The Concept of Formative Constructs and Suggested Applications in the Area of Gambling Risk Assessment:

An Annotated Bibliography

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Introduction

The most widely used instruments for measuring gambling problems and associated risk are the South Oaks Gambling Screen (SOGS), Diagnostic and Statistical Manual Version IV (DSM IV), and the nine-item Problem Gambling Severity Index (PGSI) of the Canadian Problem Gambling Index (CPGI). Each has been developed and assessed as a *reflective* construct.

Reflective constructs are based on the assumption that the underlying latent construct (e.g. problem gambling) causes the observed variation in the measure (Cote & Buckley, 1988; Nunnally 1978). That is, the construct (e.g. PGSI) assumes a latent variable exists, in this case problem gambling, and that the direction of causality is from the latent variable to the measure comprising the reflective construct (e.g. problem gambling produces the outcomes for the PGSI). While this approach is valid in relation to many constructs, it may not be the most appropriate for measuring gambling problems and associated risk. This is particularly true for measures outside of clinical or treatment populations (e.g. in the general population and for survey applications).

Almost all instruments for identifying gambling problems/risk have been assessed according to classical test theory, which assumes the construct is reflective in nature. In reality, however, such measures could be either *reflective* or *formative* in nature. In contrast to a reflective measure, a formative construct is said to cause the latent variable (e.g. endorsement of items produces a measure of gambling problems/risk). Here, the items represent different dimensions of the latent variable and the construct is therefore a summation of the observed variables with which it is associated (Bollen & Lennox, 1991; Gefen, Straub & Boudreau, 2000).

If we assume a construct is formative, the nature of the measures and how such measures can be used changes, and they can look quite different from reflective measures. A primary benefit of approaching gambling problems/risk as a formative construct may be an improvement in our ability to detect and accurately categorize at-risk and problem gamblers in the population.

The concept of formative constructs has recently gained interest in the social sciences and health literature, the most influential paper being the article by Jarvis, Mackenzie & Podsakoff (2003). These authors examined over 1146 published constructs in the literature and found that only 4% (n=46) were designed as formative measures (Jarvis et al 2003; Diamantopoulos & Winklhofer, 2001). Following evaluation of the full set of measures, they concluded that 17 of the 46 formative constructs should have been reflective. More significantly, however, 365 of all of the constructs (31%) were reflective measures that should have been formative in nature. Accordingly, a large proportion of the constructs were found to be designed incorrectly, a finding that

has major implications for the effectiveness of such constructs as useful measures (Diamantopoulos & Winklhofer, 2001; Jarvis et al 2003; Mackenzie 2003).

This finding underscores the need for research to examine the nature of the constructs and to ensure that gambling problems/risk are being appropriately measured and specified for general population use. This would entail a more detailed analysis of the construct's validity and a more rigorous assessment of its measurement properties. If these measures can be considered formative constructs there would be less reliance on estimates of internal consistency, reliability (e.g., Cronbach's alpha) and factor analysis, in order to assess validity. Reliance on these methods of assessment can lead to misspecification of the construct in that they focus on single measures whereas the actual construct may be considerably more complicated. In addition, key components of gambling risk may be missing from the constructs due to an over-reliance on classical testing theory.

Formative constructs are more inclusive in nature and, consequently, may have more construct validity. At this early juncture, we feel the final measures for improved identification of gambling problems/risk may well be a second order factor model containing both reflective and formative components. This is an area of inquiry that has not been addressed to date and may potentially contribute to development of the next generation of problem gambling instruments.

The literature reviewed in this annotated bibliography examines the concept of formative and reflective constructs. No specific timeframe was delineated; rather all research was reviewed that examined these constructs. Consequently, the years 1979-2008 are represented. The majority of articles were peer-reviewed and all were published in the English language. The twenty six reviewed articles have been published in journals covering a wide range of disciplines including *Psychological Bulletin*, *Psychological Methods*, *Journal of Marketing Research, Journal of Consumer Research, British Journal of Management, Quality of Life Research, Corporate Reputation Review, International Journal of Market Research, Journal of Academy of Marketing Science, Journal of Applied Psychology* and so on.

