

The Vertical Dimension of Social Signaling

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The Vertical Dimension

Interpersonal interactions and relationships can be described as unfolding along two perpendicular dimensions: verticality (power, dominance, control; Burgoon & Hoobler 2002; Hall, Coats, & LeBeau, 2005) and horizontality (affiliativeness, warmth, friendliness; Kiesler, 1983; Wiggins, 1979). The vertical dimension refers to how much control or influence people can exert, or believe they can exert, over others, as well as the status relations created by social class, celebrity, respect, or expertise. Numerous earlier authors have discussed variations and differences within the verticality concept (e.g., Burgoon & Dunbar, 2006; Burgoon, Johnson, & Koch, 1998; Ellyson & Dovidio, 1985; Keltner, Gruenfeld, & Anderson, 2003).

Social control aspects are prevalent in many social relationships and interactions, not only in formal hierarchies such as in the military or in organizations; there is also a difference in social control between parents and their children, and husbands and wives can have different degrees of power in their relationships. Even within groups of friends or peers, a hierarchy emerges regularly.

Verticality encompasses terms such as power, status, dominance, authority, or leadership. Although different concepts connote different aspects of the vertical dimension, their common denominator is that they are all indicative of the amount of social control or influence and thus of the vertical dimension. Structural power or formal authority describes the difference in social control or influence with respect to social or occupational functions or positions (Ellyson & Dovidio, 1985) (e.g., first officer). Status refers to the standing on the verticality dimension stemming from being a member of a specific social group (e.g., being a man versus a woman) (Pratto, Sidanius, Stallworth, & Malle, 1994). Status also means being awarded a high position

on the verticality dimension by others (e.g., emergent leader) (Berger, Conner, & Fisek, 1974). The term dominance (also authority) is used to describe a personality trait of striving for or of having high social control (Ellyson & Dovidio, 1985). Dominance is also used to denote behavior that is aimed at social control (Schmid Mast, 2010). Leadership is the influence on group members to achieve a common goal (Bass, 1960). In a given social situation, different verticality aspects can either converge or diverge. A company leader has high structural power but his or her interaction or leadership style can express more or less dominance.

Verticality is an interpersonal concept and as such it cannot exist for one person alone without a reference to other people; a person's level of social control and influence is always relative to another's (or several others'). As an example, in an organizational hierarchy, a middle manager has more position power and status than the sales representative working for him/her but at the same time less power and status than the CEO of the company. Moreover, a person can have high social control in one situation or domain and low verticality in another. The CEO of the company might control everyone at work but still take orders from her husband at home.

It is not only important to study verticality and its effect because the vertical dimension is omnipresent in different types of social interactions but also because the position within the vertical dimension affects how social interactions unfold. As examples, thinking about having power leads to better performance in a self-presentation task because power reduces feelings of stress and social signals of nervousness (Schmid & Schmid Mast, 2013). But, also, power can lead to overconfidence in decision making (Fast, Sivanathan, Mayer, & Galinsky, 2012) and power without status can make a person choose more demeaning activities for their partners to perform (Fast, Halevy, & Galinsky, 2012).

In many social encounters, the vertical position of the interaction partner is not known but needs to be inferred, and even if the position is known, the way a person exerts his or her power differs from one person to the other. The behavioral manifestations of verticality, that is, the social signals that are linked to verticality, therefore become important information that guides our social interactions and their outcomes.

Social Signaling

Social signals are nonverbal behavior cues produced and conveyed during social interactions via face, eyes, body, and voice (other than words). More specifically, they encompass vocal nonverbal behavior such as speaking time, interruptions, speech fluency and the like and visual nonverbal behavior such as gazing, nodding, facial expressions, body posture, gesturing, and interpersonal distance among others (Knapp, Hall, & Horgan, 2014). They are used, explicitly or implicitly, by a person to express his or her states and traits and can be used by social interaction partners to read those states and traits. As an example, an intern attending a team meeting of a work unit who is unfamiliar with the team members will not have much difficulty identifying the team leader because high status people behave differently than low status people in such gatherings. Most likely, the team leader will be looked at by the others more often and others will seek his or her confirmation for ideas presented. The team leader might also take up more room by showing expansive gestures and talking more and in a louder voice than the rest of the team members. Social signals therefore convey important information useful for the smoothness of the unfolding social interactions and relationships; reading these social signals correctly is an important skill.

