

Testing media naturalness theory using PLS-SEM

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Abstract

Using secondary data from a global cosmetics brand's Facebook page, this paper demonstrates how to test Media Naturalness Theory (MNT) utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM). To illustrate, we use a model linking media naturalness, emotional arousal, cognitive load, engagement, and business impact and demonstrate how to test it using WarpPLS 8.0. The results provide support for MNT and its potential to influence the impact of social media posts.

Keywords: Media Naturalness Theory; Partial Least Squares; Social Media; Digital Communication; WarpPLS.

Introduction

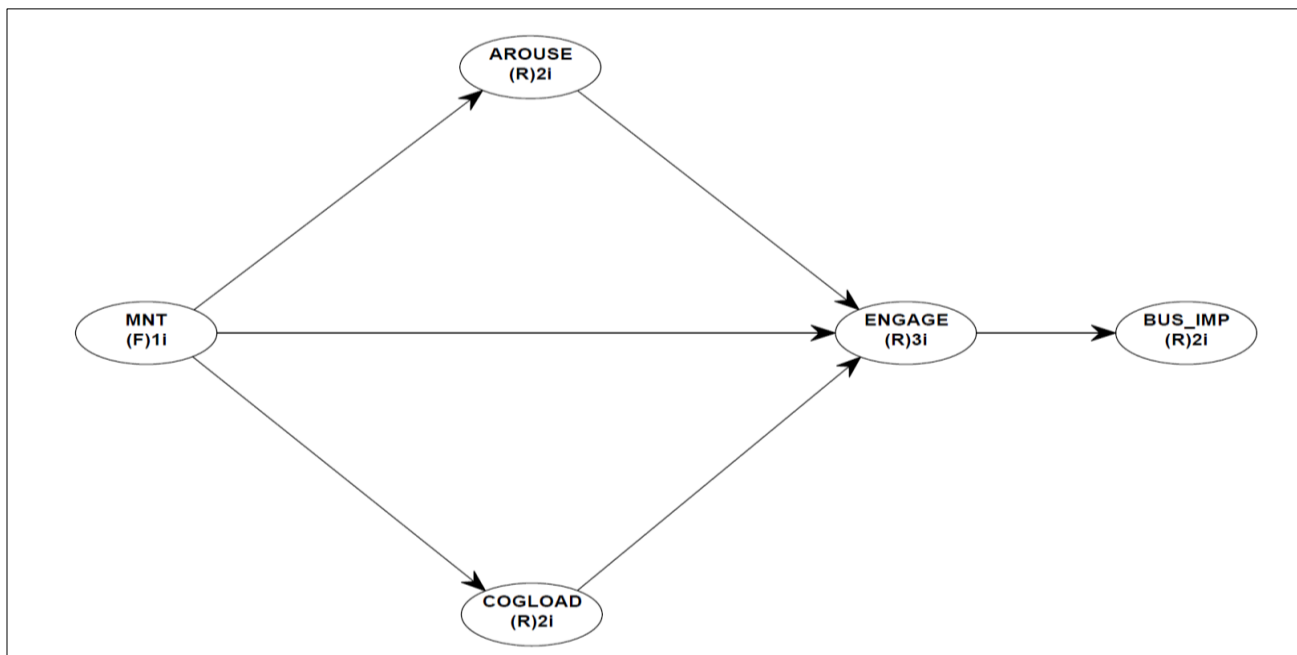
This study examines how media naturalness influences user engagement and business outcomes in social media branding by drawing on Media Naturalness Theory (MNT). MNT asserts that face-to-face is the most natural form of communication. Naturalness in any type of communication can be assessed by looking at five elements of face-to-face communication: shared context, synchronicity, facial expressions, non-verbal cues, and speech (Kock 2001). When these elements are present in face-to-face communication, they allow communicators to experience reduced ambiguity and cognitive effort, and increased excitement (Kock 2001, 2004, 2021). The presence of these components affects the naturalness of social media branding posts and has the capacity to influence the impact they yield for an organization. This paper illustrates how to empirically test MNT utilizing real-world social media branding data. We use a publicly available data set published by Moro et al. (2016), encompassing 790 Facebook posts from the official page of a global cosmetics brand. We utilize post type in the data set to measure the level of naturalness (video, photo, link, status). We conduct Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis with WarpPLS 8.0. WarpPLS was selected due to its strength in modeling non-linear relationships and suitability for small-to-medium sample sizes (Kock, 2024). Unlike traditional covariance-based SEM tools, WarpPLS excels in detecting complex mediating effects and producing robust model fit indices, making it ideal for this test. This paper demonstrates the process

