Resonance and its Implications for Constructive Social Change:
A Review and Synthesis of the Literature

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Abstract

In this paper we highlight the importance of the concept of resonance for facilitating constructive social change and peace. Despite its prevalence across disciplines, resonance has yet to be understood and operationalized in a manner that can usefully guide systemic social change. Today, its conceptualization, definition, component-parts, underlying dynamics, measurement and the conditions that foster and inhibit it have yet to be sufficiently specified. This paper summarizes some common themes in the disparate literatures on resonance, and offers a synthesis in the form of a framework for working with resonance to mobilize constructive change.

Everything is energy and that's all there is to it. Match the frequency of the reality you want and you cannot help but get that reality. It can be no other way.
This is not philosophy. This is physics.

Albert Einstein

At an innovation lab we organized for peacebuilders in 2014, one told the following story:

> The events of 9/11 brought out a host of human emotions – anger, fear, sadness, the need for retribution, and patriotism, among others. At the American Red Cross and with those we served, there was a heightened shared energy that resulted in a collective coherence that, to this day, I have never experienced in my life. I had the fortunate, or unfortunate, task of talking to many family members who were affected by this tragedy. It was the most horrible and most rewarding experience of my life. What I know is that we rallied like never before – we broke all the rules with one goal in mind – serve the families. It was this *resonance* that gave us strength when we were so tired or so emotionally drained. One of my prized possessions is a thank you letter from a little girl whose father had died. To me this letter was for everyone who felt that resonance and answered the call. I am forever proud of my colleagues for their dedication and unwavering hard work.

The idea of resonance as a force behind unity and social change is not new. The term comes from Latin and means to "resound" - to sound out together with a loud sound. Philosophers and social theorists have been articulating its centrality for human experience and social mobilization for over a century (Bateson, 1972; Canetti, 1960; De Tarde, 1903; LeBon, 1895). However, although resonance has received increasing

attention in the complex systems and peace-building literatures of late (e.g., Burns, 2007; Eoyang & Holladay, 2013; Rothman, 1997), our understanding of it remains crude. Exactly what resonance is, how it functions, and the conditions that foster and inhibit it have yet to be specified sufficiently enough to offer much practical utility. In this paper, we review the diverse literatures that have addressed the concept of resonance, and then offer a summary and synthesis in the form of a set of propositions for working with resonance to mobilize constructive social change.

The Components of Resonance

For our review, we searched a wide range of disciplinary literatures including physics, music, physiology, philosophy, political theory, anthropology, psychology, conflict resolution, systemic action research, social movements, leadership, Chinese thought and Hawaiian culture. Accordingly, we searched the term in the following databases: Super Search, ProQuest, LexisNexis, ERIC, JSTOR, and PsycINFO. Our search included theoretical models of resonance (taking into account the impact factor ranking of the journal, number of citations, and the presence of a relevant body of literature) as well as empirical research from the last 10 years. This resulted in a total of 101 articles (see Table 1).

INSERT TABLE 1

We then organized our review and coding of the articles around the following set of questions aimed at synthesizing the theory and research on resonance in a manner that has practical utility:

1) **How is the phenomenon of resonance commonly conceptualized and defined?**
2) **What are the various mediating mechanisms associated with resonance (from physical-neural to social-cultural) at different levels of analysis?**
3) **What seem to be the necessary and sufficient antecedent conditions for resonance to occur?**
4) **What are the primary outcomes associated with resonance?**
5) **How is resonance identified, detected or measured? What are the methods of assessment?**
6) **Can resonance be managed, fostered, encouraged or controlled in some manner? If so, how? What practices are associated with this?**

We then further organized the findings from our review at different levels of analysis, from more basic or micro, physical processes to more macro, social and political processes (see Table 2).

INSERT TABLE 2

How is the phenomenon of resonance commonly conceptualized and defined?
Resonance is a term that is defined variously in different areas of study. In early philosophy and mathematics, Lucretius (99 BC- 55 BC) referred to it as a process of atom attraction (and repellence) through which all matter comes to being: *"(atoms) clashing*

together of their own accord, by chance in many ways, without design, idly without result, at last by force, have coalesced, and suddenly become the rudiments of mighty things" (1882, p.78). Alfred North Whitehead and Bertrand Russell in *Principia Mathematica* (1910) proposed a mathematical theory of resonance as "*Resonance arises when two sets of connected circumstances have the same periodicities. It is a dynamical law that the small vibrations of all bodies when left to themselves take place in definite times characteristic of the body. A more complicated body may have many ways of vibrating; but each of its modes of vibration will have its own peculiar period.*" (p 170). These are the philosophers that most influenced Ilya Prigogine, the noted physical chemist and Nobel laureate, on the vibratory nature of matter (Prigogine & Stengers, 1997).

In physics, resonance refers the natural tendency of a system to respond to different frequencies depending upon the amplitude of an oscillation (Bhargava, 2012). What this means is that at certain frequencies a system can store more vibrational energy that can be more readily transferred between storage modes (think of the potential energy of a pendulum waiting to be released and its kinetic energy after being released).

There are multiple types of resonance and resonant systems: mechanical, nuclear, quantum wave, electrical and electrical magnetic, and acoustic (Rosch, 2009). Resonant systems can both create specific frequency vibrations in other systems such as musical instruments or can be used to filter out or isolate one frequency out of complex (noisy) array of frequencies in a system (Jia, 2014).

To many, the concept of resonance is most familiar with regards to music. Musical instruments are set into vibrational motion at their harmonic or natural frequency when played (Fletcher & Rossing, 2012). Vibrating systems have characteristic frequencies, the resonant frequency is the one that causes the maximum amplitude and drives the whole system (Dunn, Hartmann, Campbell & Fletcher, 2015). Although musical and biological sounds tend to be organized and harmonic, Fletcher (2012) explains that the *"apparent simplicity is constructed by the interaction of highly nonlinear feedback generators linked to resonators whose vibrational modes are not in simple harmonic frequency ratios…* (and) *emerges from complex interactions in the generation of instrumental sound and in the songs of humans and other animals"* (pp.188). In other words, despite the pleasing clarity of harmonic resonance, its mechanics are complex.