Nonverbal behaviors per se are not unequivocal in meaning. We can, for instance, smile at others because we like them, because we want to ingratiate, or because we are happy and the

other just happened to be nearby. Some nonverbal behaviors carry meanings that are more specific to the vertical dimension than others. Also, whether verbal or nonverbal behavior matters more as a source of information depends on the situation. People often turn to the nonverbal channel for information when the nonverbal cues contradict the words being spoken or when people doubt the honesty of a verbal communication. This is indeed a good strategy because lie detection seems to be more successful when people rely on nonverbal (and especially paralinguistic cues such as laughing or vocal pitch) as opposed to verbal cues (Anderson, DePaulo, Ansfield, Tickle, & Green, 1999).

Given the omnipresence of the vertical dimension in our daily lives, uncovering the social signals indicative of the vertical dimension becomes important. If we know the signals high status or high power individuals emit, we can use this knowledge to infer status or power in social interactions in which we do not know the vertical position of the social interaction partners. Although research shows that there are indeed some signals that are typically indicative of the vertical dimension (which we will review in detail in the following section), the link between verticality and nonverbal cues is not always clear cut. One reason for this is that high (and low) power individuals can be in different motivational or emotional states that might be more important for determining their interpersonal behavior than their power position per se. For example, how much the high or low power person smiles may depend on who feels happier. Or, the person with the louder voice could be the boss who commands or the subordinate who wants to compete. If such differences were merely a matter of random variation, one might not be so concerned about their influence when groups of people are compared. However, it is possible for a given situation, whether in real life or in the research laboratory, to systematically influence the motives or states of everyone in a given vertical position. For example, the situation might be

one in which all of the bosses are feeling happier than the subordinates, or the reverse. Then separating the influence of vertical position from these correlated states becomes a problem (Hall et al., 2005). Moreover, nonverbal correlates that exist for one definition of power or one situation may not hold for another (e.g., personality dominance versus rank in an organization). As one example, a preoccupied boss might not feel much need to engage in eye contact with subordinates, while an emergent leader in a group might engage in much eye contact because his leadership status rests on group members' conviction that he is interested in them and the group's goals.

Despite those challenges, there seems to be an array of nonverbal social signals that show a rather consistent link with verticality in the sense that people high on verticality tend to show these behaviors more frequently than people low on verticality. We will review these social signals of verticality in the following section.

Signals of Verticality

People high on the vertical dimension possess a number of characteristics that differentiate them from people low on the dimension. For instance, high power individuals cognitively process information in a more abstract and global way (Smith & Trope, 2006) and experience less stress in stressful situations (Carney, Cuddy, & Yap, 2010; Schmid & Schmid Mast, 2013). Some of these characteristics are reflected in the nonverbal behavior of the powerful and despite nonverbal behavior depending much on motivational and emotional influences, as discussed above, individuals high on verticality also show relatively robust differences in some of their nonverbal social signals compared to individuals low on verticality.

The meta-analysis by Hall et al. (2005) investigated how different definitions of verticality (personality dominance, power roles or rank, as well as socioeconomic status), either

experimentally manipulated or pre-existing, were associated with different nonverbal behavior. Results showed that people high in verticality used more open body positions, had closer interpersonal distances to others, were more facially expressive, spoke more loudly, engaged in more successful interruptions, and had less vocal variability compared to lower power people. For many other behaviors, there was no net effect in one or the other direction; however, results showed pronounced heterogeneity, meaning that there was considerable variation in the effects found. For instance, for smiling and gazing, some studies found individuals high in verticality to show more smiling and gazing while other studies found individuals high in verticality to show less smiling and gazing.

The amount of time a person speaks during a social interaction is also a valid cue to a high position on the vertical dimension and is, indeed, a more consistent and strong cue than most of the cues mentioned above. Meta-analytic evidence shows that superiors talk more than their subordinates, people in high power roles talk more than people in low power roles, and the more a person is dominant as a personality trait, the more he or she talks during an interaction (Schmid Mast, 2002).