of utilizing WarpPLS 8.0 to test MNT in a social media branding context while also assessing normality, reliability, validity, and model fit.

Illustrative model and data

The model shown in Figure 1 contains five latent variables: media naturalness of social media posts (MNT), intensity of reactions to posts such as likes, shares, and comments (AROUSE), cognitive load experienced by users (COGLOAD), level of engagement with posts (ENGAGE), and the perceived business impact of social media impressions (BUS_IMP). Based on MNT, it is expected that increased naturalness in social media posts will result in increased emotional arousal and decreased cognitive load ultimately impacting engagement levels. In this illustrative model we propose the effect of media naturalness on engagement is fully mediated through emotional arousal and cognitive load.

Figure 1: Illustrative model



Notes: MNT = Media Naturalness of post; COGLOAD = Cognitive Load; AROUSE = Emotional Arousal; ENGAGE = Engagement; BUS_IMP = Business Impact; notation under latent variable label describes measurement approach (reflective or formative) and number of indicators (e.g. 3 indicators).

Normality of data distribution was assessed using both the traditional Jarque-Bera (JB) and the Robust Jarque-Bera (RJB) goodness-of-fit tests. Results from these tests indicate none of the constructs follow a normal distribution, making WarpPLS and its tolerance for non-normal data a good fit for this research.

Figure 2 shows convergent and discriminant validity tests for the measurement model. As shown in the WarpPLS output, each indicator loads strongly on its related latent construct and all loadings are greater than 0.5, exhibiting convergent validity (Amora, 2021; Kock, 2014). The correlations between the different constructs are significantly lower, implying adequate discriminant validity (Kline, 2005).

Figure 2: Loadings and cross-loadings for latent variables

	MNT	COGLOAD	AROUSE	ENGAGE	BUS_IMP	Type (as defined)	SE	P value
Post_Type_Num	(1.000)	0.000	0.000	0.000	0.000	Formative	0.040	<0.001
Lifetime_Post_	-0.081	(0.924)	-0.010	-0.005	0.225	Reflective	0.040	<0.001
Lifetime_Post_	0.081	(0.924)	0.010	0.005	-0.225	Reflective	0.040	<0.001
Lifetime_Post_	0.030	0.074	(0.921)	0.100	0.012	Reflective	0.040	<0.001
Lifetime_Post_	-0.030	-0.074	(0.921)	-0.100	-0.012	Reflective	0.040	<0.001
comment	-0.057	0.106	0.046	(0.943)	-0.207	Reflective	0.040	<0.001
share	-0.027	0.006	-0.015	(0.967)	-0.063	Reflective	0.040	<0.001
like	0.083	-0.111	-0.030	(0.956)	0.267	Reflective	0.040	<0.001
Lifetime_Peopl	-0.160	0.257	-0.259	0.041	(0.908)	Reflective	0.040	<0.001
Lifetime_Post_	0.160	-0.257	0.259	-0.041	(0.908)	Reflective	0.040	<0.001

Notes: Loadings are unrotated, and cross-loadings are oblique-rotated after separate Kaiser normalization. MNT = Media Naturalness; COGLOAD = Cognitive Load; AROUSE = Emotional Arousal; ENGAGE = Engagement; BUS_IMP = Business Impact.

Figure 3 shows, on the diagonal, the square root of the average variance extracted (AVE) utilized to assess discriminant validity. The square roots of the AVEs are higher than the correlations shown below. We can conclude these constructs exhibit discriminant validity (Fornell & Larker, 1981; Kock, 2014; Rasoolimanesh, 2022).

