What do we mean by a *social interaction*, in the context of this study? It's important for us to discuss this because people sometimes have different ideas about what the phrase means.

slide 6

By a *social interaction* we mean any situation in which **two or more people** are involved and are **reacting or responding** to one another for a **minimum duration of 5 minutes**.

- We set this five minute guideline to ensure that you are not filling out forms all day long about simple greetings. Instead, you can focus on situations that involve substantial interactions.
- When I say substantial, I don't mean in terms of content – for e.g. Even if you talk to someone about the weather for 10 minutes, it still counts as long as it meets the 3 criteria
- A good example is when you are having a conversation with a friend.

Now we'll go through a couple more examples...

slide 7

If you're in a class and the professor is lecturing, would this count as a social interaction for the purpose of this study?

- NO. Unless you're in a small discussion-based class.

slide 8

Would talking on the phone count as a social interaction?

- YES. As long as it's at least 5 minutes long.

*However, text-based communication (e-mail, text messaging, etc.) does **not** count. (Skype and other similar programs are okay because they allow continuous streaming face-to-face or voice-to-voice)

- This is not because we don't think these electronic forms of communication are important. They definitely are important but we're just unsure at this point how to assess them and therefore we cannot use them.

slide 9

In general, then, the key factors in deciding whether or not a social interaction has occurred are:

- The interaction was **5 minutes or longer**.
- There was **mutual responding**.
- The interaction was **in person** or **on the telephone (face-face, voice-voice)**.

slide 10

It is also important to know when Social Interactions begin or end so that you can determine when to fill out a form. We've developed a few guidelines to make this easier for you:

- 1) A social interaction changes when there is a **discrete ending**.
 - For example, if you are talking to a friend and then you say goodbye and leave, that social interaction has obviously ended.

However, there are other ways in which a social interaction might end...

slide 11

2) If there is a change in the **environment**, then the interaction changes as well.

- For example, if you were talking to some fellow employees at work and then you go out to lunch with the same people, we would say that this constitutes two separate interactions.

- There could also be a third interaction in there if you are chatting on the way to the restaurant and it takes 5 minutes or more to get there.

3) Next, if the **composition of the group** changes, then the interaction changes as well.

- For example, if you are having a conversation with one of your friends, and another person joins the conversation, we would say that this change of composition has ended the first interaction and a second interaction may occur.

slide 12

4) Finally, if the **tone or activity** shifts, then the interaction changes as well.

- For example, if you are at home having a conversation with a friend and then the two of you decide to make lunch together, this involves two separate interactions (the initial conversation, and making lunch) even though the environment and the composition is the same, because the activity has shifted
- Change of tone happens less often but it can be a bit tricky so we like to go over it
- E.g. If you're having a pleasant conversation with a friend and all of a sudden you say something that makes them really angry and you get into a fight – the tone of the interaction has changed and therefore it would count as 2 different interactions.
- Usually we build into fights (more gradually) so that would be 1 interaction – but if it's an abrupt change & the 2 stages feel very different then it would count as 2.b

Does this make sense? Any questions?

slide 13

Key points

- It's very important that you fill out the form as soon as possible following the interaction, so that it is still fresh in your mind. This is why we developed the mobile app- most people carry their phones everywhere and are able to fill out their forms soon after an interaction.
- However, we ask this within reason, as we do not want you to disrupt the natural flow of your daily life (e.g. If you're having interaction with 1 friend and another friend joins, you might be aware that this is now a second interaction but we don't expect you to halt your conversation to fill out a form so you would just have both interactions and as soon as they're finished, fill out 2 forms) – use your discretion
- Immediacy & accuracy over quantity - we'd rather you report your interactions immediately after they happen
- In an ideal world, if we could have immediacy, accuracy, and quantity (i.e. have you fill out 10 forms in, each immediately after each interaction) but given that you're busy and things come up, we'd much rather know about 5 as soon as possible after they happen rather than all 10 at the end of the day

We're going to take a brief break now, during which I will help you download the mobile app.

slide 14

Add participants to MetricWire.

