A typology of three-way interaction models: Applications and suggestions for Asian management research

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Abstract:

We develop a typology of three-way interaction models in order to stimulate more Asia management studies using this approach. In this paper, we explain how to approach moderation based on three-way interactions, introduce three types of three-way interaction models, and provide the appropriate *post-hoc* statistical procedures accordingly. We also outline several future research examples to demonstrate how three-way interactions can be used in Asian management research.

Keywords: three-way interaction | moderation | joint moderating effects | moderated moderating effects | moderated joint effects

Article:

In examining their proposed relationships, researchers often consider one or multiple moderators in their studies (e.g., culture, team climate). When one moderator is involved, researchers need to analyze their data using two-way interactions, defined as the product term between two predictors of the outcome variable (i.e., the independent and the moderating variable). When researchers consider two or more moderators in their conceptual models, they will often use three-way interactions, that is, the product term of the independent variable and multiple moderators, in their analytical procedures (Aiken, West, & Reno, 1991). Moderators are important for research because in many cases, hypotheses proposed by researchers are conditional; that is, there exists certain conditions to be met in order for a causal relationship to be observed (Brambor, Clark, & Golder, 2006). Specifically, moderators help us to gauge the conditions (e.g., individual and situational differences) in which we expect the strength and the direction of relationship between a predictor and its outcome will change (Baron & Kenny, 1986). Researchers can consider one such condition (i.e., either individual or situation) in their studies with the use of two-way interactions. With three-way interactions, researchers will then have the advantage to consider the joint influence of multiple conditions (i.e., individual and situation) and to propose more complex relations in their studies. Moderators are also useful for researchers to understand the inconsistent findings on the relationship between two variables that are expected to correlate (Baron & Kenny, 1986). Probing the boundary conditions of an

expected relationship in this case can be more effective when researchers are able to consider the role of two moderators using three-way interactions in one research study (as opposed to using two-way interactions to examine two moderators in two separate studies).

Three-way interactions have been used in top-tiered management journals (e.g., *Academy of Management Journal, Journal of Applied Psychology*, and *Journal of Management*). In the last five years (2012–2016), about 56 (3%) articles among a total of 2,099 articles published in the six top journals have adopted three-way interactions as their analytical procedures.¹ Within the same period, however, we were only able to find two empirical studies published in the *Asia Pacific Journal of Management* using the same methodology (i.e., Ju, Qin, Xu, & DiRenzo, 2016; Li, He, Yam, & Long, 2015). Using three-way interactions, authors of these two studies were able to investigate more complex conditions under which emotional exhaustion can lead to employee unsafe behavior (Ju et al., 2016), and when empowering leadership engenders follower's taking charge behaviors (Li et al., 2015). Without considering three-way interactions, researchers interested in Asia management research may have missed a potentially useful analytical tool to approach their research questions.

The purpose of this paper is to encourage Asian management scholars to consider three-way interactions. To begin, we first briefly explain moderation and analyses involving two-way interactions. Next, we explain what three-way interactions are and the proper analytical methods in probing the specific form of three-way interactions. In particular, we develop a typology of three-way interaction models. We then discuss how these models differ and what *post-hoc* procedures should be conducted accordingly. Finally, we outline several research possibilities for Asian scholars to consider involving three-way interactions in their future studies.

Moderation and two-way interaction

Mencius, one of the most famous and influential philosophers in Ancient China, once said that that "Situation changes in different moment." It leads to an important principle for ancient Chinese government officials to consider adapting the administrative practices according to the specific situation. In most management studies, the relationship between two variables (X and Y) is also contingent rather than universal. When the relationship between X and Y is said to be dependent on a third variable Z, we consider Z to be a moderator. For example, in the classic job-demand-resource model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), the relation between job demand (X) and stress (Y) is considered to be less positive under high resources (Z). If we use slopes to describe the relationship between job demand and stress, as resources increase, the slope between X and Y will change from more to less positive. In other words, when moderation happens, the relationship between X and Y will be conditional.

