

**Measuring Multidimensional Empathy: Theoretical and
Practical Considerations for Osteopathic Medical
Researchers**

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Measuring Multidimensional Empathy: Theoretical and Practical Considerations for Osteopathic Medical Researchers

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Measuring Multidimensional Empathy: Theoretical and Practical Considerations for Osteopathic Medical Researchers

Abstract

Osteopathic physicians are increasingly recognizing the importance of empathy for improving patient satisfaction and clinical outcomes. This review advocates for a multidimensional perspective of empathy, encompassing both affective and cognitive empathy, highlights situational and dispositional factors relevant to the curtailment of empathy, and reviews the utility of self-report, behavioral and physiological measures that researchers may use to quantify empathy in further research. It is hoped that this review will encourage members of the osteopathic medical field to embrace a fuller understanding of empathy.

Introduction

Osteopathic physicians and other medical practitioners are increasingly recognizing the importance of empathy. Recent research has demonstrated that empathy is associated with increased patient satisfaction¹⁻², improved diagnostic and clinical outcomes³⁻⁴, and enhanced overall well-being for the physician⁵⁻⁸. However, there may also be negative consequences to empathizing with patients⁹: empathy may overwhelm physicians as they perform life-saving surgeries, invasive procedures, and emergency interventions. The complex role of empathy may be due, at least in part, to its multidimensional nature. By understanding the subcomponents of empathy, as well as the factors leading to its curtailment, healthcare professionals can establish how best to utilize empathy in their field.

This review outlines the theoretical and practical components of empathy measurement. Incorporating these components in research designs will potentially lead to a more nuanced understanding of the role of empathy in the field of osteopathic medicine.

Multidimensional Empathy

Outside the field of medicine, empathy is considered a complex multidimensional construct. Since the 18th Century, at least two different types of empathy have been proposed: Smith¹⁰ differentiated between one's emotional reactions to others' and the ability to recognize these emotional states free of emotional experience. Smith's distinction persists today under the nomenclature of *affective* and *cognitive* empathy.

Affective empathy refers to the extent to which a person experiences emotion in response to another person's expression of an emotion. Within this affective response, theorists distinguish between emotional resonance (feeling as another person feels) and empathetic concern (feeling for another)¹¹ (Figure 1). Cognitive empathy, on the other hand, refers to the understanding of what another person is experiencing, and is normally achieved through perspective-taking. This cognitive component has been emphasized in the medical field, often to the near exclusion of affective empathy¹². Physicians are expected to maintain emotional distance from their patients to ensure objectivity and limit their exposure to adverse emotions¹². This had led to the teaching and practice of "detached concern", a practice so engrained that the very definition of empathy used by a leading group from the Society for General Internal Medicine defines empathy as "the act of correctly acknowledging the emotional state of another without experiencing that state oneself."¹³

The exclusion of affective empathy in medical research is particularly troubling because mounting psychological research suggests that cognitive empathy alone is not enough to ensure compassion. For a dramatic example,

consider that psychopaths are characterized by a lack of *affective* empathy, their *cognitive* empathy levels are equal or even superior to the general population¹⁴. Simply, psychopaths understand, but do not care about, another's pain. Indeed, research demonstrates that *both* cognitive and affective components are necessary as they interact in the experience of empathy¹⁵. To capture the importance of this interaction, Zaki and Ochsner¹⁶ suggested an additional third facet to their multidimensional definition of empathy: in addition to cognitive and affective empathy they add prosocial concern. This concern results from using the other facets to appreciate the emotions another is feeling. In light of this research, it seems reasonable to suggest that any attempt to increase physician empathy should be a comprehensive intervention aimed at improving *all* facets of empathy.

To date, researchers have attempted to cultivate empathy in physicians using a variety of methodologies, including, but not limited to, communication skills training, role-play, and the utilization of cultural products such as literature, visual arts and theater¹⁷. Whether these interventions improve all facets of empathy is difficult to determine because their outcomes are rarely measured in a multidimensional manner. The success of many of these interventions is measured using unidimensional self-report measures or total empathy scores that merge cognitive and affective empathy into a single concept. Interventions are generally considered a success if they elicit improvements on any component of empathy.