Despite gazing not being related overall to verticality, the gaze pattern called the Visual Dominance Ratio (VDR) has consistently shown to be indicative of high vertical positions (Dovidio, Brown, Heltman, Ellyson, & Keating, 1988). The VDR is defined as the percentage of gazing at an interaction partner while speaking divided by the percentage of gazing while listening; a high VDR gives the impression of less conversational attentiveness because one gazes relatively less at the other person while that person is speaking compared to when one has the floor oneself. Research has clearly demonstrated that being higher on the vertical dimension is associated with a higher VDR for both men and women and for a variety of definitions of

power, such as personal expertise on a topic (Dovidio et al., 1988), objectively measured rank (Exline, Ellyson, & Long, 1975), experimentally ascribed status (Ellyson, Dovidio, Corson, & Vinicur, 1980), and personality dominance (Ellyson et al., 1980).

Also, the “prolonged gaze pattern” is a behavior used by both emergent and appointed leaders in three-person groups to choose the next speaker by engaging in prolonged gazing at that person as the leader nears the moment of yielding the floor (Kalma, 1992). As these examples show, relatively subtle cues and cue combinations (e.g., gazing combined with speaking time) might be more informative of verticality than certain behaviors taken alone.

Many of these findings fit into the classification suggested by Burgoon and Dunbar (2006) as indicative of dominance and power in both human and nonhuman species: (a) physical potency, (b) resource control, and (3) interaction control. Physical potency is evident by social signals expressing threat (e.g., staring, giving somebody the silent treatment), indicators of size or strength (e.g., erect posture, mature faces), and expressivity (e.g., animated face, loud voice). Resource control is evident in having command of the space (e.g., expansive and open body postures), displaying precedence, which means “who gets to go first” (e.g., walking ahead, entering a space first), exercising the prerogative to deviate from social norms and expectations (e.g., adopting close interpersonal distance, leaving more crumbs when eating), and possessing valued commodities, meaning possession of luxury goods and other status signals. Interaction control affects the where, when, and how of the social interaction and is characterized by behaviors indicative of centrality (e.g., being in the center of attention measured by the visual dominance ratio, or a central position in a group of people), of elevation (e.g., looking down on someone), of initiation (e.g., interruptions), and of nonreciprocation (e.g., resisting mimicking the social interaction behaviors of another).

If high levels of verticality are associated with certain social signals, expressing those social signals might elevate a person's felt level of verticality. In the next section, we review how the embodiment of social signals indicative of high vertical positions can make a person feel higher on verticality.

Embodiment of Social Signals Can Increase Verticality

Research on face and body feedback has long shown that the expression of certain social signals has an impact on the person who embodies these signals. For instance, when people unobtrusively activated the muscles typically used when smiling (without them being required to "smile"), they rated cartoons as funnier than when those muscles were not activated (Strack, Martin, & Stepper, 1988).

With respect to embodiment of the vertical dimension, research shows that making a fist increased men's sense of dominance (Schubert & Koole, 2009). Moreover, manipulating people's postures to be either expansive-open or contractive-closed affected how powerful they felt and even their level of testosterone (Carney et al., 2010): Individuals who adopted an open and expansive posture felt more powerful and had higher levels of testosterone.

Recently, research has evidenced that culture affects which social signals of expansiveness-openness lead to increased feelings of power (Park, Streamer, Huang, & Galinsky, 2013). The embodiment of the expansive-hands-spread-on-desk and expansive-upright-sitting postures entailed a heightened sense of power for both Americans and East Asians. However, the expansive-feet-on-desk pose activated less feelings of power in the East Asian participants than in the Americans.

Whether other social signals that have been found to be indicative of high vertical positions, such as loud voice or extended amounts of speaking time, would result in the same

embodiment results remains to be tested. The parallelism of, on the one hand, manipulating (or measuring) verticality and observing differences in certain social signals and, on the other hand, manipulating these social signals to observe differences in verticality corroborates the findings that certain, although few, social signals seem to be linked to verticality. If this is the case, knowing those signals will make it easy for observers to accurately assess the vertical position of their social interaction partner. But what are really the cues observers use to make inferences about verticality?