¹ To narrow our scope, we limited our search to survey studies published in APJM and six top-tiered management journals—*Academy of Management Journal, Journal of Applied Psychology, Journal of Management, Strategic Management Journal, Journal of Organizational Behavior*, and *Journal of Occupational and Organizational Psychology*. One of the authors used the search engine of each journal with the key words "three-way interaction." The person then examined each publication and retained those that formally proposed and tested three-way interactions in their studies.

In addition to changing the strength of the relationship (e.g., from more to less positive), moderators may sometimes alter the direction of the relation (e.g., from positive to negative). In Sun and van Emmerik's (2015) study, the relationship between proactive personality and job performance is *positive* under high political skill but *negative* under low political skill. Such moderation is described as disordinal or non-monotonic.

To analyze whether moderation takes place, researchers need to create an interaction variable (i.e., X^*Z) between the independent variable (X) and the moderator (Z). Since only two variables are expected to interact, the following equation is also referred to as two-way interaction (Aiken et al., 1991).

$$Y = a_0 + a_1 X + a_2 Z + a_3 X * Z$$
(1)

The above equation can be rearranged to show that the slope between X and Y is conditional on Z (i.e., as Z changes, the slope will also change).

$$Y = a_0 + a_1 Z + a_2 Z + (a_1 + a_3 X) Z$$
(2)

The sufficient condition for a two-way interaction to be supported is that a₃ must be statistically significant. As the previous examples demonstrate however, researchers also need to evaluate if the form of the moderated relationship is consistent with their hypothesized direction. In that regard, Aiken et al. (1991) suggested researchers to further probe the form of moderation by plotting the slope between X and Y at various levels of Z (see Fig. 1). Specifically, researchers are advised to perform simple slope tests as auxiliary analyses to show if the form and the significance of the simple slope at the expected level of Z is indeed consistent with the hypothesized relationship between X and Y. The expected level of Z for the simple slope to be significant can take on a particular value or range of values² Using Fig. 1 as an example, researchers hypothesized the positive relationship between X and Y to be the strongest at high rather than low Z. For such hypothesis to be supported researchers will need to show if the simple slope at high Z is indeed statistically significant.

² While Aiken and West's (Aiken et al., 1991) simple slope (or pick-a-point) method is rather popular, some have criticized their choice of high and low Z based on +1 and -1 s.d. to be arbitrary (e.g., Dawson & Richter, 2006). To avoid such potential limitation, we suggest readers to consider the characteristics of Z in evaluating the significance of simple slope. When Z is dichotomous or categorical (e.g., gender), researchers can still use the pick-a-point approach to analyze whether the simple slope is significant at a particular point of Z (e.g., female). If Z is continuous, however (e.g., income), readers can adopt the Johnson-Neyman technique to evaluate the range of the value of Z in which the simple slopes are significant and whether the region of significance is consistent with researchers' expectation (see Bauer & Curran, 2005 for explanation of the Johnson-Neyman technique and Lam, Xu, & Loi, 2018 for a recent application of such technique).



Fig. 1. A sample plot of two-way interaction. *Note.* For illustrative purpose, the simple slope between X and Y is expected to be more positive at high Z

A typology of three-way interaction models

In two-way interactions, researchers only need to consider one moderator. In three-way interactions, researchers will need to explain how two moderators jointly affect the relationship between X and Y. There are a number of possibilities for how two moderators can operate in such manner. To assist researchers in conceptualizing three-way interactions in their studies, we develop a typology of three-way interaction models (Fig. 2).

Type I. Joint Moderating Effects



Type II. Moderated Moderating Effects



Type III. Moderated Joint Effects



Fig. 2. A typology of three-way interaction models

In Type I (joint moderating effects), in addition to moderator Z, researchers propose another moderator W that will also moderate the relationship between X and Y. In Type II (moderated moderating effects), the moderating impact of Z is conditional on another moderator W. In other words, in a certain condition (e.g., high W), researchers expect Z to moderate the relationship between X and Y, whereas in another condition (e.g., low W), researchers expect Z either not to moderate or moderate to a lesser extent. In Type III (moderated joint effects), researchers are interested primarily in the joint effect of two independent variables X and Z (i.e., the two-way interaction term of X*Z). Researchers further ponder the joint effect to be conditional on W; that is, W is expected to moderate the joint impact of X and Z on Y. While strictly speaking, there is only one moderator in Type III, as we will show later, the analytical procedures involved in Type III are almost indistinguishable from those of Types I and II.