Some definitions (Bollen, 2007; Bollen & Ting, 2000):

Effect indicators – the most typical type of indicators that depend on the latent (or unobserved) variable. Effect indicators are also known as *reflective* indicators.

Cause or Causal indicators – ones in which the indicator affects the latent variable. Cause indicators are also known as *formative* indicators. An example

would be loss of job, divorce or birth of a child are measures of exposure to stress (the latent variable) that are best thought of as causal indicators.

Misspecification – of a model means that the equations and assumptions of a model are not a valid description of the model that generated the data.

Structurally misspecified - refers to a misspecified model in which there are omitted or unneeded paths, variables or correlations.

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Freeze, R. D., & Raschke, R. L. (2007). An assessment of formative and reflective constructs in IS research. http://is2.lse.ac.uk/asp/aspecis/20070055.pdf

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Bagozzi, R. P. (2007). On the meaning of formative measurement and how it differs from reflective measurement: Comment on Howell, Breivik, and Wilcox (2007). *Psychological Methods, 12*, 229-237.

Bagozzi comments on Howell et al's (2007) article where they recommend researchers abandon the formative measurement approach in favour of the reflective measurement model. Bagozzi agrees with Howell et al to a point but argues that the nature and interpretation of the relationship between latent and manifest variables be established first. Bagozzi posits that the relationship between the variables is not causal but rather a kind of "correspondence rule" containing various levels of meaning (e.g., empirical, operational) as part of its structure.

Bollen, K. A. (2007). Interpretational confounding is due to misspecification, not to type of indicator: Comment on Howell, Breivik, and Wilcox (2007). *Psychological Methods, 12*, 219-228.

Bollen's articles argues that each claim by Howell et al (2007) is false, and that ultimately it is the validity of a model and not the type of indicator (formative or reflective) that determines whether or not there is interpretational confounding. Regardless of whether or not reflective or

formative indicators are used by a researcher, if the model is correctly specified by the researcher no interpretational confounding need occur.

Bollen, K., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin, 110*, 305-315.

This Bollen and Lennox (1991) article discusses the possibility that some indicators may be determinant of, rather than reflections of latent variables. They argue that causal indicators (i.e., observed variables are treated as determinants rather than effects of the latent variable – aka formative modelling) results in different issues than does effects indicators (i.e., a shift in the construct leads to an expected shift in an indicator – aka reflective modelling). They also argue that causal indicators of a given independent variable does not necessarily need to be internally consistent or have high positive correlations, nor does correlations among indicators *within* a construct need to be higher than correlations *between* indicators of different constructs.

Bollen, K. A., & Ting, K. (2000). A tetrad test for causal indicators. *Psychological Methods, 5*, 3-22.

Bollen and Ting propose a formal test (the vanishing tetrad test) that will distinguish causal from effect indicators when using structural equation models. The authors illustrate the results over several empirical and simulation examples and stress this tetrad test is a technique to be used for theory testing and not for model-generation.

Bucic, T., & Gudergan, S. P. (2004). Formative versus reflective measurement implications for explaining innovation in marketing partnerships. http://Smib.vuw.ac.nz:8081/WWW/AMZMAC2004/cdsite/papers/bucic/.pdf

Bucic and Gudergan argue that the marketing literature places less emphasis on tests that assist in evaluating formative scales (a formative scale being one that exhausts the entire domain of the construct of interest). Using both formative and reflective scales, Bucic and Gudergan apply Bollen and Ting's (2000) vanishing tetrad test to evaluate formative measurement scales. Their findings illustrate some problems associated with misspecification of measurement scales and the related effects on structural model estimations.

Churchill, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research*, *15*, 64-73.

This paper by Churchill illustrates an 8 step approach for developing better measures when doing marketing research. The steps include specifying your domain of construct via a literature search; generating a sample of items; collecting the data and purifying the measure through factor analysis; collecting data again (after re-specifying domain of construct if necessary); assessing reliability and validity; and developing norms. This article is a good review of scientific methodological principles despite being authored almost 30 years ago.

Cote, J. A., & Buckley, M. R. (1988). Measurement error and theory testing in consumer research: An illustration of the importance of construct validation. *Journal of Consumer Research*, *14*, 579-582.