Social theory and research at the individual and interpersonal levels tends to concentrate on the affective and physical components of resonance (e.g. Fredrickson, 2013; Goleman, Boyatzis & McKee, 2013; Lewis, Amini & Lannon, 2007; Lockwood, Bird, Bridge &Viding, 2013; Tomkins, 1962; van Elk, van Shie, Hunnius & Bekkering, 2008;). Stephen Grossberg (1987; 2013) for example, built on notions of resonance and amplification from the hard sciences and adapted them to theories of the brain and to conditions like schizophrenia. Lewis et al. (2007) describe *limbic resonance* as *an unconscious and internal process by which two people become physically and emotionally in-synch with one another* - "a symphony of mutual and internal adaptation whereby two mammals become attuned to each other's inner states."

For Fredrickson (2013), resonance is conceptualized as emerging from interpersonal interactions and residing in the connections between individuals (Fredrickson, 2013). She defines its *underlying components as the sharing of positive emotions, a synchrony of biochemistry, behavior and motivation to invest in one*

another's well being. Gottman, Gottman & DeClaire (2007) focus on empathic attunement; *being able to imagine what the other person is thinking and feeling and being able to respond to the emotional needs of the partner.* A number of other studies, including those on *motor resonance* (van Elk et al., 2008), demonstrate the degree to which neurobiological processes can become in-synch or mirror one another during particular types of resonant interactions (Aglioti, Cesari, Romani & Urgesi, 2008; Fredrickson, 2013; Goleman et al, 2002; Kok and Fredrickson, 2010; Lewis et al., 2001; Stephens et al., 2010; van Elk et al., 2008; Zwaan & Taylor, 2006).

At the level of groups, LeBon (1895), attempted to apply the concept of resonance to crowd phenomena, employing resonance to explain unplanned collective action and riots. Later, De Tarde (1903) proposed an expanded and more empirically grounded social theory for explaining the ways that resonance can create, steer and control collective behavior. He offered the concept of "*extra-logical influence*" to describe resonance as the transmission of affect leading to a collective emotional experience. Elias Canetti (1960) expanded these theories further by employing the resonance concept to develop typologies and identify affects that particularly resonate with violent mobs. Later, writings on *Second Order Cybernetics* developed resonance in much more depth, the most advanced being Gregory Bateson (1972) in his *Steps to an Ecology of Mind*.

Rothman (1996), writing in the context of identity-based conflict resolution, conceptualizes resonance at the intergroup level as *a harmonious fusion of horizons brought forth through a process of "deep dialogue" and reflexivity*. Resonance, according to Rothman (1997), occurs when "disputants incorporate their different subjective frames into a shared inter-subjective definition of the core narratives, meaning and motives" which can foster a state of "emotional vibration" brought forth through empathy. Burns (2007), bringing attention to the action potentialities that emerge in situations of resonance, defines the phenomenon as *a process by which people discover and forge connections through their shared and disparate experiences, which fosters a state of energy and motivation for more joint action*.

Resonance has also received increasing attention at the political level. For example, the term *resonant leadership* has recently emerged in the practice literature (e.g. Boyatzis & McKee, 2006; 2013; McKee & Massimilian, 2006). Boyatzis and McKee (2013) suggesting that resonant leaders are those that "are in tune with those around them. This results in people working in sync with each other, in tune with each others' thoughts…and emotions…" (p. 4).

Studies on social movements emphasize *frame resonance* and focus mostly on the cognitive and action tendencies actualized through situations of resonance (Buffonge 2001; McCammon, Campbell, Granberg & Mowery, 2001; Reese 1996; Snow, Rochford, Worden & Benford, 1986); Trevizo, 2006). Cooter (2006) defines frame resonance as, "*the degree to which individuals can identify with the stated positions of a frame*." Such resonance energizes and mobilizes people in support of a movement's causes and goals. Similarly, resonance in social media has been studied in terms of social media interactions that result in *information propagation* (see Asur, Huberman, Szabo, & Wang, 2011; Bakshy, Rosenn, Marlow, & Adamic, 2012) and *contagion of emotional expression* (see Coviello et al., 2014; Kramer, Guillory & Hancock, 2014). For example, the anarchist manifesto "The Coming Insurrection," authored by The Invisible Committee (2009), describes resonance as the apparatus by which social revolutions spread:

"Revolutionary movements do not spread by contamination but by *resonance*. Something that is constituted here resonates with the shock wave emitted by something constituted over there." (p. 12). Della Porta and Mattoni (2014), writing on the spreading of social movements and resonance, highlight the insufficiency of linear models of causation to explain waves of mobilization, *"the concept of resonance explicitly differentiates between the proximate cause of mobilization – the 'waves' passing through and amplified by movement A – and the deep causes of mobilization, which always and already lay hidden underneath the social surface in the form of shared structural conditions and pre-existing local movement experience and activist networks"* (pp.120).

Similarly, Jullien (2004), characterizing resonance in Chinese thought, shifts the focus of resonance from figure (individual physiology, affect, cognition, and so on) to ground (context). He writes,

> Rather than set up a model to serve as a norm for his actions, a Chinese sage is inclined to concentrate his attention on the course of things in which he finds himself involved in order to detect their coherence and profit from the way that they evolve. From this difference that we have discovered, we could deduce an alternative way of behaving. Instead of constructing an ideal Form that we then project on to things, we could *try to detect the factors whose configuration is favorable to the task at hand*; instead of setting up a goal for our actions, we could allow ourselves to be carried along by the propensity of things. In short, instead of imposing our plan on the world, we could rely on the potential inherent in the situation (p. 16).

Jullien likens resonance to nature's process of ripening, as captured in the proverb from the kingdom of Qi: "However acute one's intelligence may be, it is better to rely on the potential inherent to the situation" "even with a mattock and a hoe to hand, it is better to wait for the moment of ripening (p. 16)."

Finally, resonance has also been conceptualized at the spiritual level. For instance, traditional Hawaiian culture offers *lokahi*, which speaks to the harmony between self and the great chain of being. According to the native Hawaiian worldview, the self is embedded in a web of natural, social and spiritual relations. A sense of resonance between these interdependent elements is believed to be vital for the health and functioning of both the individual and society. McCubbin & Marsella (2009) describe *Lokahi* as a triangle formed by aina (nature), Kanaka (humankind) and ke akua (gods). Connections and balance between these three elements is made possible through *mana*, which "represents the most primordial force in the universe that animates or gives life or power to all things" (Kanahele, 1986, as cited in Shook & Ke'ala Kwan, 1987, p. 5).