Type I. Joint moderating effects

In arguing why two different variables jointly moderate the relationship between X and Y, researchers usually first propose why variable Z will moderate, and then why variable W will also do so. After that, researchers will advance the arguments of why the relationship between X and Y to be the strongest under certain values of Z and W (for example, Z is high and W is high; see Fig. 3).



Fig. 3. A sample plot of Type I (joint moderating effects) three-way interaction model. *Note*. For illustrative purpose, the simple slope between X and Y is expected to be the most positive at high Z and high W

For example, in a study involving the relationship between emotional exhaustion and employees' unsafe behavior, Ju et al. (2016) first suggested that such relationship is more positive under high unsafe behavior norms (moderator Z) as emotionally drained employees are expected to take more short-cuts without worrying punishment by fellow teammates. In addition, personal control (moderator W) is also suggested to accentuate the relationship between emotional exhaustion and unsafe behavior because individuals of high personal control consider themselves to have much discretion at work. Finally, since context (i.e., unsafe behavior norms) often interacts with disposition (i.e., personal control), the authors proposed a three-way moderation hypothesis to argue why the hypothesized relationship is expected to be the strongest under high unsafe group norm and high personal control.

The analyses of three-way interaction models involve the following regression model:

$$Y = a_0 + a_1 X + a_2 Z + a_3 W + a_4 X * Z + a_5 X * W + a_6 Z * W + a_7 X * Z * W$$
(3)

Similar to two-way interaction models, Eq. 3 can be rewritten to illustrate that the relationship between X and Y is conditional on Z and W.

$$Y = a_0 + a_2 Z + a_3 W + a_3 Z * W + (a_1 + a_4 Z + a_5 W + a_7 Z * W)X$$
(4)

To test whether the joint moderating effect of Z and W is supported and whether the form of relationship between X and Y is consistent with the hypotheses, researchers need to obtain empirical evidence of the following three conditions. First, similar to testing of two-way interaction, the sufficient condition for three-way interaction to be supported is that a₇ must be statistically significant. Second, researchers need to show significance of the simple slope in which they expect the relationship to be the most positive (or negative) (e.g., high Z and high W in Fig. 3). Third, there needs to be statistical differences between the simple slope in which the hypothesized relationship is expected to the strongest and the other three simple slopes in which the relationships are expected to be weaker (e.g., high Z and high W versus high Z and low W, low Z and high W, and low Z and low W). The procedures of conducting statistical tests involving simple slopes and the simple slope difference are available in Dawson and Richter (2006).³

In Ju et al.'s (2016) study, in addition to meeting the first two conditions, the authors conducted simple slope difference tests based on Dawson and Richter's (2006) procedures. Their analyses show that at the hypothesized levels of Z and W, the simple slope (i.e., high-high on unsafe behavior norm and personal control) was indeed statistically different from the other three situations (i.e., high-low, low-high, and low-low).

Type II. Moderated moderating effects

One predominant reason to conduct moderation analyses is to find out the boundary condition (i.e., Z) in which the relationship between X and Y is expected to happen. Yet, researchers may be interested in knowing if there is another boundary condition W to the original boundary condition Z in which the relationship between X and Y is expected to happen. In other words, the moderating effect of Z is conditional on another moderator W so that Z will moderate the relationship between X and Y at certain values of W.

For instance, Ju and Zhao (2009) suggested industry competition moderated the impact of organizational slack on performance. The authors further proposed ownership type to be an important boundary condition. Since privately-owned firms are more sensitive to competition compared with state-owned and foreign-invested firms, the proposed moderating effect of industry competition will be subject to firms' ownership types.

³ The statistical procedures in probing significance of three-way interactions in Dawson and Richter (2006) and in this paper are based on the ordinary least square (OLS) method. For interpretation and analyses of interaction terms in non-OLS regression such as logistic regression, please refer to Hoetker (2007). We thank the reviewer for making this suggestion.