Cote and Buckley advocate Churchill's (1979) 8 step approach (see above) and argue that researchers should be cautious about comparing or evaluating alternative theories based upon empirical evidence unless the validity of the measure used has been determined. The authors caution that the stronger the true correlation between constructs, the more those observed correlations underestimate the true relationship between variables. Conversely, the weaker the true correlation between constructs, the more the observed correlations will overestimate the true relationship between variables.

Diamantopoulos, A., Riefler, P. and Roth, K. P., (2008) 'Advancing formative measurement models,' Journal of Business Research, in press.

This is the lead article in a special Journal of Business Research issue dealing with formative constructs. The paper starts with a brief conceptual discussion of formative and reflective measurement models after which it outlines the potential consequences of measurement model misspecification and then provides a review of the formative measurement literature. Formative constructs in the literature are relatively rare, first because a substantial number of researchers are still unaware of the appropriateness of formative indicators for operationalizing particular constructs, and those who do use them are uncertain how to incorporate them in structural equation modeling. The reflective measurement model has a long tradition in research and is well understood by researchers. The formative measurement model was first proposed in 1962 but its use has been sporadic since. The characteristics of first order formative models are well defined. However, the constructs are often conceptualized and then operationalized as multidimensional entities. This means they are used to form higher order formative models.

The paper then discusses the issues surrounding the development of four types of multidimensional constructs in a typology proposed by Jarvis et al

(2003). It then covers the need for measurement model specification when forming scale constructs. That is, many use the approach outlined by Churchill (1979) to develop their constructs when in fact this is inappropriate when the construct is formative in nature. Concrete guidelines for the construction of formative indices have been proposed by several authors since 2001. The percentage of inappropriately specified constructs found ranges from 35% up to 80% depending on the area of research. Other problems identified include poor parameter estimation due to reversed causality, parameter bias due to incorrect item purification (i.e., items discarded due to low factor loadings), and the fact that goodness of fit statistics fail to identify misspecification of the measurement model.

The article then reviews the current state of the art, identifying issues and proposing remedies for dealing with error free measures, correct interpretation of the error term, and estimation of formative models. In the later case the authors discuss how to handle multicollinearity, exogenous variable intercorrelations and model identification. A key issue is the use of two reflective constructs required for proper model identification if a covariance-based (as opposed to a components based or PLS) SEM analysis approach to modeling is used.. They finish with a discussion surrounding the assessment of the reliability and validity of formative models. While recognizing the high number of contentious issues surrounding the use of formative constructs they feel that formative constructs are indeed a viable and desirable alternative to reflective measures in many cases.

Diamantopoulos, A., & Siguaw, J. A. (2006). Formative versus reflective indicators in organization measure development: A comparison and empirical illustration. *British Journal of Management, 17*, 263-282.

Extending previous work by Bollen and Lennox (1991), Diamantopoulos and Siguaw argue that formative rather than reflective measures may better inform organization theory. By tracing the practical implications of using a formative versus reflective perspective when developing a measure, Diamantopoulos and Siguaw look at whether conventional scale development procedures (reflective) and index construction approaches (formative) leads to materially different multi-item measures in terms of content, parsimony and criterion validity. Their study also looks empirically at the consequences of following a reflective measurement perspective when a formative perspective should have been followed. The authors make sure to stress that a formative perspective is not superior to a reflective perspectives or vice versa, but that organizational researchers

need to consider the applicability of formative measurement before developing multi-item measures for their construct of interest.

Diamantopoulos, A., & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of Marketing Research, 38*, 269-277.

This article was written by Diamantopoulos and Winklhofer to provide insight on the nature of formative (cause or causal) indicators so that researchers can choose the appropriate measurement models, as well as provide guidelines on constructing formative, multi-item measures and indexes.

Edwards, J. R., & Bagozzi, R. P. (2000). On the nature and direction of relationships between constructs and measures. *Psychological Methods, 5*, 155-174.