Note. Tempest by Robotic Bit is an alternative to MetricWire (see Franzen et al 2018, Study 3). For more information about Tempest, contact Marije aan het Rot m.aan.het.rot@rug.nl

I am going to use this meeting as my example, because it counts as a social interaction. (It has lasted more than five minutes and there has been some mutual responding). You can use this meeting or another interaction. *Does everyone have a social interaction in mind?*

In the first section...

- We ask you to enter your **ID number** (you'll find this on the front of your information booklet)
- Enter the **date** that the interaction occurred (e.g. if the interaction occurred on the 21st, you would enter 21 in the textbox)
- Enter what **time** the interaction took place (enter the hour and minute and then select am or pm)
- Next, enter the **length** of the interaction in minutes
 - This can be approximate; we just want to get an idea of how long the interaction lasted (no need for a stopwatch)

**Wait for a couple of seconds for their page to change in their phones. They should be able to follow what is being said by actually looking at the page being described.*

In the next section...

- We ask for a **brief description** of the interaction (This could be something like “meeting with a co-worker” or “dinner with a friend”)
- Specify whether the interaction was **in person, on the phone or by video chat**.
- Then, specify **where** the interaction occurred
 - Home, school and work are obvious
 - Recreation refers to sports as well as things like going out to dinner or a movie, etc.
 - Other: If the interaction occurred somewhere else, like the bank or the doctor's office, you would select “other”

e.g. For myself, I would select “work” for this interaction; if you are using this interaction, which would you select? (*Ask them what they would answer; school or other acceptable*)

**This question refers to physical location (e.g. group meeting for school at home would be “home”)*

When in doubt, say other & specify where.

Alcohol and substances...

In the next question, we ask you to **specify how many alcoholic beverages you consumed within 3 hours before or during the social interaction**. One drink equals one beer, one glass of wine, or one shot of hard liquor. **If you were not drinking, please enter 0.**

We ask you to not complete a form after a social interaction that occurred within 3 hours after taking any drugs.

Primary person...

- The next section asks you to indicate **if more than one person was present** during the interaction (This allows us to determine whether you were interacting with someone in private or with other people present)
- Subsequent questions will ask you for information about the **primary person** with whom you were interacting. There are three possibilities:
 - The interaction involves only one person** (clearly, the one person is the primary person here)
 - When there are **multiple people present but you are mostly interacting with one of them**, this individual is the primary person (e.g. you are out to dinner with friends but you speak mostly to the person next to you)
 - If there are **several people actively involved in the interaction and you are not talking to one specific person**, then there is **no** primary person and questions about a primary person will not be applicable to you. (e.g. you are out to dinner and conversing with the person beside you as well as with your other friends across the table)

e.g. In thinking of this interaction, I would select “Multiple people, no primary other”, as I am interacting with all of you and not with one person in particular. The survey will skip the questions pertaining to the primary person if I select this option, so for now, let’s all select one of the other two options so that we can go through *all* of the questions.

If you guys are using this situation as well, which option would you select? (*multiple person, primary other, because you are mainly interacting with me.*)

- In this section, you will first give the **initials of the primary person** with whom you were interacting.
 - If you regularly interact with two people with the same initials, we would like you to differentiate these people for us. (e.g. for two people with the initials EL, you could use ELB for the EL who is your boss and just EL for your friend)
 - You could also use a short nickname for your friend, if this is easier to remember. Please try and be consistent.
- Next, you indicate the **gender of the primary person** by selecting “Male” or “Female”.
- The following two questions help to clarify **this person’s relationship to you**.
 - If you have more than one relationship to this person (For example, a co-worker who is also a friend), then you can indicate this by answering both questions.
 - If you have one relationship with this person, then you would answer the relevant question and select “None apply” for the other. These questions will only appear if you have indicated that there was a **primary person**.

Are there any questions so far? Okay, let’s move on to the next section.

Behaviours...

- This section is concerned with **behaviours that you may have engaged in** during the interaction.
 - Simply select **“yes” or “no” for each item**, to describe your own behaviour during the interaction (*give examples for whichever form we use on the day*).
 - During an interaction, you could have anywhere from none of the behaviors to all of them, so

don't be concerned if you find yourself with a form where you are selecting "yes" for all or none of the items IN THAT INTERACTION.