In another study, Li et al. (2015) were interested in knowing whether the relationship between empowering leadership and followers' role-breadth self-efficacy will depend on the extent to which empowering leadership is differentiated (i.e., boundary condition Z). Since individuals are less sensitive to differential treatment if they have strong respect for authority, the researchers further proposed power distance to be the boundary condition W for the hypothesized moderating effect of empowering leadership differentiation to take place. In this case, the latter moderator (W) is not expected to influence the relationship between X (empowering leadership) and Y (role-breadth self-efficacy). Rather it determines when the original moderator (Z) will have the expected impact altering the strength or the form of relationship between X and Y.

The regression model involved in the analysis of Type II is similar to that of Type I three-way interaction models (i.e., Eq. 3). For a three-way moderation to hold, showing coefficient a₇ to be significant is sufficient. However, since the conceptualization of Type II differs from Type I, researchers need to consider a somewhat different set of *post-hoc* procedures to demonstrate the form of the interaction. To begin, researchers are advised to plot a figure similar to Fig. 4.



Fig. 4. A sample plot of Type II (moderated moderating effects) three-way interaction model. *Note.* d1 and d2 represent the simple slope difference at high and low W respectively. For illustrative purpose, the moderating effect of Z is expected to take place at high rather than low W, and Z is hypothesized to moderate the relationship between X and Y so that the relationship is more positive at *low* rather than *high* Z

In Type II models, researchers expect a moderating effect to be moderated by another variable. In Fig. 4, for example, researchers expect Z to be the boundary condition when the relationship between X and Y takes place. Researchers further expect the moderating effect of Z to be more pronounced at certain levels of W (for illustrative purpose, at high W, the relationship between X and Y is hypothesized to be more positive at low rather than high Z). Such hypothesis will be supported if researchers are able to obtain empirical evidence to satisfy the following three conditions. First, the three-way interaction term (i.e., a_7 in Eq. 3) is statistically significant. Second, since researchers expect moderation of Z to take place only at high W, the simple slopes at low and high Z must be statistically different (i.e., d1 is significant; Dawson & Richter, 2006). Third, after confirming the moderating effect of Z to take place at high W, researchers also need to check if the form of moderation is consistent with their hypotheses. Thus, they need to obtain empirical evidence that in the case of high W, the simple slope at low Z is also statistically significant. Because the statistical significance of a_7 already implies that the moderating effect of Z is more pronounced at high rather than low W, the interaction in low W can take any form. On the one hand, researchers may find no difference between the two slopes. On the other hand, researchers may also find statistically significant difference between the two slopes (i.e., d2 is significant). Meier, Semmer, Elfering, and Jacobshagen's (2008) study is a good example of how the Type II model of three-way interaction is conceptualized and analyzed. According to the classic Karasek (1979) model, the negative impact of job demand (X) on well-being (Y) can be buffered by the moderator of job control (Z). Yet the empirical results have been rather inconsistent in the literature. These authors thus proposed self-efficacy belief (W) to be an important boundary condition so that only individuals of high rather than low self-efficacy can take advantage of high job control in coping with job demand. Specifically, they proposed that under high self-efficacy, job control can buffer the negative impact of job demand on well-being, whereas under low self-efficacy, job control has no such effect. In supporting their hypotheses, Meier et al. (2008) found a significant three-way interaction. As expected, under high selfefficacy beliefs, job demands were found to be significantly related to affective strain only under conditions of low job control. The authors also conducted simple slope difference tests that were consistent with the Type II model of three-way interactions. That is, at high self-efficacy, there was evidence that the relationship between job demand and affective strain under low job control was indeed statistically different from the one under high job control.

Type III. Moderated joint effects

In this model, researchers are interested in knowing the joint effects of two variables (i.e., X^*Z) on the outcome (Y). Joint effects can be either enhancing or substituting. Figure 5 is an example of these two types of joint effects. In Fig. 5, to illustrate, researchers can propose that under enhancing joint effects, the positive relationship between X and Y is expected to be the strongest when Z is high, whereas for substituting joint effects, the relationship between X and Y is expected to be positive when Z is low but negative when Z is high.⁴



Fig. 5. A sample plot of joint effects. *Note.* For illustrative purpose, for substituting effect, the relationship between X and Y is positive under low Z but negative under high Z, whereas for enhancing effect, the relationship between X and Y is more positive under high rather than low Z

⁴ As X and Z are two independent variables, they are interchangeable so that one can also state the relationship between Z and Y to be the strongest when X is high/low. Figure 5 is an illustration of how to plot joint effects in two-dimensional diagrams (see Den Hartog & Belschak, 2012 for example). An alternative is to plot joint effects of X and Z on Y on a three-dimensional space.