Figure 3: Latent variable correlations

	MNT	COGLOAD	AROUSE	ENGAGE	BUS_IMP
MNT	(1.000)	-0.260	0.042	0.013	-0.313
COGLOAD	-0.260	(0.924)	0.395	0.325	0.671
AROUSE	0.042	0.395	(0.921)	0.450	0.634
ENGAGE	0.013	0.325	0.450	(0.956)	0.566
BUS_IMP	-0.313	0.671	0.634	0.566	(0.908)

Note: Square roots of average variances extracted (AVEs) shown on the diagonal.

Figure 4 shows Composite Reliability and Cronbach's alpha coefficients. Both measures are utilized to assess reliability of the measurement instrument. Scores for all constructs exceed the 0.70 threshold recommended for reflective variables, indicating adequate reliability (Kock, 2024).

Full Collinearity Variance Inflation Factors (VIFs), shown in figure 4, were used to test for multicollinearity. COGLOAD, AROUSE, AND ENGAGE have VIFs below the recommended threshold of 3.3, suggesting no multicollinearity. BUS_IMP has a VIF of 3.5 which is still well below the more conservative threshold of 5 (Kock, 2014, 2015, 2024).

Additional multicollinearity diagnostics revealed an Average Block VIF (AVIF) of 1.179 and an Average Full Collinearity VIF (AFVIF) of 2.026, both well within acceptable thresholds, supporting our earlier conclusion that multicollinearity is not a concern. This means the variables employed in the model assess distinct underlying constructs (Kock, 2024).

Figure 4: Latent variable coefficients

	MNT	COGLOAD	AROUSE	ENGAGE	BUS_IMP
R-squared		0.140	0.029	0.261	0.442
Adj. R-squared		0.138	0.027	0.257	0.441
Composite reliab.	1.000	0.921	0.917	0.969	0.904
Cronbach's alpha	1.000	0.828	0.820	0.952	0.787
Avg. var. extrac.	1.000	0.853	0.847	0.913	0.824
Full collin. VIF	1.300	1.838	1.882	1.580	3.532

Model fit and quality indices were assessed to establish the overall adequacy of the structural model (Figure 5). While values for the Average Path Coefficient (APC), Average R-squared (ARS), and Average Adjusted R-squared (AARS) are not of particular significance for a study that focuses on testing theory, P values significant at the 0.05 level are still recommended (Kock, 2011). As shown in Figure 5 APC, ARS, and AARS are all significant at the .001 level. The Tenenhaus Goodness of Fit (GoF) exceeds the threshold for a large effect size, demonstrating sufficient explanatory power. Simpson's Paradox Ratio (SPR) indicates that at least 83.3% of the paths do not exhibit Simpson's Paradox, an acceptable measure exceeding the .7 (70%) threshold. The R-squared Contribution Ratio (RSCR) and Statistical Suppression Ratio (SSR) meet or exceed recommended thresholds, indicating the absence of suppression effects (Kock, 2014, 2024). Finally, the Nonlinear Bivariate Causality Direction Ratio (NLBCDR) was 1.000, supporting the direction of the hypothesized paths in the illustrative model. Collectively, these results provide robust evidence supporting the statistical quality, explanatory power, and causal validity of the model.

