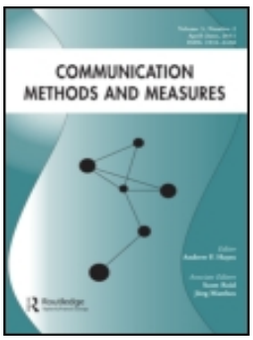

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James Stein

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"The company you keep": unpacking a measurement model of social network interdependence

James Stein

Hugh Downs School of Human Communication, Arizona State University, Tempe, AZ, USA

ABSTRACT

Both classical and contemporary interpersonal theories have identified the social networks surrounding a couple as integral players in relational development and maintenance. The current project extends this line of research by designing (Study 1) and implementing (Study 2) a measurement of social network interdependence. Scales of network interference and facilitation are developed and probed using exploratory and confirmatory factor analysis. Results support distinct measures of network interference and facilitation. Invariance between differencing samples is tested for using multifactor CFA. Results showed that measures of network interference and facilitation significantly vary between married and dating couples. Finally, convergent, divergent, and concurrent validity is tested for subscales using variables in relational turbulence theory. Results demonstrate that network interference and facilitation uniquely impact outcome variables above and beyond experiences of partner interference and facilitation. Results are discussed in terms of theory development.

Traditionally, interdependence is viewed in the context of a close dyadic relationship (Berscheid, 1983; Solomon & Knobloch, 2001). Scholarship has identified that social networks possess attributes that foster interdependence (Surra, 1988). The goal of this article is to develop and test a measurement of network interdependence using relational turbulence theory (RTT; Solomon, Knobloch, Theiss, & McLaren, 2016) as a theoretical guide. Existing attributes of network interdependence are discussed first.

Social networks and interdependence

Social networks entail individuals with a general affinity for one another that engage in repeated interaction (Hill & Dunbar, 2003). Most network members are platonic friends (Sprecher, 2011); however, networks also include family, co-workers, and neighbors (Hill & Dunbar, 2003). People are capable of seeing their partners' and networks' influence on romantic outcomes as distinct (Parks, Stan, & Eggert, 1983).

Surra (1988) documented five attributes of network interdependence. Network *size* is the number of individuals in an established network, whereas *density* is the ratio of actual connections made vis-à-vis maximum network members. Network *clusters* are subgroups that emerge from a larger network. Clusters vary in density and size, such as the difference between immediate and extended family. This may be due to *reachability*—the degrees of separation between network members.

CONTACT James Stein jbstein1@asu.edu Hugh Downs School of Human Communication, Arizona State University, PO Box 871205, Tempe, AZ 85287-1205

James Stein (Ph.D, Arizona State University, 2018) is a PhD in the Hugh Downs School of Human Communication at Arizona State University, located in Tempe, Arizona, USA.

Lastly, network *overlap* is the extent to which two network members share a mutual connection. These attributes paved the way for measures of network interdependence.

Interdependence and relational turbulence theory

Berscheid (1983) describes interdependence as emerging from "causal interchain sequences" (p. 138), such that partner A and partner B have co-occurring life events. Interdependence is the degree to which partner A's interchain sequence influences partner B's, and vice versa. Partner *interference* is the degree to which partner A interrupts partner B's interchain sequence (e.g., disrupting everyday goals/activities; Solomon & Knobloch, 2001). Conversely, partner A may *facilitate* partner B's goal completion or daily routine. Facilitating behaviors are used as relational maintenance strategies and are usually more intentional than interfering behaviors (Knobloch & Theiss, 2010).

Theoretically, partner interference and facilitation are applied in RTT. Briefly, RTT posits that as relationships progress through shifts in relational parameters partners perceive higher levels of interdependence (Solomon & Knobloch, 2001), leading to polarized emotions (Knobloch & Theiss, 2010). These emotions influence the enactment and valence of specific communicative episodes (Knobloch & Theiss, 2011; Theiss & Solomon, 2006). Partner interference and facilitation are generative mechanisms in RTT (Solomon et al., 2016).

Missing from RTT is the influence that occurs from outside of a dyad. Turbulence theory positions social network interaction as an outcome of turbulence (Solomon et al., 2016), neglecting the influence that social networks have on relationship development (see Agnew, Loving, & Drigotas, 2001; Sprecher, 2011). Network members likely influence relationships through interfering and facilitating behaviors.