Enhancing effects take place when two activities complement each other so that performing one activity will reinforce and enhance the value of performing another activity (Ennen & Richter, 2010). For example, in the domain of innovation, one asset (e.g., marketing know-how) may enhance the value of another asset (e.g., technological capability) so that researchers can propose enhancing joint effects between two complementary assets (Teece, 1986). Substituting effects take a different form. They take place while only one of the two activities is needed and not both. Some organizational behavior researchers have argued that situational factors such as organizational structure can substitute for leadership so that in order for employees to perform well, one only needs to have either good structure or leadership but not both (Kerr & Jermier, 1978; see Podsakoff, MacKenzie, & Bommer, 1996 for summary). This will be an example of substituting joint effects. In the event that the hypothesized joint effects have not received consistent support, researchers can further explore the boundary condition (i.e., W) in which the joint impact of X and Z on Y is most likely to take place. For instance, researchers can propose the context under which asset complementarities are more likely to happen (e.g., marketing and technological capability are more likely to have enhancing joint effects during particular phases of innovation). For another example, researchers may argue that the substituting effect between structure and leadership will only take place under certain organizational characteristics.

To determine whether the Type III model has received empirical support, researchers need to run the same regression equation as they will use for Type I and Type II models (i.e., Eq. 3), and obtain empirical evidence meeting the following three conditions. First, similar to the other two types, a significant a₇ in Eq. 3 is enough for a three-way interaction to be supported. Second, to demonstrate significant enhancing and substituting joint effects, the simple slopes at low and high Z must be statistically different in both conditions of W. Third, to demonstrate the specific form of the three-way interaction, researchers need to establish the following simple slope significance depending on whether the hypothesized joint effect is substituting or enhancing. To demonstrate a substituting joint effect, using Fig. 5 for illustration, both the simple slopes at high Z and low Z need to be statistically significant at the hypothesized condition of W (i.e., high or low). For an enhancing joint effect, only the simple slope at high Z needs to be statistically significant.

It is possible that the proposed joint effect can be both enhancing and substituting, depending on the level of boundary condition (i.e., high or low W). For instance, Den Hartog and Belschak (2012) hypothesized transformation leadership (X) and role-breath self-efficacy (Z) to have a joint effect on employee proactivity (Y). They further suggested that the joint effect be negative (i.e., substituting) under low job autonomy (W) but positive (i.e., enhancing) under high job autonomy. Specifically, under low W, the relationship between X and Y is expected to be positive when Z is low but negative when Z is high (see left hand side of Fig. 5). Whereas under high (see right hand side of Fig. 5). Following the conditions to demonstrate Type III, in addition to the significant three-way interaction terms, researchers need to demonstrate whether the two simple slopes (i.e., high and low Z) are indeed statistically different under both the substituting effect the two slopes under high and low Z are also statistically significant, whereas under

enhancing effect, the simple slope at the expected level of Z (high in the case of Fig. 5) is also statistically significant. Doing so is to show that the specific form of moderation is indeed consistent with researchers' hypotheses.



Fig. 6. Decision tree for determining the three-way interaction model

Choosing among the three-way interaction models

Figure 6 provides a decision tree to assist researchers in deciding which of the three-interaction models they can use in framing their research questions. First, researchers need to know whether

the focal relationship involves the impact of one independent variable (X) or interaction of two independent variables (X and Z) on the outcome variable (Y). If the question is about interaction of two independent variables (e.g., leadership and structure), researchers can consider the Type III model. Second, researchers need to know if they will propose a conditional moderating effect: that is, the moderating effect of Z will depend on another moderator W. If the answer is yes, they can use the Type II model to frame their question. If the answer is no, researchers are advised to use the Type I model to explain why each moderator will separately moderate the relationship between X and Y before considering the joint moderating effect of Z and W. As discussed previously, researchers need to obtain sufficient empirical evidence in order to claim support of their proposed three-way interaction model. Under each model, we have outlined the three conditions for researchers to examine in their *post-hoc* analyses.

