Communication, Society and Media
ISSN 2576-5388 (Print) ISSN 2576-5396 (Online)
Vol. 2, No. 1, 2019
www.scholink.org/ojs/index.php/csm

*Original Paper*

# Meta-Analysis of the Curvilinear Relationship between Rate of Delivery and Message Persuasiveness

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Received: December 21, 2018 Accepted: January 14, 2019 Online Published: January 22, 2019

doi:10.22158/csm.v2n1p1 URL: http://dx.doi.org/10.22158/csm.v2n1p1

***Abstract***

*For five decades researchers investigated whether increasing the speed of the delivery of a persuasive message produces more message comprehension and attitude change. The experimental literature on this issue appears inconsistent, with many mediating variables introduced in an effort to reconcile disparate findings. This meta-analysis seeks to determine how persuasion is influenced by the rate of message delivery. The data provide support for a curvilinear model, indicating that persuasion is maximal for moderate speech rates. Results are discussed in terms of source credibility and mechanisms of message processing.*

***Keywords***

*delivery rate, compressed speech, persuasion, curvilinear model*

## 1. Introduction

Two areas of application dominate the examination of the delivery rate-persuasion relationship: instructional communication and technological advances. One of the most frequent comments that instructors of public speaking make to students involves the rate of speaking. Most often, the recommendation is to slow down. The basis for recommending that a speaker slow down reflects the belief that faster rates of speaking reduce comprehension of the message. Fast rates may negatively affect pronunciation, organization, and emphasis, and ultimately lead to poor message comprehension. The rate-attitude change question is also important due to technological advances. Digital media technology allows virtually all mediated persuaders to “time compress” messages and regulate the rate of message delivery. Both audio and video delivery can be altered to “fit” available time slots or

adjusted to optimize persuasive impact. These reasons are *not* discrete, as message comprehension is often associated with persuasion, and attitude change *can* result from ineffective or uncritical message processing.

The majority of past studies, however, focus on the persuasive impact of speeded or compressed speech in comparison to that of a normal delivery rate. There exists a disproportionately small amount of research examining effects of messages delivered at a lower-than-normal rate. And, most importantly, no systematic observation exists encompassing the whole spectrum of delivery rates. Therefore, our understanding of the rate-persuasion relationship remains only half-complete. This meta-analysis seeks to establish the rate-persuasion relationship on a broader continuum. We explore related issues including the impact of delivery rate on message comprehension and persuasion, and meta-analyses of experiments examining the persuasive effects of compressed or speeded messages.

*1.1 Speech Rate and Comprehension*

Of interest to communication researchers focusing on social cognition is the issue of comprehending messages at various rates of presentation. The question is whether the rate of speaking increases or decreases the comprehension of a message. Empirical findings are mixed or inconsistent. Some studies indicate no significant differences existing among listening comprehension at various rates of speech. Gill (1975) and Hagaman (1976) discovered that students listening to compressed speech did no better or worse on comprehension tests than students listening to normal speech. For Gill (1975), the comparison was made among 125 wpm, 174 wpm, and 223 wpm, while Hagaman (1976) made comparisons between 150 wpm and 190 wpm. Also, Sticht (1968a) found no significant differences in recall among the compressed speech conditions ranging from 75 wpm to 222 wpm, while Barabasz (1968) provides evidence that reducing the time of a college lecture by one-third through accelerated speech did *not* adversely impact either recall or retention. Barabasz explored reducing "normal lectures" from 21 minutes to 14 minutes, and from 18 minutes to 12 minutes. Overall, these studies indicate that accelerating the rate of speech does *not* necessarily compromise comprehension.