Network influence as a form of interdependence

Quantifying interdependence within networks allows future research to explore how those behaviors impact interchain sequences. Perceptions of network influence contribute to relational quality and longevity (Agnew et al., 2001; Felmlee, 2001; Parks & Adelman, 1983). Interference and/or facilitation from a person's network might lead to changes in relationship commitment (Sprecher & Felmlee, 2000) or romantic involvement (Parks et al., 1983). Interference and facilitation from network members may also spark intensified emotions (Solomon et al., 2016).

Following Berscheid's (1983) understanding of dyadic interdependence, *network interdependence* is the degree to which members of a social network influence the goals of individuals in that network. *Network interference* is the extent that network members disrupt a person's interchain sequence, whereas *network facilitation* is the amount of support received in the completion of an interchain sequence. Below, two studies develop (Study 1) and test (Study 2) measurements of network interference and facilitation.

Study 1

Due in part to network interdependence, social networks serve as integral players in relational development and maintenance (Parks et al., 1983). As such, it is likely that they both interfere with and facilitate a person's interchain sequence. The goal of Study 1 is to gauge whether perceptions of network interference and facilitation can be quantified and distinguished from partner interference and facilitation.

RQ1a: Does network interference represent a unique index from partner interference?
RQ1b: Does network facilitation represent a unique index from partner facilitation?

Method

Participants and procedure

Data were collected from 367 individuals (208 women). Subjects identified as Caucasian (n = 196), Asian (n = 56), Hispanic (n = 53), mixed race (n = 24), and African American (n = 19). Relationship types included seriously dating (n = 184), casually dating (n = 106), friends with benefits (n = 42), and engaged/married (n = 19; *other* = 14), and averaged 1.55 years (SD = 1.73). Average age was 20.26 years (SD = 2.11).

Measures

Solomon and Knobloch's (2001) partner influence scale assessed partner interference (α = .91) and facilitation (α = .91). These items were used as a guide and modified to reflect perceptions of network interference (α = .87) and facilitation (α = .86).

Results

It was important to determine that network interference and facilitation indexed distinct measures from partner interference and facilitation. Exploratory factor analysis (EFA) was run, with items from both partner and network interference/facilitation entered. Results revealed four separate factors consisting of five items each, using a .60–.40 cutoff, preliminary answering RQ1.

Next, EFA (maximum likelihood with a direct oblimin rotation) was rerun using only network interference and facilitation items. Two factors with an eigenvalue of over 1.0 explained 60.78% of variance. Both KMO tests (.95) and Bartlett's test of sphericity, χ^2 (63) = 171.33, p < .001 were acceptable. One item was kept due to conceptual fit. Table 1 displays full results.

Discussion

The sole goal of Study 1 was to develop a measure of network interdependence. Two subscales were developed to measure network interference and facilitation. These subscales were demonstrably distinct form partner interference and facilitation—not surprising given that people often categorize their romantic partners as separate from their social network (Sprecher, 2011).

Table 1. Results for EFA measuring network interference and facilitation.

	Study 1			Study 2		
Factor Item	α	*M* (*SD*)	Loading	α	*M* (*SD*)	Loading
Network Interference	.87	3.53 (1.51)		.87	2.98 (1.77)	
1. My social network interferes with whether I achieve the everyday goals I set for myself			.62			.76
2. My social network interferes with the amount of time I spend with my romantic partner			.64			.81
3. My social network interferes with my ability to use my time well			.83			.94
4. My social network interferes with how much time I devote to school/work			.87			.89
My social network interferes with the things I need to do each day			.85			.91
Network Facilitation	.86	4.42 (1.30)		.86	4.17 (1.35)	
1. My social network helps me in my efforts to make plans			.65			.71
2. My social network helps me to do the things I need to do each day			.81			.81
3. My social network helps me in my efforts to spend time with my romantic partner			.60			.73
4. My social network helps me to achieve the everyday goals I set for myself			.80			.86
5. My social network helps me to use my time well			.80			.80