However, perhaps there are some aspects of empathy that are not beneficial in the medical field. As mentioned earlier, affective empathy can come in two forms: emotional resonance (mirroring the same emotion) and emotional concern (feeling compassion). If a patient is highly distressed it may be ineffective for a medical professional to mirror the patient's emotions, but useful for them to respond with a more appropriate compassionate emotional response. For example, Newton et al.¹⁸ demonstrated a decline in emotional resonance throughout the course of medical school, this decline may be adaptive in the case of general or orthopaedic surgeons who are required to curtail empathy in order to provide effective surgical treatment⁹.

Some measures of empathy have attempted to capture this counterproductive aspect of empathy. The widely used Interpersonal Reactivity Index (IRI)¹⁹ includes a measure of Personal Distress, which measures feelings of fear, apprehension and discomfort at witnessing the suffering of others. This self-focused aspect of empathy may lead to overwhelmingly negative feelings, leaving individuals with few resources to help and motivates withdrawal from the situation²⁰. Therefore, it is reasonable to predict that, unlike other facets of empathy, a tendency to display emotional resonance would be detrimental for healthcare professionals.

Dispositional and Situational Constraints on Empathy

When considering the virtues of empathy, it is important to distinguish between dispositional and situational empathy: some individuals are more likely to be empathetic than others, and some situations are more likely to elicit empathy than others.

Dispositional Empathy

Low levels of dispositional empathy can arise from biological and neurological deficiencies²¹ as well as by poor socialization and rearing practices²⁰⁻²⁶. The overwhelming majority of physicians, however, have a great capacity for empathy. Recent research suggests that medical students start school with average or above-average empathy levels for their age²⁷. However, empathy significantly declines over the course of

medical school^{9,18,28}, and notably, the extent of this decline varies across students. A longitudinal study by Hojat et al.²⁸ found two distinct groups of medical students: 70% demonstrated a significant decline in empathy over their 4 years of medical school, whilst 30% seemingly had a disposition that prevented the erosion of empathy over this time.

Hojat et al.²⁸ discuss two individual difference variables that appear to predict resistance to empathy decline: gender and specialty. Females demonstrated higher levels of empathy throughout medical school and showed a smaller magnitude of decline than males. This is consistent with evidence outside of the medical field which reliably finds a gender difference in empathy both physiologically²⁹, behaviorally³⁰ and using self-reports³¹. Specific to the medical field, Hojat et al.²⁵ demonstrated that individuals in “people-oriented specialties” (e.g., family medicine, internal medicine, pediatrics, emergency medicine, psychiatry, obstetrics–gynecology) showed less decline in empathy than those in “technology-oriented specialties” (e.g., anesthesiology, pathology, radiology, surgery, orthopedic surgery, etc.). This difference across specialties could be because medical students with dispositions that protect against empathy erosion self-select into the “people-focused” specialties; or that the people-focused training process encourages the maintenance of empathy. It is also worth noting that differences in specialty may be an artifact of preexisting gender differences if “people-oriented” specialties are female dominated. This possibility was not examined by the authors, however, and so remains speculative.

Situational Empathy

Failure to experience empathy is not unique to individuals with low dispositional empathy, it can also result from learning when and toward whom to experience empathy. Although the building blocks of empathy are automatic, ubiquitous processes³²⁻³³, we have the ability to curtail this natural empathetic response. This capacity is courtesy of the enhanced cognitive control exerted by the prefrontal cortex which can inhibit empathetic responses. In a host of contexts this ability is advantageous, for example, in emergency medical situations empathetic arousal may not only be detrimental for the physician, but also for the patient, as it may interfere with the physician’s ability to conclude effective diagnoses and perform essential medical interventions.

Recent fMRI findings demonstrate the usefulness of this ability for routine medical procedures as well. When visually presented with needles being inserted into another person, control participants show activation in brain areas involved in empathy for pain (anterior cingulate cortex, insula), but physicians who practice acupuncture do not³⁴⁻³⁵. In this example, curtailment of a specific empathetic response may have beneficial consequences by freeing up cognitive resources necessary for the effective completion of treatment and expressing concern¹².