Based on our review of the various conceptualizations and definitions of resonance in the scholarly literature, we propose a working definition of **social resonance as a dynamic of shared energy and connection within and between people and groups in a particular time and space.** At its essence, resonance in social systems can be conceptualized fruitfully as a form of heightened, shared (congruent) emotional, cognitive, physical or social energy that results in people feeling and finding connections and coherence. It is a form of shared motivation that gives way to different degrees of

conceptual, emotional and behavioral coherence. Directed behavior may result when this energy crosses some threshold in a group (beyond inertia or resistance to change), and may be constructive or destructive (or both) depending on the valence and direction of the groups shared interests (e.g., a mobilized community addressing joblessness or sanitation problems in their area versus an angry mob addressing grievances against members of an outgroup). From this perspective, *crisis* could also be viewed as a form of increased energy with *decreased coherence* that introduces more degrees of freedom and chaos in a system. In contrast, resonance is a form of heightened energy that induces *increased coherence* that provides a sense of shared meaning and direction in a social system.

What are the mediating mechanisms associated with resonance?

The various aspects of resonance described above have different but complementary mechanisms associated with them. In physics and music, the primary focus is on the natural frequency of an object, which is associated with one of the many *standing wave patterns* by which that object could vibrate (Bhargava, 2012). This is the inherent potential of the object or system (the natural frequencies of a musical instrument are sometimes referred to as the *harmonics* of the instrument, see Elert, 2015). As noted above, an object such as an instrument can be forced into vibrating at one of its harmonics (at one of its standing wave patterns) if another *interconnected* object moves it into vibration at one of those frequencies (Jia, 2014). Thus, the main mechanisms in these systems are a) an object's natural frequencies, b) the interconnection of the object with another object, and c) a frequency shared by both objects.

Resonance at a human physical level focuses on the *neural and biochemical processes* that underlie and produce synchronicity between individuals. The work on motor resonance, for example, has identified *mirror neurons* in the brain that foster understanding of how others feel and see the world as the automatic mechanism by which resonance is made possible (Zwaan & Taylor, 2006; Aglioti et al., 2008; van Elk et al., 2008; Praszkier & Nowak, 2011). Similarly, Fredrickson (2013) focuses on the mechanism of *neural coupling* – the way in which two or more brains connect, or synch-up, through communication – which is most evident during moments of emotional connection. She also addresses the way in which resonance produces and is produced by an increase of the *neuropeptide oxytocin* (known to play a key role in social bonding and attachment), as well as *vagal tones* (degree to which your heart rate is patterned by your breathing rate) and capacity for resonance. All three of these mechanisms, according to Fredrickson, work in *causal loop* so that each factor – brain patterns, oxytocin levels, and vagus nerve - both produce resonance and is in turn produced by resonance. There is also some evidence that *physiological resonance between individuals is fundamental to the biological capacity for empathy* (Buchanan, Bagley, Stansfield, and Preston, 2012). According to this research, physiological stress can resonate: observers of pain and distress commonly exhibit increases in reported distress, autonomic arousal, facial mimicry, and overlapping neural activity (Buchanan et al., 2012).

Interpersonally, *affective* resonance is associated with *empathy* – the capacity to comprehend or *resonate* with the emotional experiences of others (Singer & Lamm, 2009) - as a mechanism that enables resonance to take place. Lockwood et al. (2013), suggest two important processes that contribute to empathy: *being in tune with the*

emotional state of another, and *identification with and comprehension of (without necessarily feeling with) the interiority of another*. Rothman (1997) characterizes these as *emotional empathy* and *analytical empathy*. He offers a form of resonance called *reflexivity* where people find in themselves aspects of the other, and in the other aspects of themselves. This results in a dynamic interchange in which people hearing each other's narratives can begin to find deep connections – or resonance - that provides a bridge to healing after conflict (Rothman, 1997, 2012).

Further*, cooperative orientations* - the result of more cooperative personalities, relationships and promotively interdependent task and incentive structures – are another central mechanism of resonance. A large canon of research has shown consistently that cooperation and cooperative tasks and reward structures in groups, when contrasted with independent or competitive tasks and rewards, tend to induce a perceived similarity in beliefs and attitudes, a readiness to be helpful, openness in communication and to influence from the other, trusting and friendly attitudes, sensitivity to common interests, a de-emphasis to opposed interests, and an orientation to enhancing mutual power rather than power differences (see Deutsch, 2015; Johnson & Johnson, 2005).

Interpersonal resonance may also emerge through interactive processes such as *social modeling*. Zwaan and Taylor (2006) found that *observing actions and understanding sentences about those actions* activates corresponding motor processes in the observer– comprehender. Van Elk (2008) goes a step further, and explains that there is evidence that our motor skills crucially affect the way in which we perceive the actions generated by others, by *showing stronger motor resonance for observation of actions that are established in one's motor repertoire*. This again points to the importance of an actor's internal capacities or readiness for a specific type of social resonance.

Another mechanism associated with interpersonal resonance is *synchronized activity*. In a series of studies, researchers have found that people walking in step with each other, or singing and waving cups in unison, reported greater feelings of connectedness and trust with their group than did the unsynchronized groups (Wiltermuth & Heath, 2009). Others have proposed that marching in armies, religious chanting reciting the pledge of allegiance, singing in unison, and rock concert mosh pits facilitate bonding and mutual support among the participants (e.g. Haidt, 2007; McNeill, 1995; Olaveson, 2004; Radcliffe-Brown, 1922). Synchronous activity seems to create bonds among the participants that facilitate cooperation and even mutual sacrifice.

Regarding leadership in groups, research has found that a key criterion for resonant leadership is *emotional intelligence* (EI): a leaders' ability to attune him or herself to the emotions of others. According to Goleman et al. (2002), there are four dimensions to EI related to resonant leadership: self- awareness, self-management, social awareness, and relationship management. McKee and Johnston (2014) found that more resonant leaders create resonant organizations through *limbic resonance* – using emotional intelligence to drive an organization by rallying members around a shared purpose greater than the individual members.