Inferring Verticality

When interaction partners or observers infer the vertical position of a person, which social signals are used for those judgments? In research investigating this question, perceivers typically rate the degree of power or status of a target person. Then, the nonverbal behaviors of the targets are assessed by neutral coders. Those coded behaviors are then correlated with the perceivers' judgments of power to reveal the cues that predict their judgments of power. This means that the perceiver does not necessarily need to be conscious about the cues he or she is using when inferring another person's vertical position. The meta-analysis by Hall et al. (2005) showed that many nonverbal behaviors were used by perceivers to infer the vertical position of a person. Perceivers rated targets higher on verticality if they showed specific nonverbal behaviors. Concerning the *face*, more gazing, lowered eyebrows, a more expressive face, and more nodding were all related to being perceived as higher on the verticality dimension. With respect to the *body*, less self-touch, more other-touch, more arm and hand gestures, more bodily openness, more erect or tense posture, more body or leg shifts, and closer interpersonal distance were all related to higher perceived verticality. For the *voice*, results showed that a more variable voice, a louder voice, more interruptions, less pausing, a faster speech rate, a lower voice pitch, more

vocal relaxation, shorter time latencies before speaking, and more filled pauses (such as umm and ahh) were used by observers as indicators of high verticality. Smiling was negatively related to power (with more smiling being associated with lower ratings of power), but when the results for a large group of studies that all used the same facial stimuli were combined into an average effect size, this result disappeared. Moreover, there is a strong positive relation between speaking time and perceived high verticality (Schmid Mast, 2002), and observers use the visual dominance ratio (defined above) as an indicator of high vertical positions (Dovidio & Ellyson, 1982).

When people are asked what they explicitly expect in terms of social signals from people high as opposed to low in social influence, results pretty much converge with the ones we just reported. When participants are asked to report the behavior of people high or low in hierarchical rank in a work setting or high or low in personality dominance, it becomes apparent that they have consistent beliefs with significant effects occurring for 35 of 70 expressed nonverbal behaviors (Carney, Hall, & LeBeau, 2005). Among other behaviors, individuals high on the vertical dimension are believed to handshake more, stand closer, touch others more, have more expressive faces and overall animation, gesture more, gaze more, show less self-touch, have a more erect posture, lean forward more, and use more open body positions.

Not much research has investigated whether the social signals people use to infer verticality are the same across different cultures. Although power relations are more clearly displayed through nonverbal behavior in some countries (e.g., Germany) than others (e.g., United States, United Arab Emirates), there is evidence of cultural universality in the processing of dominance cues (Bente, Leuschner, Issa, & Blascovich, 2010).

There are clearly fewer social signals that are characteristic of people with an actual high standing on the vertical dimension than there are nonverbal behaviors perceived as indicators of high verticality. All signals indicative of actual vertical position are also used by observers to assess verticality, and Hall et al. (2005) even found positive correlations between the effect sizes of perceived and actual verticality cues. However, the list of verticality indicators assumed by observers is much longer than the data can support. Thus, perceivers seem to use social signals that are not necessarily diagnostic of the verticality dimension. If this is the case, are people still accurate in judging another person's vertical position? For instance, people believe that gazing is indicative of high verticality, this can only result in an accurate verticality assessment of the target if actual vertical position is conveyed by high levels of gazing (which it is not) (Hall et al., 2005).

Accurate Perception of Verticality

Accurate perception of another person's standing in terms of verticality is an important skill. Knowing who the boss is makes it easier to communicate efficiently in order to achieve one's goals (e.g., address those who have the resources and not making social gaffes). Such knowledge also helps maintain the existing social order.