Other studies propose or demonstrate the possibility that listening comprehension would be maximal at a normal speaking rate, the rate at which a speaker reads aloud a message. Sticht (1972) in particular argued that the relationship between rate of speech and listening comprehension is curvilinear. Sticht maintained that listening comprehension decreases at speech rates below normal due to lack of listener attention and above normal speaking rates because extra effort is inadequate to cope with incoming information. Consistently, Reynolds' (1976) and Adelson's (1975) results indicate that normal speech rate (175 wpm) is more conducive to learning than compressed speech (275 wpm). These studies propose that the optimal recall and retention is possible only at normal rates of speech around 150 wpm to 175 wpm.

Related research indicates a threshold in the amount of increase in speech rate that allows the listener to

maintain message comprehension (i.e., threshold hypothesis). For example, Nelson (1948) shows that comprehension, while varying little between adjacent speech rates, reaches the top at 125 wpm and then gradually decreases to the bottom at 225 wpm. Similarly, McConville (1982) demonstrates that the level of comprehension is similar when comparing between 275 wpm 175 wpm conditions, but plummets when compression reaches 375 wpm. Sticht's (1969) research corroborates that the rate of speech is the most powerful contributor to the decline in comprehension observed at accelerated speech rates. Goldhaber and Weaver (1968) consistently document a significant decrease in comprehension between the rates of 175 wpm and 325 wpm.

The threshold hypothesis receives additional support. Foulke (1966) demonstrates that recall decreases rapidly after 253 wpm. From a follow-up study, Foulke (1968) also reports that comprehension may *not* be seriously affected until the word rate extends beyond 300 wpm. Foulke hypothesizes that even though word intelligibility, or the ability to recognize words and phrases, remains high in both of the experiments, the reduction in perception time needed to decode the incoming information adversely effected listening comprehension. Thus, these studies support the idea that normal speech enhances listening comprehension and that comprehension can only be sustained if accelerated rates are maintained below 300 wpm.

Several studies indicate that slower than normal rates of speech may also impede listening comprehension. Sticht (1968a) documents a significant decrease in comprehension when the rate of delivery falls from 100 wpm to 75 wpm. Consistently, McConville (1982) shows a significant drop in comprehension when the speech rate declines from 175 wpm to 75 wpm. Rossiter (1971) reports comprehension of compressed speech declining significantly at rates slower than 175 wpm.

The focus of these studies has been on determining the "ideal" listening comprehension conditions. When a relationship appears between listening comprehension and the rate of speech, it is characterized most often by the ability to comfortably comprehend materials in the "normal" range of speech or because of the extra effort to comprehend materials presented at faster rates of speech is extended. A meta-analysis on the comprehension of compressed messages (Preiss & Gayle, 2006) indicates that compressed speech adversely affects listening comprehension; information retention tends to decrease as the speech rate accelerates from normal or conventional to compressed ($r$ = -.42, $k$ = 28, $N$ = 3,274). Collectively, the mean effect lends credence to Foulke and Sticht's (1969) claim that understanding "spoken language implies the continuous registration, encoding, and storage of speech information and these operations require time" (p. 60). As the authors argue, the increased rate of speech seems to disallow enough processing time for incoming materials to ensure information retrieval. Importantly, this meta-analytic evidence provides a partial support for the curvilinear or the threshold predictions. The study highlights the fast side (i.e., normal to compressed) of speech rates, completing the right half of the curvilinear model, where comprehension decreases as increases the speech rate. The left side of

the model, where comprehension is projected to decline as the speech rate decelerates from normal, simply remains unsubstantiated due to lack of data. Another meta-analysis covering the whole continuum of delivery rates should produce data needed to find a more definitive answer.

*1.2 Speech Rate and Persuasion*

Scholars point out that both lower than normal and faster than normal delivery rates violate expectations and interfere with message processing (Hausknecht & Moore, 1986; MachLachlan, 1982; see also LaBarbera & MachLachlan, 1979), proposing a curvilinear relationship between delivery rate and attitude change. This notion corresponds to the curvilinear prediction between speech rate and comprehension as discussed above. Assuming that a sustainable persuasion requires a thoughtful processing of the message arguments, both comprehension and persuasion must culminate at moderate rates of delivery provided that the message was sufficiently strong. As rate exceeds processing ability, peripheral persuasion is expected, in which elements other than argument quality (e.g., perception of the source) predict persuasibility (see Hausknecht & Moore, 1986).