At the level of social movements, one of the mechanisms that enables frame resonance is that of *saliency*, or the importance of a frame's message to a person's life. According to Snow and Benford (1988), frame-resonance depends on three factors: *the frame's centrality - how important are the ideas, beliefs and values to a person life; experiential commensurability - how relevant is the frame to a person's daily experience;*

and narrative fidelity/cultural resonance, - how aligned is the frame with a person's cultural narratives and understandings. This mechanism also applies to much of the research on social media interactions, where the effect of exposure to positive vs. negative content conditions individual propensities to disseminate content consistent with the exposure (Coviello et al., 2014; Kramer et al., 2014).

To summarize, a variety of complementary mechanisms are associated with resonance (a dynamic of shared energy, connection and coherence) across levels. These include:

- A person or group's *natural frequencies*, including their internal capacities, needs, motor repertoire, values or beliefs that create readiness for a specific type of social resonance;
- A set of *neural and biochemical processes conducive to interconnections* (mirror neurons, neural coupling, oxytocin and vagal tones) that underlie and produce synchronicity within and between individuals and groups;
- *Empathy* or the capacity to comprehend or resonate with the emotional or analytical experiences of others;
- *Cooperative orientations,* the result of more cooperative personalities, relationships and interdependent task and incentive structures;
- *Social modeling* or the capacity to internalize and replicate the experience of others;
- *Synchronous activity* or taking action with others where everyone is moving, singing, chanting, dancing, etc., in time together;
- *Emotional intelligence* or an ability to attune oneself to the emotions others; and
- *Frame salience, centrality*, *relevance* and *alignment*, or a messages degree of interconnection with the propensities and needs of individuals.

What are the necessary and sufficient antecedent conditions for resonance?

Once again, the conditions conducive to resonance vary in accordance with distinct levels of analysis. In physics, resonance occurs *when a system responds to different frequencies depending upon the amplitude of an oscillation* (such as kinetic energy and potential energy in the case of a pendulum). With music, *resonance only occurs when the first object is connected with and vibrating at the natural frequency of the second object*. So if the frequency at which a tuning fork vibrates is not identical to one of the natural frequencies of the air column inside a resonance tube, resonance will not occur.

Interpersonally, resonance is more likely when individuals *share an ability to identify with and describe feelings of others and to feel what others feel* (Lockwood, Bird, Bridge & Viding, 2013), evidence *self–other awareness and self-regulation* (Decety & Meyer, 2008) and show high levels of *empathy and emotional reactivity* (Balconi & Bortolotti, 2012). In addition, high levels of empathic connection tend to occur *as a result of awareness of nonverbal factors, particularly postural, gestural, and facial mirroring, emotional attunement and a capacity to articulate emotional experiences, physical touch, listening, bodily, emotional, and spatial awareness* (Lovkvist, 2013), and *awareness of internal and external cognitive and emotional states* (Haas, 2011).

Within groups, several factors increase resonance, including sharing *aspects of identity* such as cultural heritage, language, ancestral history, and factors associated with the member's current situation and relationships in everyday life (Rothman, 2012);

familiar cultural repertoires such as religion, political preferences, and other forms of group identity (Robnett, 2004); *shared emotional states* deriving from situational factors experienced collectively (Robnett, 2004); *shared narratives* that are commensurate to lived experience (Ettema, 2005); *shared interest and motivation* to increase the quality of outcomes in group processes (Bell & Morse, 2010) and *leadership that is able to define a group's self-understanding* (Mols, 2012).

<u>Between groups</u>, research on *affective resonance* emphasizes the *link between ideological beliefs and empathy* (Eckhardt and Alcock, 1970), where a sort of "resonance" mechanism between the observer and the observed permits a direct form of understanding of members of the other (Balconi and Bortolotti, 2012). *Ideological factors* such as militarism, nationalism, conservatism and religiosity, and *personality factors*, such as neuroticism, extraversion, misanthropy, and a history of strict childhood discipline can limit an individuals' level of connectedness and impair their capacities for empathy with members of other groups. According to Decety and Meyer (2008), *intergroup resonance depends on the capacities of self–other awareness and on self-regulation of emotional states, allowing the assessment of the other's state and the use of strategies to cope with distress in pro-social ways*.

With regard to resolving identity-based conflicts, Rothman (1992) suggests that reflexive dialogue can trigger introspective and interactive dynamics that lead to mutual recognition and a disposition to work towards resolution. Rothman (2012) also *highlights the importance of having identity-groups work with each other to cooperate in defining, promoting and assessing some shared future state in which agreements to reduce destructive dynamics and promote cooperation is practically consolidated through creative action*. Kuttner (2012) further defines these processes as leading to *relational mindsets, a main antecedent of resonance*.

Finally, at the <u>macro level</u>, research on frame resonance focuses on how *collective action frames* (Vicari, 2010) *can lead to forms of resonance that motivate social mobilization and change*. Mols (2012) found that radical leaders are able to gain considerable control by persuading the electorate of *threats to collective identities*. Further, emotional resonance at this level has been defined as *the emotional harmony and/or disjuncture between collective action frames and the emotional lives of potential recruits* (Schrock, Holden, & Reid, 2004). In particular, frames that are *inclusive of multiple groups and minorities* (Resnick, 2009), *take into account socio-political aspects beyond cultural and identity factors* (Ernst, 2009), have a *solid argumentative logic* of collective action (McCammon, 2009), *involve claim-makers that are perceived as credible* (Matesan, 2012), *include value appeals through messages that match with the value orientations of recipients* (Schemer, Wirth & Matthes, 2012), and *appeal to people's sentiments and emotions in a holistic manner* (Schrock, Holden & Reid, 2004), are particularly resonant.

In sum, the antecedent conditions for resonance begin when two or more individuals are somehow connected and share similar "frequencies", which may be needs, values, identities, beliefs or interests. Interpersonally, empathy and emotional attunement, careful listening and spatial awareness enhance resonance. With groups, sharing aspects of identity, familiar cultural repertoires, shared emotional states, shared narratives, shared interests and motivation and leadership that is able to unite groups all contribute to resonant conditions. Antecedent conditions for resonant social movement include frames

that employ threats to collective identities, connect to the emotional lives of people, are inclusive of multiple groups and minorities, have a solid argumentative logic, involve credible claim-makers and include value appeals through messages that match with the value orientations of recipients.

What are the primary outcomes associated with resonance?