The authors begin by addressing the key issues underlying the definitions of constructs and measures. They go on to develop criteria for determining the direction of the relationship between a measure and a construct, and derive models by which a construct and measure can relate. Ultimately Edward and Bagozzi come up with guidelines that specify this relationship between construct and measures in terms of (a) direction; and (b) structure (i.e., is the relationship direct, indirect, unanalyzed or spurious), using examples from psychological, sociological and organizational research. Finally, the article concludes with recommendations for theory development, noting that auxiliary theories (one which bridges the gap between abstract constructs and measurable empirical phenomena) and substantive theories should be developed jointly.

Fayers, P. M., & Hand, D. J. (1997). Factor analysis, causal indicators and quality of life. *Quality of Life Research, 6*, 139-150.

Fayer and Hand's thesis is that when it comes to doing Quality of Life research Exploratory Factor Analysis (EFA) - one of the most common methods used to demonstrate the construct validity of a measure - is irrelevant as a method of validation for measures that contain causal indicators, and in fact EFA should only be used with scale items that are effect indicators. They conclude that in the area of quality of life research, construct validation of measures should rely less on EFA and more on patient debriefing questionnaires and consensus interviews with psychologists and clinicians.

Fayers, P. M., Hand, D. J., Bjordal, K., & Groenvold, M. (1997). Causal indicators in quality of life research. *Quality of Life Research, 6*, 393-406.

As a companion piece to Fayers and Hand's (1997) article in the same journal issue, this study looks at both effect and causal indicators as they relate to quality of life research. They argue that effect indicators and causal indicators have fundamentally different relationships with regards to quality of life. In the paper they use a model to look at how both indicators behave in very different ways, and how the results impact instrument validation and the design and analysis of subscales. The authors include a discussion of the implications for scale reliability and construction and scoring methods. They conclude that many items used in quality of life measures would be causal (not effect) indicators and that while effect indicators can lead to homogenous summary scales with high reliability, causal indicators should be treated with greater caution.

Freeze, R. D., & Raschke, R. L. (2007). An assessment of formative and reflective constructs in IS research. http://is2.lse.ac.uk/asp/aspecis/20070055.pdf

Freeze and Raschke review the Information Systems (IS) research and discuss three issues in relation to measurement models: Misspecification, identification and construct validation. They lay out guidelines for researchers each of the three areas. Misspecification: clearly define the construct and the contextual domain of the construct; do not assume that all constructs are reflective; and ensure that the construct the researcher is using is clearly defined as either reflective or formative. Identification: when using reflective models, carefully consider the number of indicators; with formative indicators, emphasis must be placed on at least two emitting paths for each formative construct. Validation: For reflective models use classical test theory to validate the construct; for formative models use nomological validity methods; assess multi-collinearity issues. They conclude that researchers must understand the difference between formative and reflective constructs and their respective methods of identification and validation.

Helm, S. (2005). Designing a formative measure for corporate reputation. *Corporate Reputation Review, 8*, 95-109.

Helm conceptualizes corporate reputation as a formative construct with ten indicators: Quality of products; commitment to protecting the environment; corporate success; treatment of employees; customer satisfaction; commitment to charitable and social issues; value for money of products; financial performance; qualification of management; and credibility of advertising claims. Her study contributes to a better knowledge of

formative versus reflective conceptualization of reputation and demonstrates how to develop a formative measure of corporate reputation.

Howell, R. D., Breivik, E., & Wilcox, J. B. (2007). Is formative measurement really measurement? Reply to Bollen (2007) and Bagozzi (2007). *Psychological Methods, 112*, 238-245.

In this article, Howell et al suggest a return to the more conventional wisdom that researchers should measure their constructs reflectively with as many strongly correlated indicators that are unidimensional for the same construct. They examine the evidence for using formative measurement, but ask the important question "given the choice between developing a formative or reflective measure or between an existing formative or reflective measure, which should be preferred?" Contrary to most of the current research, they conclude that formative measurement is not an equally attractive alternative to reflective measurement, that reflective measurement should be chosen when researchers are developing new measures or choosing existing ones, and that in a case where reflective measurement is not possible formative indicators should be modeled as separate constructs.

Howell, R. D., Breivik, E., & Wilcox, J. B. (2007). Reconsidering formative measurement. *Psychological Methods, 12*, 205-218.