Scholars interested in communication and social cognition seek to understand the perceptions and mechanisms associated with persuasive rates of delivery. Early speech communication researchers noticed that dynamic or charismatic speakers gained effectiveness by using their rate of delivery strategically (e.g., Dietrich, 1946) and conjectured that message processing and source perception may account for rate-based influence outcomes.

Faster delivery may be perceived as a marker of sincere belief or endorsement. This perception may create an expectation that the excitement in the delivery of the message reflects enthusiasm, emotionality, and commitment to the topic. Scholars of speeded communication indicate the audience tends to prefer sources speaking faster than normal (e.g., Hausknecht & Moore, 1986). Apple, Streeter, and Krauss (1979) observed that fast delivery is associated with perceptions of speaker competence and trustworthiness, as well as with persuasion. Miller, Maruyama, Beaber, and Valone (1976) conclude that fast talkers are perceived as being more confident in their positions on topics.

While this reasoning indicates a positive relationship between rate and persuasion, it is *not* unbounded. Extremely fast delivery may convey desperation or coercion as well as impede a clear message comprehension. Similarly, a speaker talking extremely slowly may bore the audience or appear less competent than he/she actually is, with inviting unnecessary critiques. While currently there exists little empirical support for the curvilinear rate-persuasion relationship, the curvilinear prediction is *not* incompatible with the existing evidence supporting the positive rate-persuasion relationship. Results from past studies, mostly on the impact of “speeded delivery”, only indicate that a moderately fast delivery produces more persuasion than a “normal” speech rate. Whether or not a slower-than-normal or extremely slow/fast delivery rate would actually dampen source credibility and/or persuasion remains unclear. That is, the evidence supporting the positive rate-persuasion relationship might

actually be revealing only a small part of the larger picture of the curvilinear prediction. This meta-analysis examines the rate-persuasion relationship on an extended spectrum incorporating the effects involving slow delivery rates.

*1.3 RQ: Is the Association between Speech Rate and Persuasion Linear or Curvilinear?*

## 2. Method

Collecting quantitative studies about a phenomenon and converting results into a common metric can resolve statistical inconsistencies and test for homogeneity of effects. Experimental studies of speech rate, compressed speech, time compressed speech, and persuasion were retrieved using the computer-based retrieval systems *ERIC, Education Abstracts, Academic Universe, Psychinfo, Dissertation Abstracts, Business Abstracts, Communication Index,* and *Communication and Mass Media Complete*. The reference section of each manuscript was searched for additional studies involving delivery rate and persuasion. *Three inclusion rules were applied to manuscripts. An experiment had to: (a) adopt some measure of persuasion related to the rate of speech measured in words/seconds per minute; (b) contain a quantitative estimate of the rate's impact on persuasion; and (c) provide adequate information to allow conversion of results into a common metric for comparison. The 18 manuscripts located in the search contained separate effect sizes meeting all the criteria for the effect or rate of delivery on persuasion.*

*2.1 Coding of Studies*

The studies provided a comparison between two different rates of delivery (measured in words per minute) of the persuasiveness of a message. Studies that used more than one rate of delivery allowed for multiple comparisons. The comparisons use the particular rate of words per minute to indicate a fast or slow rate of presentation. Each acceptable manuscript was coded for the year published, the word per minute comparison, and the number of participants. A total of 44 rate-persuasion comparisons were identified (for the summary of data, see Table 1).