Essentially, social resonance results in increases in energy though the interconnection of shared frequencies between people. However, we found that resonance can be associated with both constructive and destructive outcomes. Lewis, et al., (2007) contend that resonance is a basic human need whose fulfillment is essential for the *healthy development and functioning of individuals*, and whose *frustration leads to host of pathologies, ailments and even death*. Fredrickson (2013) associates resonance with a host of benefits including *cognitive*: opens up perceptions, orients awareness towards others, and enlarges circles of concern; *behavioral*: creates physical synchronicity (when body postures/movements and nonverbal gestures mimic one another) which increases trust and cooperation between people; *relational*: fosters greater growth, resilience, and moments of intimacy; and *health:* reduces risks of a multitude of ailments: including heart disease and stroke, diabetes, Alzheimer disease, common colds and even some cancers (Fredrickson, 2013). Resonance is also seen as integral to therapeutic intervention (Lewis, et al., 2001), a core of great leadership (Goleman et al., 2002), the engine of political revolutions (Gordillo, 2011), and an essential ingredient for transforming protracted social conflict (Burns, 2007; Rothman, 1991).

While the bent in the literature on resonance is principally positive, some authors recognize resonance to be a value-neutral concept that can *also be associated with the politics of exclusion and inter-group violence* (Cooter, 2006; Goleman, et al., 2002; Gordillo, 2011). Goleman et al. (2002), for example, differentiates between negative and positive resonance: *positive resonance unites and is pro-social, while negative resonance, also called "demagoguery", divides and is anti-social.* Gordillo (2011), who differentiates between political and non-political resonance, also separates political resonance that stands in opposition to state power (e.g. 2011 Egyptian uprising), with reactive and exclusionary resonance that is manipulated by state power (e.g. Nazi Germany).

How is resonance identified, detected or measured?
Measuring Resonance in Research

At the individual and interpersonal levels, one method of assessment of affective resonance and empathy measures the extent to which individuals' *physiological reactions* are similar to the experiences of others (Buchanan et al., 2012). Another *compares assessments of specific facial expressions* of actors to biofeedback readings from observers (Balconi & Bortolotti, 2012). A third comes from research on the resonance between children and parents (i.e. child socialization from parents), described as "ideo-affective resonance," which has been measured by *calculating the survey response correlations between ideological beliefs, personal feelings, and values of parents and children* (Eckhardt & Alcock, 1970). Another method is *Centering Resonance Analysis* (CRA), which use a linguistic analysis to pinpoint key words from discussions and then creates a network map of the links between these keywords. The authors write,

Resonance is a latent property of the structure of a CRA in the presence of an external signal (i.e., another network), just as a physical material only resonates when brought into contact with an external vibrating wave. To the extent that other texts or utterances deploy words in the same way as a given network, they may be said to resonate with it (Corman, Dooley, Kuhn & McPhee, 2002, p. 177)

Other methods at this level focus on assessing interpersonal resonance in therapy through *video analysis of observable behaviors such as "postures, gestures, body-spatial dynamics, movement rhythms, facial expressions, speech qualities, and breathing patterns… video segments were also scanned for nonverbal communication concerning the influence of touch, and skin tone variations"* (Lovkvist, 2013; pp. 33,46)

At the macro level, research on voting patterns, activism and activist activities offers some possibilities for measuring resonance. For example, Ernst (2009) *used interviews of activists to measure existing and shifting "terms of frame resonance,"* while McCammon (2009) measured activist frames using *content analysis of historical documents, such as speeches given by activists, letters to lawmakers, articles in newspapers, public interviews, organizing documents outlining topics for public speeches, and minutes from legislative hearings*. Other methods at this level include *measuring emotional resonance by coding "emotion discourses" from interviews, secondary sources, and archival data* (Robnett, 2004), and *analyzing news media to measure the extent to which certain patterns of story reporting are repeated – representing "formal textual features" of the topic* (Ettema, 2005).

Assessing Resonance in Practice

In practice, when identifying resonance at the interpersonal level, some psychotherapists report employing *"intuitive tracking skills" to sense shifts in the therapist-client "shared energy field"* (Siegel, 2013). Haas (2011) has proposed *measuring collections of brain charges between organisms as increases or decreases in brain activity can be measured using fMRI and EEG, representing "windows of opportunity" for influencing therapeutic change*.

Burns (2011) provides an example in the context of community development work that illustrates how an individual assesses resonance through *retelling of one's experience*: "At the market she talks casually with the women about their lives. One of the women tells her about the difficulties the women have in getting salt. They now have to dig for salt in locations which expose them to danger. She tests the resonance of this narrative by talking about the issue of salt with other women. They have similar stories to tell. They are receptive to being brought together to talk about this issue" (p. 106).

Resonance in groups is often assessed through *facilitator observations and by analyzing records of participants' dialogues and interactions* (e.g. Burns, 2007; Wadsworth, 2008). Rothman and Olson (2001) suggest that resonance in conflict interventions can be assessed by "*the ability of the participants to reframe the conflict in terms of their identities, and recognizing where they mesh and merge. The degree to which parties have come to recognize and accept one another's identity* (p. 299)." In conflict resolution, Kuttner (2012) identified resonance as *the emergence of a "common dialogic space" that shifts from a dialog about positions or interests to, instead,*

constructed meanings. This is measured through observation: *"Thinking together…*
Somebody would get an idea, somebody else would take it up, somebody else would add
to it. The thought would flow rather than there being a lot of different people, trying to
persuade others" (p. 324).

Perhaps the most common method of group resonance assessment is through
survey administration. Analysis involves assessing the extent to which group members
report sharing experiences, as well as the consistency of the experience across members
(Barsade, 2002; Faraj & Sproull, 2000; Lewis, 2003; Stinson & Hellebrandt, 1972).
Another method involves assessing *shared mental models*, which can be measured
through survey (e.g. Levesque, Wilson & Wholey, 2001; Mathieu, Goodwin, Heffner,
Salas & Cannon-Bowers, 2000; Stout, Cannon-Bowers, Salas & Milanovich, 1999) or
by assessing individually elicited models and then comparing the similarity of these
models across group members (Marks, Zaccaro & Mathieu, 2000). Ballard, Tschan and
Waller (2008) describe an experience sampling method using PDA's (Personal Data
Assistants; today smartphones could fulfill this role), where data is collected from each
participant periodically throughout a session and patterns in the group's dynamics are
identified using various algorithms. SYMLOG is a similar approach to analyzing group-
level interactions where group member actions are rated along three dimensions: upward-
downward, positive-negative, forward-backward (Bales & Cohen, 1979; Polley, 1987),
which allows for assessment of group *unification* or *cohesion* – processes central to
resonance.