Strong loadings and reliabilities for both subscales provide initial validity for this scale. What is more, the ability for these scales to account for over 60% of variation is encouraging for both external and ecological validity. It is, however, necessary to conduct a second data to further gauge the measures' validity

Study 2

Study 2 seeks to extend the findings from Study 1 by using confirmatory factor analysis (CFA) and more detailed measurements of construct validity. These methods articulate how measures of network interdependence functions within the broader nomological network (Worthington & Whittaker, 2006). Parks and colleagues (1983) showed that people are capable of distinguishing network impact from partner impact on their relationships. Therefore, the scales indexing network and partner interdependence should covary with one another, but also be empirically distinct.

H1: Network interference, network facilitation, partner interference, and partner facilitation operationalize distinct structures.

Measures of network interdependence will likely correlate with RTT variables. Since multiple individuals can simultaneous influence someone's interchain sequence (Berscheid, 1983), network and partner interdependence are likely related. Given that partner interdependence predicts emotional reactions (Knobloch & Theiss, 2010), it is likely that network interdependence shares comparable associations. Lastly, partner interference (Theiss & Solomon, 2006) and facilitation (Solomon & Knobloch, 2001) correlate with the enactment and valence of communication episodes, so too should measures of network interdependence.

H2a: Network interference will positively correlate with partner interference, partner facilitation, negative emotions, and communicative enactment while negatively correlating with communication valence.

H2b: Measures of network facilitation will positively correlate measures of partner interference, partner facilitation, communicative enactment and communication valence while negatively correlating with negative emotion.

A final test of this novel scale is its ability to interact with and relate to variables within theoretical suppositions (Worthington & Whittaker, 2006). For network interdependence, the ability to predict negative emotional responses, while controlling for partner interdependence, is a key indicator of the scales' validity.

H3a: Network interference will positively influence negative emotion above and beyond partner interference and facilitation.

H3a: Network facilitation will negatively influence negative emotion above and beyond partner interference and facilitation.

Method

Participants and procedure

Data were collected from 642 individuals (336 men; M_{age} = 35.17, *SD* = 10.01) across the United States using Amazon's *Mechanical Turk* (MTurk). Participants received $1.50 for completion of the survey. Average relationship length was 6.28 years (SD = 4.44). Respondents identified as being married/engaged (n = 398), seriously dating (n = 177), or casually dating (n = 67). Ethnicity was

Caucasian (n = 409), Asian (n = 113), Indian (n = 51), African American (n = 40), and Hispanic/Latino (n = 18).

Measures

Measurements for this study included: Solomon and Knobloch (2001) measure of partner interference (α = .93), and facilitation (α = .89), measures of network interference (α = .94), and facilitation (α = .89) from Study 1, Dillard, Kinney, and Cruz's (1996) *emotions in close relationships* scale (α = .96), Knobloch and Theiss' (2011) scale of enacted relational talk (α = .88), as well as three follow-up questions to gauge the valence of relational talk (positive vs. negative; α = .88). All measures involved Likert-style questions that ranged from one through seven.

Results

A maximum likelihood CFA (using AMOS) tested H1. Multiple fit indices were implemented: χ^2/df < 3.0, CFI < .95, and RMSEA < .06 (Hu & Bentler, 1999). Initial CFA included both network and partner interdependence, and demonstrated excellent fit, χ^2 (144) = 321.30; χ^2/df = 2.32, CFI = .958, RMSEA = .058, supporting H1.

Because of demographic differences between Studies 1 and 2, multifactor analyses tested for invariance between samples. This method tests three nested models: an unconstrained model, a weight-constrained model, and weight/covariance-constrained model. The sample from Study 1 χ^2 (81) = 180.63; χ^2/df = 2.23, CFI = .961, RMSEA = .057 and Study 2, χ^2 (81) = 208.17; χ^2/df = 2.57, CFI = .974, RMSEA = .050 fit well. The unconstrained model significantly differed from the weight-constrained model χ^2_{diff} (11) = 63.25, p < .05. The weight-constrained model significantly differed from the weight/covariance-constrained model χ^2_{diff} (14) = 44.41 p < .05. Thus, there is variation between samples (see Table 2).