The summary statistics of each study were converted to product-moment correlations so that the magnitude of outcomes attributable to delivery rate could be standardized across studies. The correlations were weighted for sample size and then averaged using a random effects model described by Hunter and Schmidt (2014). A $\chi^2$ test was conducted to determine if the variance in the observed sample correlations exceed that expected by random sampling error (Hedges & Olkin, 1985). A statistically non-significant result indicates that the amount of variability is probably by chance, whereas a significant result suggests a potential existence of a moderator as a systematic cause of the variability.

**Table 1. Effects Included in the Meta-Analysis (k = 44)**

| Author* | Year | WPM (slow) | WPM (fast) | *r* | *N* |
|---|---|---|---|---|---|
| Dietrich | 1946 | 165 | 185 | .387 | 760 |
| Mack | 1970 | 153 | 180 | .174 | 120 |
| | 1970 | 153 | 218 | .180 | 120 |
| | 1970 | 153 | 278 | -.127 | 120 |
| | 1970 | 180 | 218 | .006 | 120 |
| | 1970 | 180 | 278 | -.180 | 120 |
| | 1970 | 218 | 270 | -.174 | 120 |
| Wheeless | 1971 | 145 | 296 | -.054 | 296 |
| Gunderson | 1976 | 125 | 150 | 0 | 229 |
| Miller | 1976 | 102 | 195 | .503 | 359 |
| | 1976 | 111 | 140 | .294 | 60 |
| | 1976 | 111 | 190 | .294 | 60 |
| | 1976 | 140 | 190 | .294 | 60 |
| Woodall | 1978 | 161 | 179 | -.040 | 247 |
| MacLachlan | 1978 | 150 | 187 | .564 | 222 |
| Ritter | 1982 | 150 | 187 | -.028 | 120 |
| Schlinger | 1983 | 160 | 192 | -.250 | 240 |
| Nickell | 1984 | 150 | 175 | .166 | 40 |
| | 1984 | 150 | 200 | .166 | 40 |
| | 1984 | 150 | 225 | -.220 | 40 |
| | 1984 | 175 | 200 | .166 | 40 |
| | 1984 | 175 | 225 | -.220 | 40 |
| | 1984 | 200 | 225 | -.220 | 40 |
| Hausknecht | 1986 | 165 | 215 | .067 | 160 |
| | 1986 | 165 | 264 | .067 | 160 |
| | 1986 | 215 | 264 | -.067 | 160 |
| Moore | 1986 | 137 | 178 | .128 | 160 |
| | 1986 | 137 | 219 | .128 | 160 |
| | 1986 | 178 | 219 | .128 | 160 |
| Vann | 1987 | 173 | 190 | .251 | 40 |
| | 1987 | 173 | 207 | .209 | 40 |
| | 1987 | 173 | 224 | -.167 | 40 |

| | | | | | |
|---|---|---|---|---|---|
| | 1987 | 190 | 207 | -.251 | 40 |
| | 1987 | 190 | 224 | -.167 | 40 |
| | 1987 | 207 | 224 | -.167 | 40 |
| Kittle | 1989 | 153 | 172 | .106 | 60 |
| | 1989 | 153 | 191 | .159 | 60 |
| | 1989 | 172 | 191 | .051 | 60 |
| Smith | 1991 | 144 | 182 | .118 | 66 |
| | 1991 | 144 | 214 | .236 | 66 |
| | 1991 | 182 | 214 | -.118 | 66 |
| Smith | 1995 | 180 | 220 | .176 | 94 |
| McGehee | 1996 | 163 | 226 | -.072 | 240 |
| Lucia | 1998 | 111 | 201 | .053 | 120 |

*Only the first author is listed. See references for complete citations.

The prediction that the relationship is curvilinear was examined by establishing the correlation between the median speech rate (i.e., [wpm of the "fast" condition—wpm of the "slow" condition] / 2 + wpm in the "slow" condition) and the size of persuasion. Given the prediction, the two variables must be inversely related; the manipulation would initially return a large positive effect when the speech was read relatively slowly in both conditions because the "slow" speech would be perceived to be usually slow; the size of the effect should decrease to zero as increases the wpm for both treatment conditions which should be perceived to be similarly moderate; and finally, the effect starts to reverse in direction and intensify in size as accelerates the wpm for both conditions to an extreme because the speech read in the 'fast' condition must be perceived to be too fast to comprehend.