To facilitate researchers to better use each of the three-way interaction models, we have also summarized three sets of procedures to probe and to analyze different three-way interaction models (see the bottom of Fig. 6). Once researchers have chosen a particular three-way interaction model, they can follow these procedures for model building, hypotheses development, and *post-hoc* analyses.

Potential research involving three-way interactions

In order to stimulate more Asian management research using three-way interactions, we provide several future research examples in this section to demonstrate how three-way interaction models can be applied.

We believe one of greatest future potentials is to use three-way interactions to understand the role of context in Asian management research. To understand whether and how Asian management matters, many scholars have previously urged to examine the boundary conditions of existing research findings based on the Asian context. For instance, after comparing leadership research conducted in Asia and Western countries, Liden (2012) recommended that future research should model unique characteristics of Asia as contextual moderators rather than as the basis of a new leadership style. In the area of justice, Leung (2005) has also called for an adoption of cultural perspective as the effects of justice are not necessarily generalizable across cultures. For example, in making fair allocation, it is conceivable that some cultures prefer the rule of equity while others prefer the rule of needs. In particular, he pointed out that individualism-collectivism and power distance are the two distinct cultural pillars in enhancing our understanding of justice. Interestingly, Leung's (2005) summary of the justice literature showed that a great majority of cross-cultural studies examined either individualism-collectivism or power distance but not both. Based on the Type I three-way interaction model, it will thus be possible to examine how these two cultural variables may jointly interact in affecting perceptions of justice across cultures (see also Leung & Stephan, 2001). Another possibility is to explore how individual characteristics interact with culture in affecting fairness evaluation. For example, using an approach very much similar to that of the Type II three-way interaction model, Tata, Fu, and Wu (2003) developed a conceptual framework of why gender will further moderate the moderating effect of culture on the justice-fairness relationship.

In addition to justice, Asian culture may also affect how organizational politics are perceived by employees. Perceived organizational politics (POP) is usually defined as the perception of others' engagement in behaviors for promotion of self-interests (Abbas, Raja, Darr, & Bouckenooghe, 2014; Rosen, Ferris, Brown, Chen, & Yan, 2014), including use of upward influence tactics, formation of coalitions, connection to high-ranking executives, back stabbing, taking credit for others' work, and so on (Chang, Rosen, & Levy, 2009; Hochwarter, Kacmar, Perrewe, & Johnson, 2003). As such, researchers consider POP to be a stressor for employees (Ferris et al., 1996; Li, Wu, Liu, Kwan, & Liu, 2014; Rosen et al., 2014), and prior research has found that resources could buffer the negative impact of POP on employee outcomes such as reduced commitment (see Chang et al., 2009). In addition to resources, others have argued that culture may be an important moderator as people from different countries react to POP differently (see Vigoda, 2001). For instance, Ralston, Giacalone, and Terpstra's (1994) study revealed significant cultural differences regarding whether certain political behaviors were acceptable among managers. Based on these two lines of research, POP researchers may consider the joint moderating effects (the Type I model) of resources and culture in their future studies. Given the inconsistent moderating role of resources in prior research of POP (Chang et al., 2009), researchers may also consider using the Type II model to examine the boundary condition of such moderating effect based on individuals' cultural orientations. For example, with Asian's emphasis on collectivism, would social support be more valued by employees in coping with the stress as a result of POP?

Another promising area of research is to examine the mechanisms of *how* three-way interactions affect the outcome variables. Mediation analysis is the standard approach to understand how X affects Y through M (mediator). The necessary condition for mediation to be established is that the indirect effect of X on Y through M is statistically significant (Zhao, Lynch, & Chen, 2010). Based on the general framework of moderated mediation (Edwards & Lambert, 2007; Preacher & Hayes, 2008), researchers are able to propose and analyze whether their hypothesized indirect effects are conditional on one moderator (e.g., Lam, Liu, & Loi, 2016; Xu, Loi, & Lam, 2015). Extending the logic of conditional indirect effects, we believe that researchers can further propose their hypothesized indirect effect to be conditional on two moderators.