Despite the possible benefits of empathy curtailment in certain situations, there are a variety of contexts where this learned ability would lead to poor patient care. One particularly concerning example is the selective curtailment of empathy to certain groups. Humans are adept at creating social boundaries, indeed we seem to automatically categorize our social world: we see men and women, cashiers and doctors, Muslims and Jews. Neuroscientists Avenanti, Sirigu and Aglioti³⁶ have recently demonstrated that these social categories are not simply banal descriptive heuristics, but are meaningful at a neurological level. Using transcranial magnetic stimulation, they measured the neural activity of Black and White individuals in response to others’ pain. They demonstrated that when people witness a member of their own group getting pricked with a needle they exhibit sensorimotor empathetic brain responses. However, when participants saw a member of another group, in this case someone with a different skin color, their brain responded slower and less intensely. One of the most remarkable things about this research is that they also looked at participants’ response to a violet hand, that is, a hand that had been dyed purple so that it did not fit into any racial category. Participants’ response to this hand were more similar to an in-group response, than an out-group response, suggesting that empathy is our default

reaction, and that curtailing it towards others requires us to first place them firmly in the “other” category. We have no category for violet-hands as yet, allowing our default empathy to kick in.

This tendency to curtail empathy towards stigmatized social groups has important implications for medical practitioners who are expected to offer compassionate care to all patients regardless of their group membership. Despite this laudable goal, physicians of all races are susceptible to learned empathetic biases. This may explain why physicians underestimate minority patients’ pain³⁷ and systematically undertreat Black³⁸⁻⁴⁰ and Hispanic⁴¹⁻⁴² patients for pain relative to White patients. Future research, both in the medical field and outside, should urgently address ways to unlearn or prevent this group-based empathetic bias.

Measuring empathy

There are many measurement tools available for the quantification of empathy, which can be grouped into self-reports, behavioral measures and physiological measures. Each group, and indeed each individual measure, can focus on widely disparate aspects of empathy. Researchers should carefully select a measurement instrument depending on their interest. Multidimensional measures, or indeed the use of multiple measures, may be the safest choice for exploratory research without a clear theoretical definition of empathy.

Self-report measures

There are a wide variety of self-report measures available to measure empathy. The first measure to achieve widespread use was Hogan’s Empathy Scale³⁸. This scale was widely employed as a measure of cognitive empathy³⁹, but psychometric analysis of the scale demonstrated questionable test-retest reliability; low internal consistency, and low factor-structure stability⁴⁸. It has now been supplanted in popularity by the Interpersonal Reactivity Index (IRI)¹⁶. The IRI contains four subscales: empathic concern, personal distress, perspective taking and fantasy which together tap both affective and cognitive components of empathy. Another popular multidimensional measure of empathy is the Basic Empathy Scale (BES), which measures emotional contagion, emotional disconnection, and cognitive empathy⁴⁹. Both the BES and the IRI have been validated in a variety of languages and age groups⁵⁰⁻⁵³.

Many researchers may be motivated to utilize a measure of empathy developed specifically for medical populations. The Jefferson Scale of Physician Empathy (JSPE) was developed to measure empathy in physicians and other health professionals (HP/Physician version), medical students (S-version), and health professional students (HPStudent version). The authors define empathy as: “A predominantly cognitive attribute that involves an understanding of experiences, concerns and perspectives of another person, combined with a capacity to communicate this understanding”⁵⁴. This definition and the scale itself deliberately omits measurement of affective components of empathy, instead measuring “perspective taking”, “compassionate care” and “standing in the patient’s shoes”. Neither of these factors correlates with the personal distress subscale of the IRI (correlations of 0.01, 0.02, and 0.13, respectively)⁵⁵, indicating that the JSPE fails to capture this aspect of affective empathy. Researchers who use the JSPE should do so only if they intend to solely measure cognitive empathy.

Exploratory research on the effects of empathy interventions would be advised to utilize a multidimensional measure of empathy or a cognitive and affective measure together. Failure to measure all dimensions of empathy might risk developing interventions that have unintended negative consequences on the arousal of personal distress, which would go unnoticed by the researchers. This occurrence may not be uncommon as researchers regularly fail to measure all facets of empathy¹⁷.