You might also notice that the items may change from day to day. This is because we realise that there are many different behaviors that you can engage in during your interactions with others, so we try to list a variety of them on our forms. At the same time, we want to keep our forms short, so we do not include all the behaviors on each form.

**If anyone asks, each form will have 11 or 12 behavior items.*

Are there any questions about this section?

Feeling items...

- This next section deals with **how you were feeling during the social interaction.**
 - For each of these feelings, your answer can range from 0, which indicates "not at all", to 6, which means "extremely".
 - Keep in mind that "0 Not at all" is neutral (meaning that the feeling is simply not present) - for e.g., 0 for happy would NOT mean that you are very unhappy
 - It's important to remember that you can have many types of feelings during the same social interaction. For example, you might feel happy and sad and angry at different points of the same interaction. Sometimes you can even feel many different things at once. Please don't worry if you feel like you are contradicting yourself in this section. Simply answer each question individually; take each feeling one at a time and think about how much you felt that way during the interaction.

**If anyone asks, each form has the same 15 feeling items.*

Does that make sense to everyone?

e.g. On the first item, I am going to fill in "5" because I am happy to meet all of you today and I really enjoy talking about this research. For the second item, I am going to fill in a 1, because I am a little bit worried about being clear in my instructions (I won't go through each one of these items today, because most of them are straightforward.)

--- BACK TO POWERPOINT FOR GRID ---

Final question...

- We would like you to think about the **motivation for your own behaviour** during the interaction.
- Think about the extent to which your behavior reflected your own choices and values or whether your behavior was more due to internal or external pressures to behave in a certain way.
 - Choosing 1 would indicate behaviour that was completely due to your own choices and your own values
 - Choosing 7 would indicate behaviour that was completely due to internal or external pressure.

For example, let's say that I have been invited to a party that I don't really want attend. If I attend it because my friends really want me to, my behavior would reflect external pressures. If I attend it because I feel guilty due to having declined previous invitations and would feel bad declining another, my behavior would reflect internal pressures. If I were keen to attend the party all along and do so because I want to, my behavior reflects my own choices and values.

Are there any questions about this item?

slide 15

Let's move on to the grid section.

- This grid will be used to describe the behavior of the person with whom you were interacting.
- The grid may look a little complicated the first time that you see it, but it will make sense once we've gone over it.
-

**If anyone asks: if there was no primary person (you selected "Multiple people, no primary other"), you will not be given this question).*

- It is also very important for you to remember that we would like you to indicate how the individual was behaving **during the interaction, towards you**, rather than how that individual tends to behave **in general**.
- For example, if you have a friend who is generally very warm and approachable but who behaves coldly towards you in an interaction, report about that person's behavior during that interaction.

slide 16

Okay, let's take a closer look.

- You are going to describe the of this person during the interaction by indicating which position on the grid best describes the person's behavior towards you.
- There are basically two axes to think about.
- For the time being, ignore the words in the corners, and we will talk about these axes.
- The horizontal direction ranges from cold and quarrelsome to warm and agreeable.
- If you felt, for example, that the person was cold and quarrelsome toward you, you would choose a position somewhere near the left-hand side of the grid (for example, 25).

*Max. cold/quarrelsomeness would be far left, decreasing towards the center (15 would be very cold and 45 would be a little bit cold)

slide 17

- If you thought the person was warm and agreeable toward you, you would choose a position somewhere near the right-hand side (for example, 84).
- E.g. 96 = very warm, 67 = a little bit warm

slide 18

- If you thought the person was neither cold nor warm, you would choose a position somewhere near the center (for example, 56).

slide 19

- Once you have decided how far left or right the position needs to be, you need to decide how high or low it should be.
- The vertical direction ranges from assured and dominant on the top to unassured and submissive on the bottom.
- If you thought the person behaved assuredly and dominantly towards you, you would choose a position toward the top of the grid (for example, 47).

- Max dominance at top, decreasing towards bottom (e.g. 59 = very dominant, 36 = a bit dominant)

slide 20

- If you thought the person was unassured and submissive toward you, you would choose a position toward the bottom (for example, 33)
- E.g. 41 = very submissive, 54 = a bit submissive

slide 21

- If you thought that the other person was neither dominant nor submissive, you would a position somewhere in the center of the grid (for example, 35).