**3. Results**

The overall analysis involving 44 heterogeneous set of estimates ($\chi^2[43, N = 5{,}645] = 286.43$, $p < .05$) indicates that faster rates of presentation are associated with increased persuasiveness of the message, $\bar{r} = .114$, $N = 5{,}645$.

A subsequent analysis tested the predicted curvilinear relationship between the median wpm and the effect size. The sample size and the induction strength (i.e., "fast" wpm—"slow" wpm) were also added to the linear equation to isolate the unique impact for median wpm on persuasion. Consistent with the prediction, the median wpm had an ample negative effect for persuasion, $\beta = -.588$, $p < .001$ (Note 1). Neither the sample size ($\beta = .225$, $p = .08$) nor the induction strength ($\beta = .074$, $p = .57$) had a statistically significant impact for the outcome at level $\alpha = .05$. As Figure 1 (left) illustrates, the effects (a) start out ample positive for lower median wpms, mainly occupying quadrant II of the plane, (b)

retreat close to the zero point for moderate median wpms near around 181, the median wpm of the entire sample, (c) and then recover the power, this time in the opposite direction, with filling quadrant IV, as the median wpms increase even further.

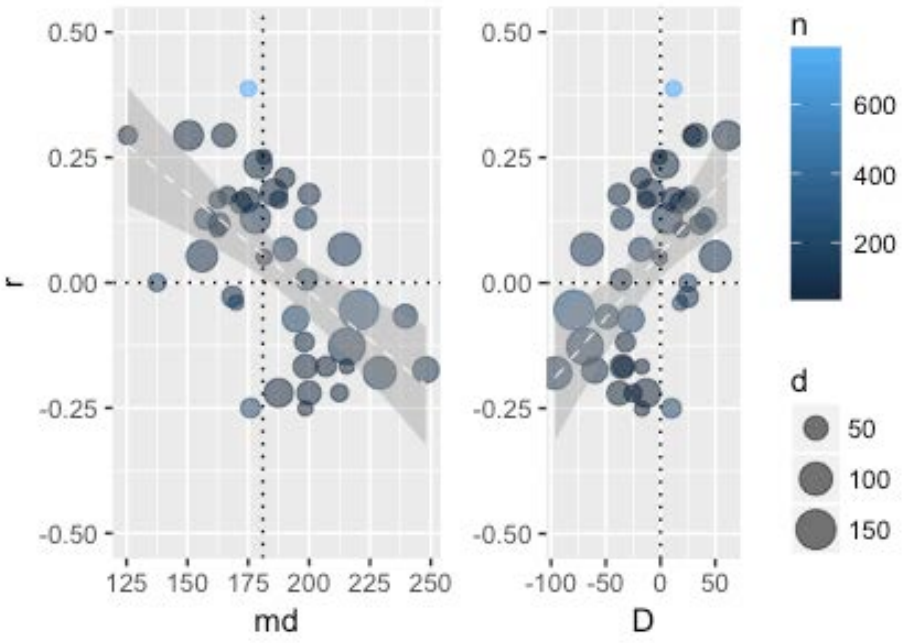


**Figure 1. Date Scatterplot**

Figure Explanation: Scatter plots predicting the observed effects from median speech rates (*md*, left) and from a new variable reproduced to follow a curvilinear model (*D*, right). The black vertical dotted line (left) indicates the median speech rate (wpm = 181) of the entire sample. *n* = sample size. *d* = distance in wpm or induction strength (i.e., "fast" wpm—"slow" wpm). The dashed white line summarizes the pattern in a linear function. The shaded area represents the $CI_{95\%}$ region.