Researchers looking to measure only affective empathy may find The Toronto Empathy Questionnaire (TEQ)⁵⁶ or the Questionnaire Measure of Emotional Empathy⁵⁷ suits their specific needs.

Behavioral Measures

Self-report measures of empathy have always been treated with caution because they are fairly transparent in their goals, and therefore may tell us more about a participant's response style than their empathetic tendencies. For this reason, researchers may choose to use one of several behavioral measures of empathy. The classic behavioral measure of cognitive empathy is the false-belief task which measures one's ability to recognize that others hold beliefs that are different to their own. Numerous versions of the false-belief task have been developed, based on the initial task developed for children by Wimmer and Perner⁵⁸. Although subsequent false-belief tasks have been created for adults⁵⁹, performance on false belief tasks often suffers from ceiling effects as all participants succeed in their completion. Recently, a more sensitive measure of cognitive empathy has been developed which assesses the ability to judge mental states based on verbal cues, eye gaze and facial expression, named The Yoni Test. Although it is fairly new, the Yoni test has been validated⁵²⁻⁵⁴ and has the advantage of assessing both cognitive and affective empathy.

Behavioral measures of affective empathy are more widely used than cognitive measures. For example, the Reading the Mind in the Eyes Test (RMET)⁶³ is a measure of advanced affective empathy that has been translated into over 12 languages⁶⁴. This task asks participants to identify the emotion a person is expressing from only a picture of their eyes. An alternative measure of affective empathy, the Diagnostic Analysis of Nonverbal Accuracy test (DANVA) asks participants to identify emotion in full faces (DANVA2-HF)⁶⁵ or from standing and sitting postures (DANVA-POS)⁶⁶.

Despite being widely utilized as measures of empathy, recent research suggests, at least some, behavioral measures of empathy may tap entirely different constructs from their self-report counterparts. Melchers et al.⁶⁷ found that the RMET barely correlated with the IRI and another self-report measure of empathy, suggesting it measures a distinct endophenotype of empathy. For this reason, care should be taken when generalizing from behavioral measures, and multimodal methods are encouraged.

Physiological Measures

Emotional resonance, the subset of affective empathy can be assessed by the concordance of physiological measures between two individuals. Marci et al.⁶⁸ demonstrated that similarities in skin conductance between two individuals indicated empathetic arousal and the authors note that this measurement technique could employ additional physiological measures (e.g., heart rate, respiratory rate).

Neuroscientists have employed a variety of neuroimaging techniques to measure the many dimensions of empathy. Affective empathy is related to activation in the brainstem, amygdala and sensory cortices, as well as the hypothalamus, insula and somatosensory cortex whilst the cognitive aspects of empathy are related to processes in the medial prefrontal cortex, dorsolateral prefrontal cortex and temporo-parietal junction⁶⁸. Finally, the neural underpinnings of the ability to feel concern and care for others are found in subcortical neural areas such as the hypothalamus and orbitofrontal cortex⁶⁹.

The measurement techniques presented here are by no means comprehensive and simply serve to highlight the variety of choices available to researchers interested in quantifying empathy. Individual researchers must carefully select the method(s) best suited to answer the research question at hand.

Conclusion

Osteopathic physicians increasingly recognize the importance of empathy, however, a more nuanced understanding of the subcomponents of empathy, as well as the factors leading to its curtailment are needed in order to better understand the role of empathy within the various osteopathic medical subspecialties. The understanding and utilization of empathy will vary greatly between specialties. Each subspecialty field is presented with different challenges, the extent of which are likely and uniquely unbalanced. For the osteopathic surgeon, it would potentially be more useful to briefly curtail empathy in order to focus cognitive resources on effectively carrying out life-saving and technically challenging surgical procedures. Whereas for the osteopathic family physician, the cognitive resources utilized by empathetic processes would provide the greatest benefit to the patient by developing rapport and understanding how medical concerns relate to each patient's individual and unique situation.

The theoretical relationship between empathy and clinical outcomes is seductive in its simplicity: physicians who show more empathy will have better patient outcomes. However, this simplistic understanding is under strain as more nuanced measures of empathy are introduced. Empathy is not a unitary construct and different facets may be related in very different ways to patient outcomes. Further research into empathy in the osteopathic medical field requires cognizance of the multidimensional nature of empathy.