So it's a pretty simple model but it is fairly reliable & thoroughly covers most kinds of interpersonal behaviors – the way it does this is by combining the axes (& this is what the corner words are about)

slide 22

- Now look at the words in the corners of the grid. These adjectives are meant to describe a person at the extremes on both agency and communion For e.g., In the top left, you see that a person who is both cold and dominant in an interaction might be seen as “critical” (judgmental, arrogant; for example, 28) – e.g. 49 = very dominant and a little bit cold (*give example for this zone only*)
- In the top right, you see that a person who is both dominant and agreeable might be described as “engaging” (lively, outgoing; for example, 87).
- The bottom right describes a person who is both agreeable and submissive as “deferring” (yielding in a polite fashion; for example, 92). □ e.g. Saying “yeah whatever you want to do”
- Finally, the bottom left describes a person who is submissive and quarrelsome as “withdrawn” (reticent, aloof, prickly; for example, 13).
- A person whose behavior is very neutral, meaning neither dominant nor submissive and neither cold nor warm, would be described by a position in the center of the grid (For example, 55).
- Keep in mind, we are asking you to select **one** square on the grid to describe the person's behavior; that is, the single position that you choose will represent a combination of both the horizontal (Cold-Warm) and the vertical (Dominant-Submissive) axes.

The actual numbers in each square don't mean much. Ideally we wanted a grid where you could tap a position on it to select it but unfortunately we weren't able to do that with this software. Numbers identify the square.

This is a subjective exercise – don't tie yourself up in knots about whether someone is an 18 or 19.

Is this making sense to everyone so far? Are there any questions?

BACK TO WEBSITE FOR LAST QUESTION

slide 23

And that's the form! I want to quickly review what recording this information will require.

- You will use these forms to record information about social interactions for the next 20 days.

- Every time you have a social interaction that lasts **at least 5 minutes**, involves **mutual responding** and takes place either **in person or over the phone/Skype** you will access the app on your phone and fill out a form about the interaction, **as soon as possible following the interaction**.
- The form will not take long to complete (2-5 minutes).
- We ask that you fill out no more than 10 forms a day; in past studies, the average has been 6-7 per day.
- If you do find yourself filling out 10 forms a day, please do try and spread them out.
- You may find yourself having more or less interactions and thus filling out more or less on some days compared to others; this is perfectly fine.
- You may feel that some interactions are redundant, for example because you are interacting with the same person and/or engaging in the same activity.
- Please remember; however, that all of your interactions are important to us and we want to hear about them!
- We understand that everyone leads busy lives and value immediacy and accuracy over quantity.

Are there any questions about the forms? Okay, great.

**There may be questions about when to fill out the forms and incorporating them into their daily lives. May also give examples.*

slide 24

Consent forms

-Used to take a total of 22 hours over the 20 days – this is from when we used paper forms

- With this new mobile application method, total of 8-10 hrs on average (incl this meeting & the last meeting)

-Slip of paper – not going to harass you every day

- 2 day call (software) & 10 day call (questions)
- Single daily reminder
- If at any point you feel like you don't need them/they're becoming an annoyance, let us know and we'll stop sending them

*consent form covers all parts of study

Questionnaires (Qualtrics, then M-site)

*remind them about name/question instructions for second survey

*ID will always be the one you received today

APPENDIX B

French Translation

French Translation of the SBI (used in Rappaport, Moskowitz & D'Antono, 2017)

Dominant Behavior Scale

J'ai établi des objectifs pour l'autre (les autres) ou pour nous
 J'ai donné de l'information
 J'ai exprimé une opinion
 J'ai critiqué l'autre (les autres) *
 J'ai pris en charge la planification/organisation d'un projet ou d'une activité
 J'ai demandé l'assistance d'une personne volontaire
 J'ai parlé d'une voix ferme et claire
 J'ai demandé à l'autre (aux autres) de faire quelque chose
 J'ai été droit au but.
 J'ai essayé de faire en sorte que l'autre (les autres) fasse(nt) autre chose
 J'ai fait une suggestion
 J'ai désigné quelqu'un pour faire une tâche