In an attempt to document more definitive evidence, we created a new predictor of the observed effects. To the extent that the relationship between speech rate and persuasion is indeed curvilinear, persuasion must culminate at the inflection point (i.e., median wpm = 181) such that moderate speech rates return the optimum persuasion, *and* the level of persuasion declines as the speech rate deviates from the point in either directions. Given the curvilinear assumption, the new predictor (*D*) is a function of (a) the respective distance of the slow and the fast wpm from the optimum point of 181 wpm (i.e., effect size) and (b) the slope obtained by connecting their (i.e., "slow" and "fast") points projected onto the curvilinear function (i.e., direction of the effect); the slope becomes positive (negative) when the fast (slow) wpm is closer to the median, and zero when the slow and the fast wpms are away from the median equally. According this rule, for example, a study that compared 141 wpm and 171 wpm returns

*D* = +30; ||171-181| - |141-181|| = 30, and the slope is positive because 171 (fast wpm) is closer to 181, or more persuasive than 141 (slow wpm) (Note 2). The curvilinear model should return zero if a speaker was communicating at a slow rate of 161 wpm and a fast rate of 201 wpm because each rate is 20 wpm off of the optimum in the opposite direction. To the extent that the curvilinear prediction is true, this new variable (*D*) must correlate positively with the observed effects.

To test the hypothesis, a linear equation was established, in which *D*, induction strength, and sample size independently predict the observed effects. Consistent with the prediction, *D* had an ample, positive impact on observed effects $\beta = .607$, $p < .001$. The impact of same size ($\beta = .222$, $p = .08$) and that of induction strength ($\beta = .124$, $p = .35$) were statistically ignorable (see for illustration Figure 2, right).

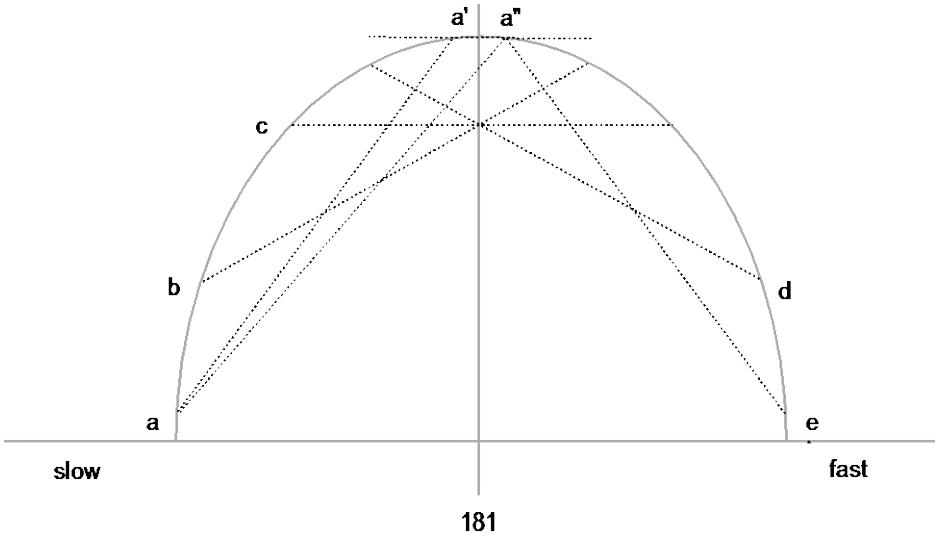


**Figure 2. Curvilinear Display of Analysis**

Figure Explanation: A curvilinear mechanism used to reproduce the effects. The model considers 5 possible conditions; in *a* and *b*, the fast speech rate is closer to the optimum wpm (*md* = 181) than the slow speech rate, creating a positive slope, hence the effect must be positive; when the slope reaches zero as in *c* (i.e., the fast and the slow speech rates are away from the optimum wpm by the same amount), so must be the effect because persuasibility of both the "slow' and the 'fast" conditions are equally less optimal; *d* and *e* consider the opposite situations of *b* and *a*, respectively, that is, as the slope turns negative, the slow speech rate becomes closer to the optimum wpm than the fast speech rate, hence the effect must be negative. Importantly, it should be noted that, due to the symmetric nature of the curvilinear assumption, a' and a" represent an equally non-optimal persuasion. Therefore, the two

effects (i.e., a – a' and a – a") remain indistinguishable in the current model. Mathematically, the effect is calculated following:

$D$ = | slow wpm – 181 | – | fast wpm – 181 | for positive slopes (fast wpm closer to 181)

= –1 × (| fast wpm – 181 | – | slow wpm – 181 |) for negative slopes (slow wpm closer to 181)

= 0 for zero slope (fast and slow wpms equally distanced from 181)

Current results indicate a curvilinear relationship between the rate of speaking and the persuasiveness of the message. That is, as the speech rate increases, so does the attitude change up to a point where it levels off and then starts to diminish as the speech rate accelerates further.

**4. Discussion**

The curvilinear test received strong support in this meta-analysis. Distance from the 181 wpm inflection point was strongly associated with persuasion. This curvilinear model predicts persuasion based on the extent to which the baseline rate is approached or exceeded in either directions. Essentially, the inflection point of 181 wpm seems to reflect the upper end of the normal speaking rate; the persuasiveness of the message improves as a speaker increases from a low wpm up to about 181 wpm, and further increases in speaking rate starts hampering the persuasiveness of the message.

The homogeneity test indicates the presence of possible moderator variables. Although we were unable to isolate the moderator(s), it may be that the prediction is operating on certain topics or for receivers of certain demographics only. Future studies are recommended to extend the current one by including more contextual variables for analysis (e.g., recipient demographics, topics, anti-, pro-social, or commercial).

Future research needs to examine why the curvilinear relationship exists. One explanation was that faster speaking reduces the ability to comprehend or understand the arguments. At some point, the rate of speaking approaches a speed that a person, particularly unaccustomed to such rates, can no longer comprehend. The failure of high rates of delivery to be more persuasive may simply reflect the inability to process the information.

A second explanation may deal with the perception of the message situation. Unusually fast rates are often associated colloquially with deception or dishonesty, “fast talking salesman”. A listener may understand the argument but react negatively because a very high rate may incur feelings of deception. Unlike the moderately fast rate that may indicate excitement and intensity, a faster rate may generate negative thoughts about the speaker.

Future research needs to evaluate the nature of the perceptual issues that may explain the manner in which the message becomes less persuasive at higher/lower rates of delivery. The current meta-analysis does *not* address or directly consider what perceptual changes are taking place in the mind of a set of

message receivers when one compares messages. Essentially, the changed rate of presentation creates a different set of reactions that ultimately mediate the outcome of attitude change. This meta-analysis provides no direct evidence about the nature of the process that should be taking place to generate the particular outcomes. Rate-persuasion studies should be designed to include source perceptions and comprehension as fundamental variables. The results may help clarify whether the rate-induced attitude change takes comprehension-based or credibility-based mechanism or some combination of both.

The results from the meta-analysis favor the curvilinear model. While moderators may affect actual persuasion, the baseline rate provided a threshold that governed persuasion. Approaching the expected, conversational rate was associated with greater attitude change. Rates lower or higher than this inflection point were associated with less attitude change. This insight offers opportunities for exploring several competing explanations for the rate-persuasion relationship.

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**Notes**

Note 1. The same result was upheld when the predictor variable was replaced by points randomly selected between the “slow” wpm and the “fast” wpm.

Note 2. The curvilinear model is symmetric and thus considers the distance in absolute terms. That is, in the current model, 171 wpm and 191 wpm are equally less persuasive than the optimum, and hence indistinguishable. The same outcome would result when we had the fast wpm of 191 and the slow wpm of 141. See the notes under Figure 2 for more detailed explanation.