Based on the logic of joint moderating effects (i.e., Type I model), for example, researchers can probe whether their proposed indirect effects will be moderated by two contextual variables. Researchers can also take advantage of the Type II model to explore whether there is boundary condition for their proposed moderated mediation to take place. In both circumstances, researchers will need to evaluate the significance of their hypothesized indirect effects at four different scenarios (i.e., high W and high Z; high W and low Z; low W and high Z; low W and low Z). Depending on whether the Type I or Type II model is involved, researchers also need to compare the statistical difference of at least two of the four conditional indirect effects (see Li et al., 2015 for an example).

As discussed before, joint effects can be specified as either enhancing or substituting. In moderated joint effects (i.e., Type III model), researchers need to specify the condition (e.g., high W) in which the hypothesized joint effect (i.e., X*Z) is more significant. Based on the logic of mediated moderation (Preacher, Rucker, & Hayes, 2007), researchers can then hypothesize the mechanism (M) of how the conditional indirect effect happens (i.e., X*Z on Y though M at

certain condition of W). While we are not aware of any empirical study using such an approach, we believe that it has the potential to offer researchers new insights of how their proposed joint effects affect outcomes (see George, Chattopadhyay, & Zhang, 2012 for an example of mediated moderation).

As mentioned in the introduction, compared with research in top-tiered management journals, the use of three-way interactions is relatively scarce in Asian management research. We suspect the low usage is perhaps due to the lack of understanding of what three-way interactions are and how such an approach can be used to answer research questions in Asian management. By developing a typology of three-way interaction models and demonstrating several possibilities of using this typology, we hope to stimulate more Asian Management research using this approach in theory and model building. Specifically, researchers should first conceptualize their research question according to the three different models and make sure that the phenomenon that they are interested in is consistent with one of the models. Then they should present their theoretical arguments about the moderation and conduct their empirical analyses accordingly.

Our proposed typology also illustrates what the appropriate *post-hoc* analytical procedures are for each of the three-way interaction models. Indeed, in our review of prior studies using threeway interactions, we have found cases in which researchers have not provided sufficient empirical evidence to support these hypotheses. For instance, in one study, researchers have argued that role overload would reduce organizational commitment, and the buffering effect of empowerment would take place under low rather than high power distance (Fisher, 2014). Yet, other than a significant three-way interaction term, the author did not provide any statistical evidence in the paper of whether the moderating effect of empowerment is indeed significant under low power distance (i.e., conditions 2 and 3 of Type II). In another circumstance, some researchers also only reported the significance of the three-way interaction term and did not provide sufficient information in supporting of their hypothesized relationships (Shalley, Gilson, & Blum, 2009). Specifically, the authors hypothesized a positive relationship between individuals' growth need strength and creativity. Based on the logic of Type I model, they further expected supportive work context and job complexity to moderate such relationship. With the significance of the three-way interaction, the authors plotted a figure very much similar to Fig. 3. Based on the figure, the authors concluded that consistent with their hypothesis, creativity was the highest at high supportive work context and high job complexity. However, we are not able to find statistical evidence in the paper to support such conclusion. In addition, if the authors' conjecture is correct, the relationship between growth need strength and creativity should also be the most significant at high supportive work context (Z) and high job complexity (W) accordingly. The study's conclusion would have been more convincing if there is empirical evidence regarding the significance of simple slopes at high Z and high W, and its statistical difference against simple slopes of the other three conditions (i.e., high Z and low W, low Z and high W, and low Z and low W). By specifying what the appropriate *post-hoc* analytical procedures are in this paper, we hope researchers will be more able to garner the needed empirical evidence in supporting their hypotheses.

To conclude, we have developed a typology of three-way interaction models in order to show that each model has different implications for model conceptualization and analytical procedures. By clarifying the crux of what three-way interaction is and how to use it, we hope the readers of the Asia Pacific Journal of Management will be inspired by our proposed typology in their research agenda.

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