Submissive Behavior Scale

J'ai attendu que l'autre parle ou agisse en premier.
 J'ai suivi les idées ou vœux de l'autre (des autres). *
 Je n'ai pas exprimé mon désaccord quand je le ressentais.
 J'ai parlé doucement.
 J'ai laissé l'autre (les autres) dresser les plans ou prendre les décisions
 J'ai cédé.
 J'ai parlé seulement lorsque l'on s'adressait à moi.
 Je n'ai pas dit clairement ce que je voulais
 Je n'ai pas fait valoir mon point de vue
 Je n'ai pas dit comment je me sentais
 J'ai évité de prendre les commandes ou d'agir comme responsable
 Je n'ai pas dit ce que je pensais vraiment

Agreeable Behavior Scale

J'ai écouté l'autre (les autres) attentivement

J'ai suivi les idées ou vœux de l'autre (des autres)*
 J'ai parlé favorablement de quelqu'un qui était absent
 J'ai fait des compromis par rapport à une décision
 J'ai complimenté ou félicité l'autre (les autres)
 J'ai souri et j'ai ri avec l'autre (les autres)
 J'ai démontré de la sympathie
 J'ai échangé des plaisanteries
 J'ai souligné les points sur lesquels nous étions en accord
 J'ai manifesté de l'affection, que ce soit en paroles ou par gestes
 J'ai fait des concessions pour éviter une situation désagréable
 J'ai dit des paroles rassurantes

Quarrelsome Behavior Scale

Je n'ai pas répondu aux questions ou aux commentaires de l'autre (des autres)
 J'ai critiqué l'autre (les autres)*
 J'ai élevé la voix
 J'ai fait un commentaire sarcastique
 J'ai exigé que l'autre (les autres) fasse(nt) ce que je voulais
 J'ai discrédité ce qu'une personne avait dit
 J'ai confronté l'autre (les autres) sur un point que je n'aimais pas
 J'ai fourni de fausses informations .
 J'ai énoncé avec vigueur que je n'aimais pas ou ne ferais pas quelque chose
 J'ai ignoré les commentaires de l'autre (des autres)
 J'ai gardé pour moi des informations utiles
 J'ai montré des signes d'impatience

APPENDIX C

Dutch Translation

The Dutch translation of the SBI was used in aan het Rot, Hogenelst, & Moskowitz, 2013). Participants were asked to rate the SBI items in Dutch and in English . Results are available from Marije aan het Rot, m.aan.het.rot@rug.nl or in

Dominant Behavior Scale

Ik formuleerde doelstellingen voor de ander(en) of voor ons [form 4: item 9]
 Ik verschaft informatie [4:5]
 Ik uitte een mening [2:5]
 Ik bekritiseerde de ander(en) [2:1] *
 Ik nam het initiatief bij het plannen/organiseren van een project of activiteit [1:10]
 Ik vroeg om een vrijwilliger [4:2]
 Ik sprak met een duidelijke, vaste stem [1:7]
 Ik vroeg de ander(en) om iets te doen [3:11]
 Ik kwam onmiddellijk ter zake [2:9]
 Ik probeerde de ander(en) iets anders te laten doen [1:2]
 Ik deed een voorstel [3:7]
 Ik bedeelde iemand een taak toe [3:3]

Submissive Behavior Scale

Ik wachtte tot de ander(en) eerst iets deden of zeiden [3:1]
 Ik ging met de ander(en) akkoord [4:3] *
 Ik uitte niet dat ik het ergens niet mee eens was maar dacht het wel [2:7]
 Ik praatte zachtjes [2:3]
 Ik liet de ander(en) plannen maken of beslissingen nemen [1:3]
 Ik gaf me gewonnen [4:7]
 Ik sprak alleen als er tegen me gesproken werd [4:11]
 Ik zei niet direct wat ik wilde [3:9]
 Ik drukte mijn eigen denkbeelden niet uit [2:11]
 Ik zei niet hoe ik me voelde [1:4]
 Ik vermeed de leiding of de verantwoordelijkheid te nemen [1:11]
 Ik zei niet wat er in mijn gedachten om ging [3:5]

Agreeable Behavior Scale

Ik luisterde aandachtig naar de ander(en) [1:1]
 Ik ging met de ander(en) akkoord [4:3] *
 Ik sprak positief over iemand die niet aanwezig was [3:12]
 Ik schikte me naar een genomen beslissing [1:9]
 Ik complimenteerde of prees de ander(en) [2:6]
 Ik (glim)lachte met de ander(en) mee [2:2]