More recent innovations allow for live automated coding of group member
behaviors, such as technologies that provide live real-time feedback to the group
regarding individual participant behaviors (Bergstrom & Karahalios, 2007; DiMicco,
Pandolfo & Bender, 2004), and others capable of *monitoring the vocalizations and*
indicators of individual group members to detect and contrast individual engagement
with the group as a whole (Gatica-Perez et al., 2005; Kim, Chang, Holland & Pentland,
2008; Olguin et al., 2009; Pentland & Madan, 2005).

Although a multitude of methods have been identified for measuring resonance in
research and in practice, there is often a tension between the quality and timeliness of
real-time assessments and the need for more rigorous, systematic approaches to
measuring resonance. Moving forward however, new technologies employing live data
collection, analysis and feedback may bridge this research-practice gap by providing
tools that are both immediately useful to practitioners and informative for hypothesis
testing by researchers.

Can resonance be managed, fostered, nurtured or controlled in some manner?
Our review of the literature identified three broad categories of practices or levers
associated with the promotion and management of resonance: strategies to increase self-
awareness and regulation; facilitated intervention processes; and framing techniques for
social mobilization.

Increasing self-awareness and self-regulation
Research focusing on the underpinnings of empathy (affective resonance) has
shown that along with the capacity of understanding and incorporating visual information

related to motor goals, self-other awareness and the ability to regulate one's own emotional states are fundamental components of prosocial forms of resonance (Decety & Meyer, 2008). Eckhardt and Alcock (1970) highlight the importance of childhood training in determining values of compassion and compulsion and consequently levels of empathy and resonance. Frederickson (2013) explains that an increase of awareness of individual physical and spiritual dimensions as well as of cognitive and emotional states of others can aid in the prediction and influence of resonant behavior.

Resonance Facilitation

In systemic action research, Burns (2011) proposes an approach where facilitators operate by intervening in multiple streams with different community members informed by a strong understanding of energy patterns in a system. Burn's approach advocates for intervention where action is seen as important as dialogue, issues can be reframed, the act of doing collectively can lead to changes in the landscape and the creation of new 'entry points.' From this perspective, Kakabadse, Kakabadse, and Kalu (2007) underline the importance of interaction in interventions where both facilitators and participants embark on collaboratively inquiry.

In cases of identity-based conflicts, Rothman (1991; 2012; see also Rothman & Olson, 2001) proposes a framework where one of the facilitator's primary goals is to foster *reflective dialogue*. In his ARIA framework, Rothman explains that practitioners are tasked with guiding the parties through the process, facilitating a discussion that will ideally lead away from antagonism between long-time disputants, into resonance between new allies. Most effective are identity-based third party interventions conducive to introspection processes that go beyond interest-based methods and address identity needs (Rothman, 1996; Rothman & Olson, 2001), address human needs associated with the factors that are fundamental to the parties' identities (Badawi, Sipes & Sternberg, 2012), and promote a relational view of the self (Kuttner, 2012).

Framing

The general assumption behind notions of resonance in social change theories is that by appealing to the interests of different audiences through framing, social movements can gain strength, legitimacy, and support (Resnick, 2009). McCammon (2009) found that frames that diagnose social problems as serious and with broad implications are more likely to convince lawmakers to alter policy as opposed to narrower political scopes. Matesan (2012) explains that the resonance of frames depends not just on internal organizational factors, but on the legitimacy and credibility of the different claim-makers in a particular context. Schemer, Wirth, and Matthes (2012) found evidence supporting the value-resonance hypothesis, or the idea that value appeals are more persuasive when messages match with the value orientations of recipients. Robnett (2004) found that resonance is determined by the socially located positions of participants, and that emotional resonance is a mediator in the ideology-frame link. In other words, emotional resonance can mobilize participants even in the absence of resonant ideological practices.

In social media research framing is taken one step further, focusing on the effects of *exposure to select behaviors, emotions, and other external factors* on the individual's emotions and propensity to share and disseminate information. Bakshy, Rosenn, Marlow

& Adamic (2012) assessed how much exposure to a URL on the Facebook feed increases an individual's propensity to share and found that that subjects who are exposed to signals about friends' sharing behavior are considerably more likely to share that same information, and share sooner than those who are not exposed. Another example, Coviello et al. (2014) looked at the effect of rainfall on emotional expression and confirmed that individual expression of emotions depends on what others in an individual's social network are expressing. These results imply that emotions themselves might ripple through social networks to generate large-scale synchrony that gives rise to clusters of happy and unhappy individuals.

Toward a Theory of Resonance in Social Systems

The story of resonance that emerges from our review of the literature is eclectic but coherent. It reveals a rich array of antecedent conditions and processes, mediating mechanisms, levers, measures and outcomes associated with shared energy and coherence at several levels of analysis (see Table 2). However, our review allowed us to identify the following set of eight testable propositions on resonance in social systems:

Proposition 1: Resonance in social systems is a form of heightened, shared emotional, cognitive, physical or social *energy* that results in people feeling and finding mutual connections and coherence.

Proposition 2: Resonance is contingent on a person or group's *natural frequencies or states*, including their internal capacities, needs, concerns, motor repertoire, values or beliefs that create readiness for a specific type of social resonance.

Proposition 3: Resonance is also contingent on the strength of interconnections of individuals with other individuals or groups who share his or her natural frequencies or states.

Proposition 4: Resonance operates through various mechanisms across different levels of analysis (neural to macro-structural), and at different points in time, and therefore there are many distinct paths to resonance.

Proposition 5: Resonance is unlikely to be imposed or induced sustainably in groups and communities, but can be identified, encouraged or enhanced.

Proposition 6: A propensity for resonance in social systems is increased by the presence of the following processes and conditions:
   a) Empathy and emotional attunement/intelligence
   b) Cooperative orientations
   c) Social modeling
   d) Synchronous physical activity
   e) Shared identities, cultural repertoires, narratives, and interests
   f) Integrative leadership
   g) Frame salience, centrality, relevance and alignment

Proposition 7: Action for social change results when resonant energy crosses some threshold in a group beyond their resistance to change.