Figure Legends:

Figure 1: Batson & Ahmad's Four Psychological States called "Empathy"

References

1. Derksen F, Bensing J, Lagro-Janssen A. Effectiveness of empathy in general practice: a systematic review. *Br J Gen Pract.* 2013 Jan 1;63(606):e76-84.
2. Mercer SW, Reynolds WJ. Empathy and quality of care. *Br J Gen Pract.* 2002 Oct 1;52(Suppl):S9-12.
3. Irving P, Dickson D. Empathy: towards a conceptual framework for health professionals. *International Journal of Health Care Quality Assurance.* 2004 Jun 1;17(4):212-20.
4. Stueber KR. *Rediscovering empathy: Agency, folk psychology, and the human sciences.* MIT Press; 2006.
5. Shanafelt TD, West C, Zhao X, Novotny P, Kolars J, Habermann T, Sloan J. Relationship between increased personal well-being and enhanced empathy among internal medicine residents. *J Gen Intern Med.* 2005 Jul 1;20(7):559-64.
6. Shanafelt TD, Novotny P, Johnson ME, Zhao X, Steensma DP, Lacy MQ, Rubin J, Sloan J. The well-being and personal wellness promotion strategies of medical oncologists in the North Central Cancer Treatment Group. *Oncology.* 2005 Apr 22;68(1):23-32.
7. Hojat M, Gonnella JS, Mangione S, Nasca TJ, Veloski JJ, Erdmann JB, Callahan CA, Magee M. Empathy in medical students as related to academic performance, clinical competence and gender. *Med Edu* 2002 Jun 1;36(6):522-7.
8. Brock CD, Salinsky JV. Empathy: an essential skill for understanding the physician-patient relationship in clinical practice. *Family Medicine.* 1993 Apr;25(4):245-8.

9. Newton BW. Walking a fine line: is it possible to remain an empathetic physician and have a hardened heart? *Front Hum Neurosci* 11 June 2013 doi 10.3389/fnhum.2013.002233
10. Smith, A. *The Theory of Moral Sentiments*, London: 1759 A. Millar. Online version.
11. Batson CD, Ahmad NY. Using empathy to improve intergroup attitudes and relations. *Soc Issues Policy Rev* 2009 Dec 1;3(1):141-77.
12. Decety J, Smith KE, Norman GJ, Halpern J. A social neuroscience perspective on clinical empathy. *World Psychiatry*. 2014 Oct 1;13(3):233-7.
13. Halpern J. What is clinical empathy?. *J Gen Inter Med*. 2003 Aug 1;18(8):670-4.
14. Wai M, Tiliopoulos N. The affective and cognitive empathic nature of the dark triad of personality. *Personality and Individual Differences*. 2012 May 31;52(7):794-9.
15. Decety J, Svetlova M. Putting together phylogenetic and ontogenetic perspectives on empathy. *Developmental cognitive neuroscience*. 2012 Jan 31;2(1):1-24.
16. Zaki J, Ochsner KN. The neuroscience of empathy: progress, pitfalls and promise. *Nat Neurosci*. 2012 May 1;15(5):675-80.
17. Kelm Z, Womer J, Walter JK, Feudtner C. Interventions to cultivate physician empathy: a systematic review. *BMC Med Edu*. 2014 Oct 14;14(1):219.
18. Newton BW, Barber L, Clardy J, Cleveland E, O'sullivan P. Is there hardening of the heart during medical school?. *Acad Med*. 2008 Mar 1;83(3):244-9.
19. Davis MH. A multidimensional approach to individual differences in empathy. 1980 [thesis]
20. Eisenberg N, Eggum ND. Empathic responding: Sympathy and personal distress. *The social neuroscience of empathy*. 2009;6:71-83.
21. Decety J, Ickes W. *The social neuroscience of empathy*. MIT Press; 2011 Jan 21.
22. Eisenberg N. The development of empathy-related responding. In *Nebraska symposium on motivation* 2005 Jan 1 (Vol. 51, p. 73).
23. Hoffman ML. Parent discipline and the child's consideration for others. *Child Development*. 1963 Sep 1:573-88.
24. Hoffman ML. *Empathy and moral development: Implications for caring and justice*. Cambridge University Press; 2001 Nov 12.
25. Krevans J, Gibbs JC. Parents' use of inductive discipline: Relations to children's empathy and prosocial behavior. *Child Dev* 1996 Dec 1;67(6):3263-77.
26. Staub E. A conception of the determinants and development of altruism and aggression: motives, the self, and environment. *Reaching out: caring, altruism, and prosocial behavior*. New York & London: Garland Publishing, Inc. 1994:11-40.
27. Handford C, Lemon J, Grimm MC, Vollmer-Conna U. Empathy as a function of clinical exposure-Reading emotion in the eyes. *PLoS One*. 2013 Jun 5;8(6):e65159.
28. Hojat M, Vergare MJ, Maxwell K, Brainard G, Herrine SK, Isenberg GA, Veloski J, Gonnella JS. The devil is in the third year: a longitudinal study of erosion of empathy in medical school. *Academic Medicine*. 2009 Sep 1;84(9):1182-91.
29. Han S, Fan Y, Mao L. Gender difference in empathy for pain: an electrophysiological investigation. *Brain Res* 2008 Feb 27;1196:85-93.
30. Kirkland RA, Peterson E, Baker CA, Miller S, Pulos S. Meta-analysis Reveals Adult Female Superiority in "Reading the Mind in the Eyes Test". *North American Journal of Psychology*. 2013 Mar 1;15(1):121.
31. Pulos S, Elison J, Lennon R. The hierarchical structure of the Interpersonal Reactivity Index. *Soc Behav Personal* 2004 Jan 1;32(4):355-9.
32. Iacoboni M. Mesial frontal cortex and super mirror neurons. *Behavioral and Brain Sciences*. 2008 Feb 1;31(01):30-.
33. Rizzolatti G, Craighero L. The mirror-neuron system. *Annu Rev Neurosci* 2004 Jul 21;27:169-92.