Ik toonde medeleven [3:8]
 Ik wisselde beleefdheden uit [3:4]
 Ik wees de ander(en) op waar er sprake was van overeenstemming [4:10]
 Ik toonde mijn genegenheid met woorden of gebaren [1:6]
 Ik kwam de ander(en) tegemoet om wrijving te voorkomen [2:10]
 Ik stelde de ander(en) gerust [4:6]

Quarrelsome Behavior Scale

Ik reageerde niet op andermans vragen of opmerkingen [3:6]
 Ik bekritiseerde de ander(en) [2:1] *
 Ik verhief mijn stem [4:4]
 Ik maakte een sarcastische opmerking [2:4]
 Ik eiste dat de ander(en) deden wat ik wilde [4:8]
 Ik trok wat iemand anders zei in twijfel [3:10]
 Ik confronteerde de ander(en) over iets wat me niet zinde [1:5]
 Ik gaf onjuiste informatie [2:8]
 Ik zei met klem dat ik ergens niet van hield of iets niet wilde doen [3:2]
 Ik negeerde andermans opmerkingen [1:12]
 Ik onthield de ander(en) van nuttige informatie [1:8]
 Ik toonde mijn ongeduld [4:1]

APPENDIX D

Annotated SAS Syntax

Original code by David C. Zuroff; adaptation and annotation by Kayleigh-Ann Clegg. Researchers having difficulty using the code can contact Professor Zuroff (David.Zuroff@mcgill.ca).

/ The SAS syntax below can be used to calculate several between- or within-person behavior variables. It assumes that four forms of the SBI have been administered and rotated to prevent the formation of response sets, and that each form's data is stored in four separate files containing the variables ID and B1 through B12 for the behavior items. */*

*/** COMBINING THE FOUR FORMS **/*

data all; **set** formA1 formB1 formC1 formD1; **run**;

*/** CALCULATING BEHAVIOR SCORES **/*

/ Calculating the total and average number of behavior items endorsed for each pole for each interaction */*

DATA temp; **SET** all;

IF FORM = 1 **THEN DO**;

 AGRBEH = SUM (B4,B8,B12); */* Total number of agreeableness items endorsed for each interaction */*

IF AGRBEH > 0 **THEN** MAGRBEH = AGRBEH/3; **ELSE** MAGRBEH = 0; */* Average number of agreeableness items endorsed for each interaction */*

 QURBEH = SUM (B2,B6,B10); */* Total number of quarrelsomeness items endorsed for each interaction */*

IF QURBEH > 0 **THEN** MQURBEH = QURBEH/3; **ELSE** MQURBEH = 0; */* Average number of quarrelsomeness items endorsed for each interaction */*

 DOMBEH = SUM (B3,B7,B11); */* Total number of dominance items endorsed for each interaction */*

IF DOMBEH > 0 **THEN** MDOMBEH = DOMBEH/3; **ELSE** MDOMBEH = 0; */* Average number of dominance items endorsed for each interaction */*

 SUBBEH = SUM (B1,B5,B9); */* Total number of submissiveness items endorsed for each interaction */*

IF SUBBEH > 0 **THEN** MSUBBEH = SUBBEH/3; **ELSE** MSUBBEH = 0; */* Average number of submissiveness items endorsed for each interaction */*

END;

IF FORM = 2 **THEN DO**;

 AGRBEH = SUM (B1,B6,B9);

IF AGRBEH > 0 **THEN** MAGRBEH = AGRBEH/3; **ELSE** MAGRBEH = 0;

 QURBEH = SUM (B5,B8,B12);