Proposition 8: Resonance can result in constructive or destructive individual and group processes and outcomes depending on the valence, direction and intensity of the group's shared interests.

To summarize, the literature suggests that working with resonance effectively typically involves identifying, supporting and marshaling coherent and directed waves of motivation and energy in networks of people in service of communal change. It can spring from a variety of sources including from an increased awareness of unmet basic human needs; from perceptions of wrongdoing or injustice; from the emergence of crises and opportunities; from internal top-down, middle-out or bottom-up leadership, organization and mobilization; or from external actors and events. Resonance is often mercurial; ebbing and flowing and taking different forms at different stages of systemic change. Ultimately, resonance is a vital source of energy useful for driving and sustaining systemic change.

The eight propositions identified here outline a new agenda for systematic research on resonance in social systems. Perhaps the time has come to look beyond individual psychological or structural models of human motivation, and to take seriously the dynamic interconnections between people and groups that so often drive social change. Our hope is that this review and synthesis of the literature on resonance provides a platform for this research.

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Field	N. of articles	
First and second order cybernetics	8	Ashby (1956); Bateson (1972); Beer (1974); Deutch (1963); Lasswell (1978); Stephen Grossberg (1987); Varela & Maturana (1980); Wiener (1950)
Identity-based conflict	6	Badawi (2012); Kuttner (2012); Robnett (2004); Rothman (1991); Rothman (2001); Rothman (2012)
Systemic action research	6	Burns (2011); Bell, Simon, & Morse (2010); Coghlan, David (2002); Kakabadse, Kakabadse, and Kalu (2007); Paton, Graham (2001); Wadsworth (2008)
Frame analysis for social movements	19	Buffonge (2001); Cooter (2006); Ernst (2009); Ettema (2005); Johnston and Noakes (2005); Matesan (2012); McCammon (2009); McCammon, Campbell, Granberg & Mowery (2001); Mols (2012); Reese (1996); Resnick (2009); Robnett (2004); Schemer, Wirth, and Matthes (2012); Schrock, Holden, and Reid (2004); Snow & Benford (1988); Snow, Rochford, Worden & Benford (1986); Trevizo (2006); Vicari (2010); Zemanová (2009)
Interpersonal extension of affect theory	5	Balconi,and Bortolotti (2012); Buchanan, Bagley, Stansfield, and Preston (2012); Decety, and Meyer (2008); Eckhardt and Alcock (1970); Lockwood, Bird, Bridge, and Viding (2013)
Motor theories of action understanding	4	Aglioti (2008); Van Elk (2008); Stephens, Liu, Lester, Lagasse, Shankaran, Bada & Higgins (2010), Zwaan (2006)
Morphic resonance and telepathy	8	Levin (2010); Roe and Hitchman (2011); Rosen, Smith, Huston, and Gonzalez (1991); Schmidt, Schneider, Utts, and Walach (2004); Sheldrake (1987); Sheldrake (2000); Sheldrake (2013); Whitfield (2004)
Transpersonal psychology	7	Bache (2008); Haas (2011); Larson (1987); Lovkvist (2013); Siegel (2013); Thygesen (2008); Welch (2012)
Resonance in social media	10	Asur, Huberman, Szabo, & Wang (2011); Bakshy, Rosenn, Marlow, & Adamic (2012); Bandari, Asur, & Huberman (2012); Bennett, & Segerberg (2012); Coviello, Sohn, Kramer, Marlow, Franceschetti, Christakis, & Fowler (2014); Kramer, Guillory, & Hancock (2014); Romero, Galuba, Asur, & Huberman (2011); Stieglitz, & Dang-Xuan (2013); Ugander, Backstrom, Marlow, & Kleinberg (2012); Zhou, Bandari, Kong, Qian, & Roychowdhury (2010)
Limbic Resonance	5	Borod (2000); Hoffman (2008); Lewis, Amini & Lannon (2000); Meunier & Baker (2012); Ryback (2006)
Leadership	9	Hazy (2004); Boyatzis & McKee (2006); Goleman, Boyatzis & McKee (2013); Grossberg (1999); Lord et al (2011); Makri & Scandura (2010); Marion & Uhl Bien (2001); McKee & Massimilian (2006); Uhl-Bien, Marion & McKelvey (2007)
Organizational resonance	6	Corman, Dooley, Kuhn & McPhee (2002); Drolet & Morris (2000); Eoyang (2006) Eoyang (2014); McGrath (1991); McKee & Johnston (2014); Nadler & Tushman (1989)
Hawaiian culture	3	Kanahele (1986); McCubbin & Marsella (2009); Shook & Ke'ala Kwan (1987)
Narrative art	6	Castano & Kidd (2013); Katz and Zalk, (1978); Hunt (2007); Litcher and Johnson (1969); Pinker (2011); Tolstoy (1897)
Music	3	Dunn, Hartmann, Campbell & Fletcher (2015); Fletcher (2012); Fletcher & Rossing (2012)
Total	105	