34. Cheng Y, Lin CP, Liu HL, Hsu YY, Lim KE, Hung D, Decety J. Expertise modulates the perception of pain in others. *Current Biology*. 2007 Oct 9;17(19):1708-13.
35. Decety J, Yang CY, Cheng Y. Physicians down-regulate their pain empathy response: an event-related brain potential study. *Neuroimage*. 2010 May 1;50(4):1676-82.
36. Avenanti A, Sirigu A, Aglioti SM. Racial bias reduces empathic sensorimotor resonance with other-race pain. *Current Biology*. 2010 Jun 8;20(11):1018-22.
37. Staton LJ, Panda M, Chen I, Genao I, Kurz J, Pasanen M, Mechaber AJ, Menon M, O'Rourke J, Wood J, Rosenberg E. When race matters: disagreement in pain perception between patients and their physicians in primary care. *Journal of the National Medical Association*. 2007 May;99(5):532.
38. Todd KH, Deaton C, D'Adamo AP, Goe L. Ethnicity and analgesic practice. *Ann Emerg Med* 2000 Jan 31;35(1):11-6.
39. Tait RC, Chibnall JT. Work injury management of refractory low back pain: Relations with ethnicity, legal representation and diagnosis. *Pain* 2001;91: 47–56.
40. Schulman KA, Berlin JA, Harless W, Kerner JF, Sistrunk S, Gersh BJ, Dube R, Taleghani CK, Burke JE, Williams S, Eisenberg JM, Escarce JJ. The effect of race and sex on physicians' recommendations for cardiac catheterization. *N Engl J Med* 1999;340:618–26.
41. Todd KH, Samaroo N, Hoffman JR. Ethnicity as a risk factor for inadequate emergency department analgesia. *JAMA* 1993;269:1537–9
42. Cleeland CS, Gonin R, Baez L, Loehrer P, Pandya KJ. Pain and treatment of pain in minority patients with cancer. The Eastern Cooperative Oncology Group Minority Outpatient Pain Study. *Ann Intern Med* 1997;127:813–6.
43. Bonham VL. Race, ethnicity, and pain treatment: Striving to understand the causes and solutions to the disparities in pain treatment. *The Journal of Law, Medicine & Ethics*. 2001 Mar;28(4_suppl):52-68.
44. Drwecki BB, Moore CF, Ward SE, Prkachin KM. Reducing racial disparities in pain treatment: The role of empathy and perspective-taking. *Pain*. 2011 May 31;152(5):1001-6.
45. Green CR, Anderson KO, Baker TA, Campbell LC, Decker S, Fillingim RB, Kaloupek DA, Lasch KE, Myers C, Tait RC, Todd KH. The unequal burden of pain: confronting racial and ethnic disparities in pain. *Pain Med* 2003 Sep 1;4(3):277-94.
46. Hogan R. Development of an empathy scale. *Journal of consulting and clinical psychology*. 1969 Jun;33(3):307.
47. Eslinger PJ. Neurological and neuropsychological bases of empathy. *Eur Neurol* 1998 May 20;39(4):193-9.
48. Froman RD, Peloquin SM. Rethinking the use of the Hogan Empathy Scale: A critical psychometric analysis. *Am J Occup Ther* 2001 Sep 1;55(5):566-72.
49. Carré A, Stefaniak N, D'Ambrosio F, Bensalah L, Besche-Richard C. The Basic Empathy Scale in Adults (BES-A): Factor structure of a revised form. *Psychol Assessment*. 2013 Sep;25(3):679.
50. Gilet AL, Mella N, Studer J, Grün D, Labouvie-Vief G. Assessing dispositional empathy in adults: A French validation of the Interpersonal Reactivity Index (IRI). *Can J Behav Sci* 2013 Jan;45(1):42.
51. Roose A, Bijttebier P, Decoene S, Claes L, Frick PJ. Assessing the affective features of psychopathy in adolescence: a further validation of the inventory of callous and unemotional traits. *Assessment*. 2010 Mar;17(1):44-57.
52. Jolliffe D, Farrington DP. Development and validation of the Basic Empathy Scale. *J Adolesc*. 2006 Aug 31;29(4):589-611.
53. D'Ambrosio F, Olivier M, Didon D, Besche C. The basic empathy scale: A French validation of a measure of empathy in youth. *Pers Individ Dif* 2009 Jan 31;46(2):160-5.