Figure 5: Model fit and quality indices

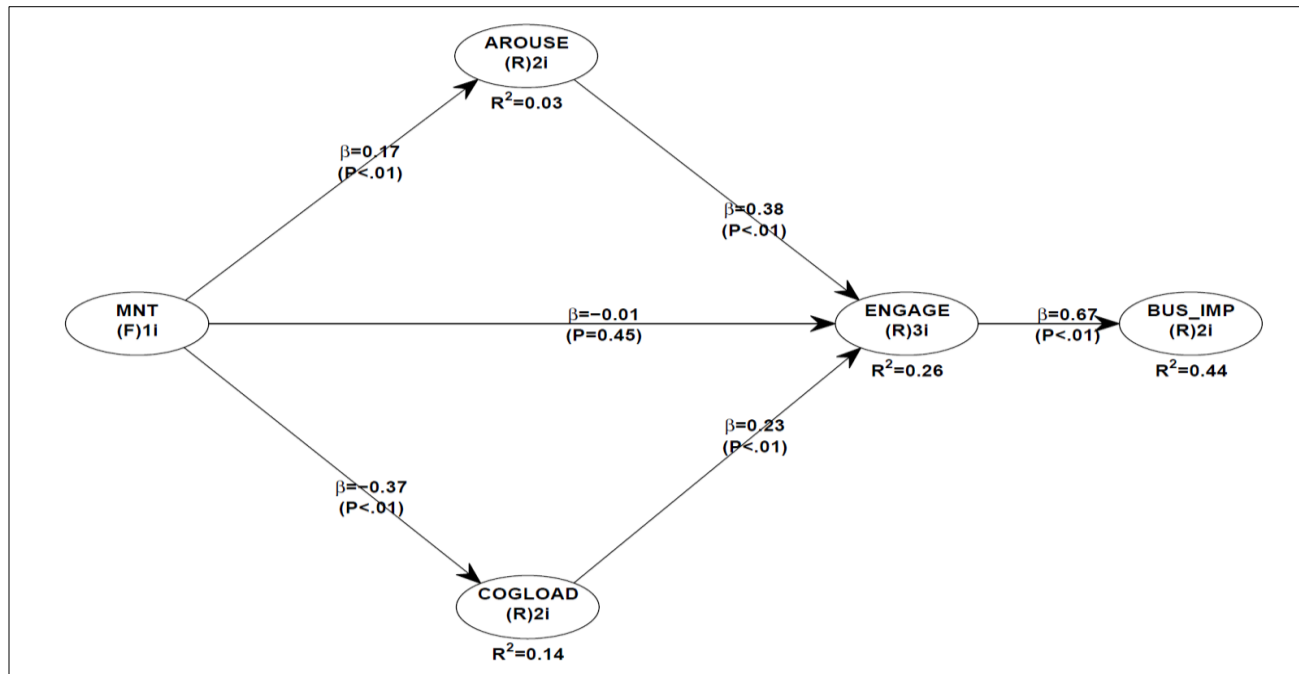
Model fit and quality indices
Average path coefficient (APC)=0.303, P<0.001 Average R-squared (ARS)=0.218, P<0.001 Average adjusted R-squared (AARS)=0.216, P<0.001 Average block VIF (AVIF)=1.179, acceptable if <= 5, ideally <= 3.3 Average full collinearity VIF (AFVIF)=2.026, acceptable if <= 5, ideally <= 3.3 Tenenhaus GoF (GoF)=0.440, small >= 0.1, medium >= 0.25, large >= 0.36 Simpson's paradox ratio (SPR)=0.833, acceptable if >= 0.7, ideally = 1 R-squared contribution ratio (RSCR)=1.000, acceptable if >= 0.9, ideally = 1 Statistical suppression ratio (SSR)=1.000, acceptable if >= 0.7 Nonlinear bivariate causality direction ratio (NLBCDR)=1.000, acceptable if >= 0.7

Results

Figure 6 summarizes the results of the path analysis. Overall, the structural model demonstrates strong empirical support for MNT. As anticipated, social media posts exhibiting higher levels of media naturalness (e.g. video vs. status) increase emotional arousal and decrease cognitive load. Emotional arousal and cognitive load were found to be positively and statistically significantly related to the level of engagement, ultimately influencing the business impact of social media branding. The direct path from media naturalness to engagement was not statistically significant indicating the effect of media

naturalness on engagement is fully mediated through emotional arousal and cognitive load rather than being direct.

Figure 6: Model with results



Notes: MNT = Media Naturalness of post; COGLOAD = Cognitive Load; AROUSE = Emotional Arousal; ENGAGE = Engagement; BUS_IMP = Business Impact.

Conclusion

This study advances both theoretical and practical understanding of how media naturalness influences the perceived business impact of digital branding. The results show that social media posts utilizing higher levels of naturalness are associated with increased impact for an organization. These insights emphasize the importance of using rich, natural social media branding techniques to increase the effectiveness of these interactions.

Acknowledgments

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