Table 1: Literature Review Summary

	Conceptualizations	Mechanisms	Conditions	Outcomes	Measures	Practices
Basic Processes [philosophy, physics, music]	Particles with shared "periodicities" (Whitehead, 1921) Increased amplitude of oscillation (Fletcher & Rossing, 2012) Harmonics in and between musical instruments (Dunn, Hartmann, Campbell & Fletcher, 2015)	Interaction of highly nonlinear feedback generators linked to resonators that result in sound (Fletcher, 2012)	Potential for energy storage & transfer across modes (Bhargava, 2012) One instrument vibrating at the natural frequency of the other (Dunn, Hartmann, Campbell & Fletcher, 2015)	[NONE]	[NONE]	[NONE]
Intra/Interpersonal	Affective & physical connections (Tomkins, 1962; Goleman et al, 2002; Singer & Lamm, 2009; Lockwood et al, 2013; Lewis et al., 2001; Van Elk, 2008; Fredrickson, 2013) Understanding mental illness (Ashby, 19??) Internal limbic states (Lewis, Amini & Lannon, 2001) Interpersonal transactions (Fredickson, 2013) Empathic attunement (Gottman, Gottman & DeClaire, 2007) Neurobiological synchronization (Aglioti, 2008; Fredrickson, 2013; Goleman et al, 2002; Kok & Fredrickson, 2010; Lewis et al., 2001; Stephens et al., 2010; Van Elk, 2008; Zwaan, 2006)	Mirror neurons (Aglioti, 2008; Praszkier, 2014; Van Elk, 2008; Zwaan, 2006) Neural coupling (Fredrickson, 2013) Shared physiological distress (Buchanan, Bagley, Stansfield & Preston, 2012) Empathy (Lockwood et al, 2013; Rothman, 1997; 2012) Cooperative orientations (Deutsch, 2014; Johnson & Johnson, 2005) Social modeling (Van Elk, 2008; Zwaan, 2006) Synchronized activity (Wiltermuth & Heath, 2009)	Internal/external empathic awareness and connection (Balconi & Bortolotti, 2012; Decety & Meyer, 2008; Hass, 2011; Lockwood, Bird, Bridge & Viding, 2013; Lovkvist, 2013)	Multiple benefits: open awareness/perception; physical sychronicity; relational intimacy, growth & resiliance; reduced health risk (Fredrickson, 2013)	Physiological reactions (Buchanan et al., 2012) Facial expression & biofeedback (Balconi & Bortolotti, 2012) Survey response correlation (Eckhardt & Alcock, 1970) Centering Resonance Analysis (CRA; Corman et al., 2002) Video analysis of multiple indicators (Lovkvist, 2013) Therapist intuition (Siegal, 2013) Brain activity scans (e.g. fMRI, EEG, etc.; Haas, 2011)	Encouraging self-awareness & emotional regulation (Decety & Meyer, 2008) Childhood compassion training (Eckhardt & Alcock, 1970) Increasing physical, spiritual, cognitive & emotional awareness (Fredrickson, 2013)
Intra/Intergroup	Collective emotional experience (De Tarde, 1903) Shared narratives (Rothman, 1997) Shared energy for joint action (Burns, 2007) Unplanned collective action/ riots (LeBon, 1895) Formation of violent mobs (Canetti, 1960)	Leadership & emotional intelligence (Goleman et al., 2002; McKee & Johnson, 2014)	Shared identity, cultural repertoires, narratives & situationally induced emotional states (Ettema, 2005; Robnett, 2004; Rothman, 2012) Group motivation (Bell & Morse, 2010) Leaders that inspire group identity (Mols, 2012) Ideological empathy (Balconi & Bartolotti, 2012; Eckhardt & Alcock, 1970) Self-other awareness & self-regulation (Decety & Meyer, 2008) Reflexive dialgue & defining a shared future state (Rothman, 1992; 2012) Relational mindsets across members (Kuttner, 2012)	Transformed social conflict (Burns, 2007; Rothman, 1991) Exclusion & inter-group violence (Cooter, 2006; Goleman, et al, 2002; Della Porta and Mattoni, 2014)	Observing participant dialogues and interactions (Burns, 2007; Wadsworth, 2008) Changing cognitive frames (Rothman & Olson, 2001) Expression of co-constructed meanings (Kutner, 2012) Survey administration (Barsade, 2002; Faraj & Sproull, 2000; Lewis, 2003; Stinson & Hellebrandt, 1972) Assessing mental models (Levesque, Wilson & Wholey, 2001; Marks, Zaccaro & Mathieu, 2000; Mathieu et al., 2000; Stout et al., 1999) Diary studies (Ballard, Tschan & Waller, 2008) SYMLOG ratings of group members (Bales & Cohen, 1979; Polley, 1987) Live automated coding (Bergstrom & Karahalios, 2007; DiMicco, Pandolfo & Bender, 2004; Gatica-Perez et al., 2005; Kim et al., 2008; Olguin et al., 2009; Pentland & Madan, 2005)	Engaged facilitation and intervention (Burns, 2011) Collaborative inquiry from both facilitators & participants (Burns, 2011; Kakabadse, Kakabadse & Kalu, 2007) Facilitated reflexive dialogue (Rothman, 1991; 2001; 2012)
Political/Social Movements	Leadership as being in-tune with others (Boyatzis & McKee, 2006; 2013; McKee & Massimilian, 2006) Shared cognitive & action tendencies (Snow et al., 1986; Buffonge 2001; McCammon et al., 2001; Reese 1996; Trevizo, 2006) Information propogation (Asur, Huberman, Szabo, & Wang, 2011; Bakshy, Rosenn, Marlow, & Adamic, 2012) Emotional contagion (Coviello et al., 2014; Kramer, Guillory, & Hancock, 2014) Mechanisms for revolution (The Invisible Committee, 2009) Expanding power & connectivity (Gordillo, 2011) Shift from figure to ground (i.e. primary to contextual; Julien, 2004) Lokahi - harmony between self and the great chain of being (McCubbin & Marsella, 2009)	Salient frame messaging (Snow & Benford, 1988) Positive vs. negative social media messaging (Coviello, Sohn, Kramer, Marlow, Franceschetti, Christakis, & Fowler, 2014; and Kramer, Guillory, & Hancock, 2014)	Collective action frame (Vicari, 2010) Activating threats to collective identities (Mols, 2012) Emotional harmony with potentional new members (Schrock, Holden, & Reid, 2004) Inclusivity across multiple group identities (Resnick, 2009) Socio-politically sound messaging (Ernst, 2009) Solid argumentative logic (McCammon, 2009) Credible leadership/influencers (Matesan, 2012) Matching value orientations to receipients (Schemer, Wirth & Matthes, 2012) Appeals that are holistic to sentiments & emotions (Schrock, Holden & Reid, 2004)	Political revolution - Possibilities for both opposition to, and manipulation by, state power (Gordillo, 2011)	Interviews of activists (Ernst, 2009) Historical analysis (McCammon, 2009) Emotion discourses from interviews and secondary sources (Robnett, 2004) News media reporting patterns (Ettema, 2005)	Reframing activities (Mateson, 2012; McCammon, 2009; Resnick, 2009) Value appeals (Schemer, Wirth & Matthes, 2012) Social media messaging (Bakshy, Rosenn, Marlow, & Adamic, 2012; Caviello et al., 2014)

Table 2: Aspects of Resonance by Level of Analysis