Research shows that people's vertical position can be assessed accurately at better than chance level. For instance, judges were accurate at deciding which of two target people in a photograph was the other's boss (Barnes & Sternberg, 1989). People can accurately assess the status of university employees based on photographs (Schmid Mast & Hall, 2004). In another study, perceivers' ratings of CEOs' dominance based on their photographs significantly predicted the CEOs' company earnings (Rule & Ambady, 2008). This result may be an indirect indicator of accuracy in judging dominance if the CEOs' dominance was responsible for the

performance of the company. The ability to accurately assess the vertical position of a target seems to develop early in life. Children who were asked to select a leader out of pairs of photographs depicting real politicians reliably chose the politicians who actually won the election (Antonakis & Dalgas, 2009).

It is surprising that, although people seem to use a number of non-diagnostic cues to infer verticality, they are still able to correctly infer the vertical position of a person. Maybe the researchers have not measured the cues the observers actually use to infer verticality. Although this certainly remains an option, we do not think that this is the case given the long list of social signals that researchers have tested to date. More likely, the perceiver might rely on a combination of specific social signals, such as the visual dominance ratio mentioned before, to infer verticality. Judging the vertical position may be more of a Gestalt-like impression formation process. For example, a nonverbal behavior pattern involving touching, pointing at the other, invading space, and standing over the other has been related to perceived dominance (Henley & Harmon, 1985). Or, people might change their strategy when assessing a person's verticality depending on the nonverbal cues that seem most salient in a given situation. For example, in a work setting, perceivers might rely more on how formally somebody is dressed to assess his or her status, whereas in a peer group discussion, indicators such as speaking time or loud voice might be used to find out who is the most influential person in the group.

There is clearly more research needed to understand how observers use social signals to infer verticality of their social interaction partners correctly.

Verticality and Accurate Social Perception

Another question in the realm of interpersonal accuracy (defined as correctly assessing another's state or trait) and verticality is whether high or low power people are more accurate at

person perception (in general and not necessarily with respect to detecting interpersonal power). Both positions have been argued and have received empirical support.

Powerless people are said to be more accurate than the powerful at inferring others' states (Fiske & Dépret, 1996; Goodwin, Gubin, Fiske, & Yzerbyt, 2000), primarily because it is likely to be adaptive for them to be accurate. Subordinates may be motivated to learn their superiors' intentions, moods, and desires so that subordinates can adjust their own behavior in order to achieve their desired goals. If one assumes that the people high in verticality do not depend on others and they control relevant resources, powerful people may not be motivated to know their subordinates' feelings, thoughts, or expectations.

It is also possible that because of high cognitive demands that come with high power positions, high power people may not have the cognitive capacity to attend to the feelings and behaviors of others. This then also results in individuals high on the vertical dimension being less interpersonally accurate than individuals low on the vertical dimension. The hypothesis that high levels of verticality result in less accuracy than low levels was supported in some studies (e.g., Galinsky, Magee, Inesi, & Gruenfeld, 2006; Moeller, Lee, & Robinson, 2011).

However, the opposite hypothesis that high levels of verticality are correlated with better interpersonal accuracy has also obtained empirical support (Rosenthal, 1979; Schmid Mast, Jonas, & Hall, 2009). Powerful people may be motivated to know others who depend on them to secure respect and support and thus maintain their power position. Indeed, felt pride and felt respect partially mediated the effect of power on interpersonal accuracy (Schmid Mast et al., 2009). Also, it is possible that people who are particularly interpersonally sensitive are more likely to become leaders (Riggio, 2001). Alternatively, people high in verticality might be more interpersonally accurate because they use a more global cognitive processing style (Smith &

Trope, 2006) which can favor interpersonal accuracy in certain circumstances (e.g., facial emotion recognition) (Bombari et al., 2013).

We conducted a meta-analysis on the question of how power relates to interpersonal accuracy (Hall, Schmid Mast, & Latu, 2013). The meta-analysis consisted of 104 studies encompassing two definitions of accuracy (accurate inference about others and accurate recall of others' behavior or attributes) and four kinds of verticality (pre-existing vertical position, personality dominance, socioeconomic status [SES], and experimentally manipulated vertical position). Most of the studies in the literature measure interpersonal accuracy by giving people a test of cue judgments that is then scored for accuracy. For these studies, there was a significant but small and heterogeneous effect showing that people higher on verticality were better at accurately assessing others than were people low on verticality. Given the high heterogeneity of the results, we broke down the analyses separately for the different definitions of accuracy and verticality. Results showed that people higher in SES had better accuracy at inferring others' states and higher experimentally manipulated vertical position predicted higher accuracy defined as recall of others' words.