IF QURBEH > 0 **THEN** MQURBEH = QURBEH/3; **ELSE** MQURBEH = 0;

```

DOMBEH = SUM (B2,B7,B10);
IF DOMBEH > 0 THEN MDOMBEH = DOMBEH/3; ELSE MDOMBEH = 0;
SUBBEH = SUM (B3,B4,B11);
IF SUBBEH > 0 THEN MSUBBEH = SUBBEH/3; ELSE MSUBBEH = 0;
END;

IF FORM = 3 THEN DO;
  AGRBEH = SUM (B2,B6,B10);
  IF AGRBEH > 0 THEN MAGRBEH = AGRBEH/3; ELSE MAGRBEH = 0;
  QURBEH = SUM (B1,B4,B8);
  IF QURBEH > 0 THEN MQURBEH = QURBEH/3; ELSE MQURBEH = 0;
  DOMBEH = SUM (B1,B5,B9);
  IF DOMBEH > 0 THEN MDOMBEH = DOMBEH/3; ELSE MDOMBEH = 0;
  SUBBEH = SUM (B3,B7,B11);
  IF SUBBEH > 0 THEN MSUBBEH = SUBBEH/3; ELSE MSUBBEH = 0;
END;

IF FORM = 4 THEN DO;
  AGRBEH = SUM (B3,B6,B10);
  IF AGRBEH > 0 THEN MAGRBEH = AGRBEH/3; ELSE MAGRBEH = 0;
  QURBEH = SUM (B1,B4,B8);
  IF QURBEH > 0 THEN MQURBEH = QURBEH/3; ELSE MQURBEH = 0;
  DOMBEH = SUM (B2,B5,B9);
  IF DOMBEH > 0 THEN MDOMBEH = DOMBEH/3; ELSE MDOMBEH = 0;
  SUBBEH = SUM (B3,B7,B11);
  IF SUBBEH > 0 THEN MSUBBEH = SUBBEH/3; ELSE MSUBBEH = 0;
END;

COMMUN = MAGRBEH - MQURBEH; /* Average communion for each interaction */
AGENCY = MDOMBEH - MSUBBEH; /* Average agency for each interaction */

/* Calculating ipsatized behavior scores for each interaction */
IP = SUM (MAGRBEH,MQURBEH,MDOMBEH,MSUBBEH);
IPS = IP/4;

IMAGRBEH = MAGRBEH - IPS;
IMQURBEH = MQURBEH - IPS;
IMDOMBEH = MDOMBEH - IPS;
IMSUBBEH = MSUBBEH - IPS;

PROC SORT; BY ID INTDATE TIME;
RUN;

/* Calculating average behavior scores for each pole for each person across interactions and within-
person centered behavior scores for each interaction */
PROC SQL;

```

```

CREATE TABLE temp1 as
select *,
mean(IMSUBBEH) as MSUB, /* Person's average submissiveness across all interactions */
IMSUBBEH-MEAN(IMSUBBEH) as SUBCT, /* Person's level of submissiveness in a given
interaction relative to their average */
mean(IMDOMBEH) as MDOM,
IMDOMBEH-MEAN(IMDOMBEH) as DOMCT,
mean(IMAGRBEH) as MAGR,
IMAGRBEH-MEAN(IMAGRBEH) as AGRCT,
mean(IMQURBEH) as MQUR,
IMQURBEH-MEAN(IMQURBEH) as QURCT,
FROM temp
GROUP by ID;
QUIT;

/* Calculating grand-mean centered behavior scores for each person across interactions */
data means; set temp1; by id; if first.id then output; keep msub mdom magr mqur; run;

proc means data=means; var msub mdom magr mqur; run;

data temp2; set temp1;
msubct=msub +/- grandmean; /* Person's average level of submissiveness relative to the average level
of submissiveness in the sample*/
mdomct=mdom +/- grandmean;
magrct=magr +/- grandmean;
mqurct=mqur +/- grandmean;
mmotct=mmot +/- grandmean;
run;

PROC SORT data=temp2; BY ID INTDATE TIME;
RUN;

data in.behavior; set temp2; run; /* Saving all scores generated up until this point in a permanent file */

/** CALCULATING INDICES OF WITHIN-PERSON VARIABILITY IN BEHAVIOR **/

/*Calculating angle and vector length for each interaction within each quadrant of the interpersonal
circumplex */

DATA temp; SET in.behavior;

ICOM=COMMUN;
IAGENCY= AGENCY;

KEEP ID ICOM IAGENCY;
run;