The second hypothesis tested convergent/divergent validity. Across 21 correlations, 17 came back significant and in the predicted direction, partially supporting H2. Full correlations can be viewed in Table 3.

The third hypothesis tested the influence of network interdependence on negative emotion above and beyond partner interdependence using a hierarchical regression (see Table 4). At the first step, network interference and facilitation explained a significant amount of variance in negative emotion, adjusted

Table 2. Fit indices for multi-level confirmatory factor analysis.

Model	χ^2/df	RMSEA	CFI	ΔCFI			
Study 1	2.23	.057	.961				
Study 2	2.57	.050	.974				
Unconstrained Model	2.67	.053	.931				
Weight-constrained Model	2.78	.053	.926	.012			
Weight/Covariance-Constrained Model	2.93	.054	.922	.008			
Correlations between factors							
Measures	1	2	3	4	5	6	7
(1) Network Interference	—	.55***	.65***	.15*	.41***	.12*	.09
(2) Network Facilitation		—	.30**	.41***	−.14*	.16*	.03
(3) Partner Interference			—	.04	.50***	.02	.19*
(4) Partner Facilitation				—	−.26**	.38**	.35**
(5) Negative Emotion					—	.25**	.29**
(6) Communicative Enactment						—	.12*
(7) Communicative Valence							—
M	2.98	4.17	3.43	5.03	2.08	6.23	4.87
SD	1.77	1.35	1.68	1.22	1.39	1.32	1.36

Note. *p < .05, **p < .01, ***p < .001

Table 3. Hierarchical regression of negative emotion on network and partner interdependence.

Predictor	ΔR^2	B
Step 1	.17***	
Network Interference		.21***
Network Facilitation		.05
Step 2	.16***	
Partner Interference		.33***
Partner Facilitation		.30***
Total R^2	.33***	
N	642	

Note. *$p < .01$ **$p < .001$
F (4, 637) = 79.52 $p < .001$

$R^2 = .17$, $F(2, 639) = 67.51$, $p < .001$. Network interference (β = .21) but not facilitation (β = .05) was significantly associated with negative emotion at the second step.

Discussion

Study 2 confirmed the measure developed in Study 1. This demonstrates internal, external, and ecological value of the scale. It is clear that measures of network interdependence are distinct from measures of partner interdependence.

Network interdependence significantly correlated with partner interdependence, negative emotion, enactment, and valence of relational talk episodes (H2). These findings are both in line RTT (Solomon et al., 2016) and confirm the viability of the scale (Worthington & Whittaker, 2006). Because most people struggle to balance time between their romantic partners and social networks (Felmlee, 2001), it is likely that a person's interchain sequence is influence by multiple parties simultaneously (see Berscheid, 1983).

Network interference (but not facilitation) significantly impacts negative emotion when controlling for partner interdependence (H3). This coincides with RTT research (e.g., Solomon & Theiss, 2008; Theiss & Solomon, 2006) by suggesting that interfering network behaviors are more impactful than facilitating network behaviors.

General discussion

This article extended work by Berscheid (1983) and Solomon and Knobloch (2001) by developing and implementing measurements of network interference and facilitation. Results support the measurement of network interdependence and offer both conceptual and theoretical contributions to the study of interpersonal communication.

Both EFA and CFA demonstrated clear empirical distinctions between partner and network interdependence. Entire networks may have detailed intertwining interchain experiences (Berscheid, 1983)—especially for dense networks (Surra, 1988). These connections likely impact communication episodes and relationship parameters (such as relational transitions; Solomon et al., 2016). It remains unclear which of Surra's elements of network interdependence contribute the most to levels of interference and facilitation.

The demographic difference between samples (i.e., primarily dating versus primarily married) required multi-level CFA. Analyses demonstrated variance between the samples of Studies 1 and 2, suggesting that network interdependence may function differently across relational stages. That said, excellent fit and reliability in both samples supports the measures' external validity. Future research should employ these measures across a variety of relationship types.

That network interference influenced negative emotions above and beyond partner interdependence implies that RTT's tenets can benefit from extra-dyadic revision. Network interdependence

may be a generative mechanism in the theory's structure. This manuscript calls for consideration of network-based measurements as independent variables in additional communication theories.

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