54. Hojat M, Mangione S, Nasca TJ, Cohen MJ, Gonnella JS, Erdmann JB, Veloski J, Magee M. The Jefferson Scale of Physician Empathy: development and preliminary psychometric data. *Educ Psychol Meas* 2001 Apr 1;61(2):349-65.
55. Hojat M, Mangione S, Kane GC, Gonnella JS. Relationships between scores of the Jefferson scale of physician empathy (JSPE) and the interpersonal reactivity index (IRI). *Med Teach* 2005 Nov 1;27(7):625-8.
56. Spreng* RN, McKinnon* MC, Mar RA, Levine B. The Toronto Empathy Questionnaire: Scale development and initial validation of a factor-analytic solution to multiple empathy measures. *J Pers Assess* 2009 Jan 1;91(1):62-71.
57. Mehrabian A, Epstein N. A measure of emotional empathy. *J Personal* 1972 Dec 1;40(4):525-43.
58. Wimmer H, Perner J. Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*. 1983 Jan 31;13(1):103-28.
59. Converse BA, Lin S, Keysar B, Epley N. In the mood to get over yourself: mood affects theory-of-mind use. *Emotion*. 2008 Oct;8(5):725.
60. Shamay-Tsoory SG, Aharon-Peretz J. Dissociable prefrontal networks for cognitive and affective theory of mind: a lesion study. *Neuropsychologia*. 2007 Dec 31;45(13):3054-67.
61. Shamay-Tsoory SG, Harari H, Aharon-Peretz J, Levkovitz Y. The role of the orbitofrontal cortex in affective theory of mind deficits in criminal offenders with psychopathic tendencies. *Cortex*. 2010 May 31;46(5):668-77.
62. Shamay-Tsoory SG. Recognition of 'fortune of others' emotions in Asperger syndrome and high functioning autism. *J Autism Dev Disord* 2008 Sep 1;38(8):1451-61.
63. Baron-Cohen S, Wheelwright S, Hill J, Raste Y, Plumb I. The "Reading the Mind in the Eyes" test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. *J Child Psychol Psychiatry*. 2001 Feb 1;42(2):241-51.
64. Olderbak S, Wilhelm O, Olaru G, Geiger M, Brennehan MW, Roberts RD. A psychometric analysis of the reading the mind in the eyes test: toward a brief form for research and applied settings. *Front Psychol* 2015 Oct 6;6:1503.
65. Nowicki Jr S, Duke MP. Manual for the receptive tests of the Diagnostic Analysis of Nonverbal Accuracy 2. Atlanta, GA: Department of Psychology, Emory University. 2000.
66. Pitterman H, Nowicki Jr S. A test of the ability to identify emotion in human standing and sitting postures: The Diagnostic Analysis of Nonverbal Accuracy-2 Posture Test (DANVA2-POS). *Genet Soc Gen Psychol* 2004 May 1;130(2):146-62.
67. Melchers M, Montag C, Markett S, Reuter M. Assessment of empathy via self-report and behavioural paradigms: data on convergent and discriminant validity. *Cogn Neuropsychiatry* 2015 Mar 4;20(2):157-71.
68. Marci CD, Ham J, Moran E, Orr SP. Physiologic correlates of perceived therapist empathy and social-emotional process during psychotherapy. *J Nerve Ment Dis* 2007 Feb 1;195(2):103-11.
69. Decety J, Smith KE, Norman GJ, Halpern J. A social neuroscience perspective on clinical empathy. *World Psychiatry*. 2014 Oct 1;13(3):233-7.