```

```

DATA ALLDAYS; SET TEMP;

*** First Quadrant ****;

IF ICOM > 0 AND IAGENCY >= 0 THEN DO;
    angle= atan (iagency/icom);
END;

IF ICOM=0 AND IAGENCY > 0 THEN ANGLE = 1.5708;

***** Second Quadrant *****;

IF ICOM LT 0 AND IAGENCY >= 0 THEN DO;

RICOM = -ICOM;
RANGLE= ATAN (IAGENCY/RICOM);
ANGLE = 3.1416 - RANGLE;

END;

***** Third Quadrant *****;

IF ICOM LT 0 AND IAGENCY < 0 THEN DO;
RICOM = -ICOM;
RIAGEN = -IAGENCY;
RANGLE= ATAN (RIAGEN/RICOM);
ANGLE= 3.1416 + RANGLE;
END;

IF ICOM=0 AND IAGENCY LT 0 THEN ANGLE = 4.7124;

***** Fourth Quadrant *****;

IF ICOM GT 0 AND IAGENCY < 0 THEN DO;

RIAGEN = - IAGENCY;
RANGLE= ATAN(RIAGEN/ICOM);
ANGLE = 6.2832 - RANGLE;
END;

/* Computing vector length */

VL= SQRT (IAGENCY**2 + ICOM**2);

KEEP ID ANGLE VL ICOM IAGENCY;

```

RUN;

/ Calculating pulse, communion and agency flux, mean vector length, mean angle, mean communion, and mean agency for each person across interactions */*

```
PROC MEANS DATA=ALLDAYS MEAN STD; BY ID;
VAR VL ICOM IAGENCY;
OUTPUT OUT=PULSE STD(VL ICOM IAGENCY)
      = SDVL FLUXCOM FLUXAGENCY
      MEAN (VL ANGLE ICOM IAGENCY)= MNVL MNANGLE MNCOM MNAGE; RUN;
```

/ Calculating spin as each person's circular standard deviation across interactions using formulae from Mardia (1972) */*

```
DATA MARDIA1; SET ALLDAYS;
KEEP ID ANGLE C S VL;
```

```
C= COS (ANGLE);
S= SIN (ANGLE);
```

```
PROC MEANS DATA=MARDIA1 MEAN NOPRINT; BY ID;
VAR C S;
OUTPUT OUT=MARDIA2 MEAN (C S)= MEANC MEANS; run;
```

```
DATA MARDIA3; SET MARDIA2 ;
```

```
RBAR= SQRT(MEANC**2 + MEANS**2);
*RBAR IS FORMULA 2.2.4 IN MARDIA;
```

```
CIRCVAR= 1 -RBAR; * FORMULA 2.3.5;
CSD= SQRT( -2*LOG(1 - CIRCVAR) ); * FORMULA 2.3.12;
```

```
MANG = ATAN (MEANS/MEANC); * FORMULA 2.4.3;
```

```
* FORMULA 2.4.3;
```

```
IF MEANC GT 0 AND MEANS GT 0 THEN DO; CMNANG= MANG; END;
IF MEANC LT 0 THEN DO; CMNANG= MANG + 3.1416; END;
IF MEANC GT 0 AND MEANS LT 0 THEN DO; CMNANG = MANG + 6.2832; END;
```

```
LABEL CMNANG= 'CIRCULAR MEAN ANGLE (MARDIA)'
      CSD= 'CIRCULAR SD(MARDIA)';
```

```
KEEP ID RBAR MEANC MEANS MANG CMNANG CSD ; run;
```

/ Combining within-person variability measures */*

```
DATA LABILITY; MERGE MARDIA3 PULSE ; BY ID;

PULSE=SDVL;
SPIN=CSD;
LABEL MNVL='MEAN VECTOR LENGTH';

KEEP ID SPIN PULSE FLUXCOM FLUXAGENCY MNCOM MNAGE; run;

/** MERGING BEHAVIOR SCORES AND WITHIN-PERSON VARIABILITY SCORES */

data behaviorvars; merge in.behavior lability; by id; run;

proc sort data=behaviorvars; by id intdate time; run;

/* Save as a permanent file */
data in.behaviorvars; set behaviorvars; run;
```

APPENDIX E

Annotated R Code

R code for calculating spin scores prepared by Jeffrey Girard, Department of Psychology, University of Kansas.