In a smaller number of studies, accuracy was measured based on people's judgments of another live person in a dyadic interaction. For studies of this type, there was evidence that the lower vertical person was more accurate than the higher vertical person. However, one cannot interpret this result with confidence because of the possibility that it is due to failures of expressive clarity on the part of the lower vertical partners, and not on failures of perceptivity on the part of the higher vertical perceivers (Hall, Rosip, LeBeau, Horgan, & Carter, 2006; Snodgrass, Hecht, & Ploutz-Snyder, 1998).

This meta-analysis confirmed that verticality per se might not be enough to explain interpersonal accuracy and as with verticality and social signaling, different definitions and operationalizations of power as well as different emotional and motivational states high and low power people can be in, affect the outcomes.

Future Directions

One challenge for future research is to consider the different types (definitions and operationalizations) of verticality as a moderator of the link between verticality and social signals. For instance, low power individuals who strived for a high power position talked more in a social interaction than low power individuals who were content with the relatively powerless position (Schmid Mast & Hall, 2003). The study of the interplay between different types of verticality (e.g., power and status) and its effect on social signals and how social signals are interpreted in terms of say power or status is only beginning to emerge (Dunbar & Burgoon, 2005).

Another avenue to pursue is the inclusion of the specific motivational or emotional states the powerful or the powerless individual is in when investigating social signals of verticality. These states can chiefly influence the social signals emitted. As an example, powerful people tend to show aggressive behavior more so when their ego is threatened than when not (Fast & Chen, 2009).

Research on social signals has typically looked at single social cues and how these relate to verticality. We therefore know very little about how different combinations or different timing of single cues indicate different levels of verticality and how they can affect the perception of verticality. In order to be able to advance more in this direction, the tedious coding of nonverbal cues needs to be facilitated and automatized. This becomes more and more possible when

researchers from the field of nonverbal behavior collaborate with computer scientists whose skills can help tackle questions of cue combination and cue timing. As an example, nonverbal cues of dominance have successfully been modeled by computer scientists (Jayagopi, Hung, Chuohao, & Gatica-Perez, 2009). Moreover, computer algorithms were developed to identify the emergent leader in a group of people working on a problem solving task based on the group member's nonverbal (vocal and visual) signals (Sanchez-Cortes, Aran, Schmid Mast, & Gatica-Perez, 2010). Also, efficiency is gained even without the help of computer algorithms if researchers use excerpts of behavior for coding instead of the entirety of the behavioral episodes at hand. Research increasingly points to the validity of this "thin slice of behavior" approach (Murphy, 2005; Murphy et al., 2013).

Knowing the nonverbal cues indicative of high verticality in a given social interaction, *nonverbal social sensing* can be used to assess a person's level of verticality while he or she is engaged in a social interaction. Nonverbal social sensing means the extraction of nonverbal behavioral cues from people engaged in social interactions via ubiquitous computing and with the help of computational models and algorithms for extracting the cues. Ubiquitous computing means that the computer fits the human environment and does not require the user to enter the computer environment. The so detected nonverbal behavior of a person could then be compared to what we know from research about the nonverbal behavior signs of actual high verticality. This comparison would inform us about where on the vertical dimension the person in a given interaction actually stands. This would result in building a dominance detector. Also, the so sensed nonverbal behavior of a person could be compared to the nonverbal behaviors people use to infer verticality of others. This would result in the information about how high on the verticality dimension a person is perceived by others. Such information could even be fed back

to the person who would then be able to constantly monitor and eventually auto-train to convey an impression of high power to others.

Knowledge about how verticality and is expressed in nonverbal behavior and how it is inferred through nonverbal behavior has not only value in that we better understand how interpersonal interactions unfold and how interaction outcomes can be optimized, it is also of practical relevance so that people can be trained efficiently in leadership skills, for instance.

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