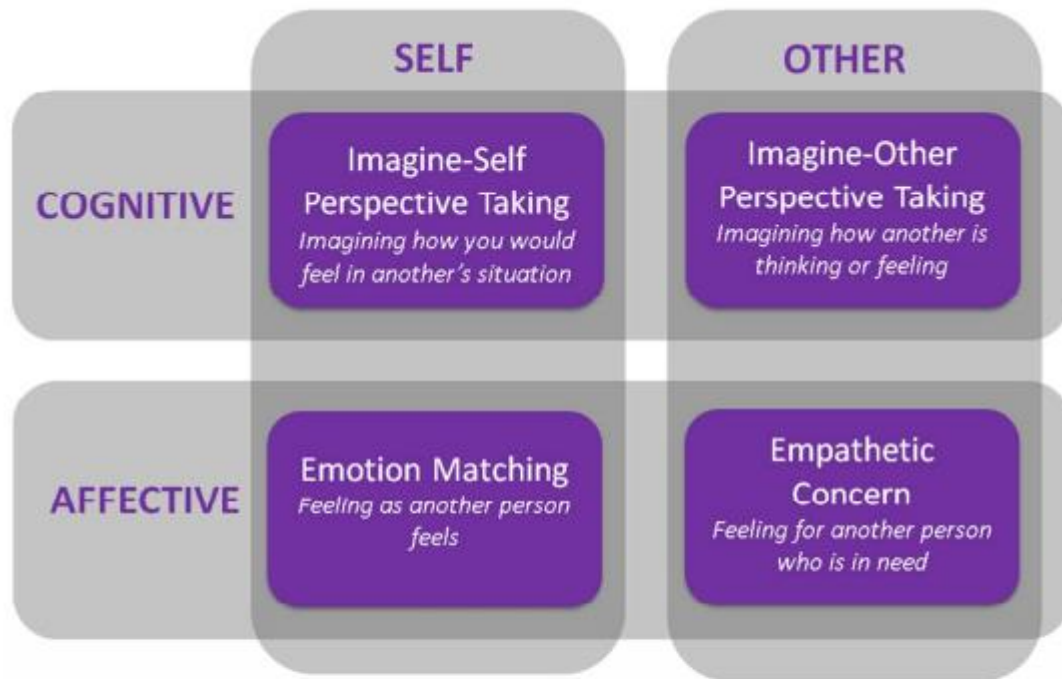


Figure 1: Batson & Ahmad's Four Psychological States called "Empathy"

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