This paper critiques formative measurement and advocates that wherever possible, researchers should use reflective measurement. Their argument is based on four claims purporting that causal (formative) indicators lead to the empirical meaning of the latent (independent) variable to be other than what it was assigned to be by its researcher – something Howell et al call interpretational confounding. Their critique is built on the following four claims: (1) a latent variable exists apart from the model when there are reflective indicators but not when there are formative indicators; (2) formative indicators do not need to have the same consequences as reflective indicators; (3) formative indicators are inherently subject to interpretational confounding; and (4) researchers cannot detect interpretational confounding when formative indicators are used.

Jarvis, C. B., MacKenzie, S. B., & Podsakoff, P. M. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research, 30*, 199-218.

Jarvis et al begin their article with a review of the distinctions between reflective and formative measurement models. Next they review articles from four of the top marketing journals to determine the extent of

measurement misspecification for each construct represented. They then examine the extent to which misspecification biases estimates of the relationships between constructs, and provide recommendations and procedures for correctly modeling formative indicator constructs. With regards to misspecification, they found that 28% of the latent constructs with multiple indicators were incorrectly specified as reflective when they should have been formative. They conclude that researchers should think carefully about measurement model relationships and make sure the model used matches the conceptualization.

Kalafatis, S. P., & Sarpong, S. (2005). An examination of the stability of operationalisations of multi-item marketing scales. *International Journal of Market Research, 47*, 255-266.

Kalafatis and Sarpong's study undertakes to investigate the impact that adopting different scales has on the structural relationship of latent variables. The authors stress that continuous theoretical, conceptual and contextual developments in the marketing field need to be reflected in the use and application of scales, and that the development of multi-item scales is an ongoing process that needs to be carefully examined and replicated.

MacCallum, R. C. & Browne, M. W. (1993). The use of causal indicators in covariance structure models: Some practical issues. *Psychological Bulletin, 114*, 533-541.

The thesis of this article is to argue that researchers, when formulating models, consider whether indicators are causal or effective and thus construct the model accordingly. Issues that MacCallum and Browne discuss when using models with causal indicators include: (1) when causal indicators are used, one approach to model specification can result in implied covariance of zero among some variables; (2) identification problems arise only for composite variables that emit one path; and (3) composite variables that emit only one path can be eliminated from a model. They conclude that all these problems can be addressed, although it may involve changing the original model in terms of its meaning or simplicity, or both.

MacKenzie, S. B. (2003). The dangers of poor construct conceptualization. *Journal of the Academy of Marketing Science, 31*, 323-326.

In his brief but eloquent paper MacKenzie deals with the failure on the part of many researchers to adequately specify the conceptual meaning of a study's main constructs. MacKenzie argues that because researchers never fully realize the focal construct(s), it becomes difficult to develop

measures to represent its domain, and to correctly specify how the construct should relate to its measures. These errors in turn affect all issues of validity (he describes four in his paper: construct, statistical conclusion, internal and external validity). He puts forward four recommendations to address these errors of construct conceptualization: (1) carefully define your construct of interest; (2) develop measures that adequately represent the construct(s); (3) think carefully about the relationship between the construct and the measures; and (4) insist on the conceptually appropriate measurement model for your construct domain.

Mackenzie, S. B., Podsakoff, P. M., & Jarvis, C. B. (2005). The problem of measurement model misspecification in behavioural and organizational research and some recommended solutions. *Journal of Applied Psychology, 90*, 710-730.

Similar to Jarvis et al (2003; see above) Mackenzie and his co-authors begin their article with a review of the distinctions between reflective and formative measurement models. Next they set out criteria for determining whether measures are formative or reflective and set out guidelines for developing, evaluating and validating constructs with formative indicators. They empirically test the effects of measurement model misspecification and recommend new scale development procedures for latent constructs with formative indicators. The authors' empirical test indicates that measurement model misspecification can inflate unstandardized structural parameter estimates by as much as 400%, or deflate them by as much as 80%, depending on which latent construct (exogenous or endogenous) is misspecified. Mackenzie et al also discuss Type I or Type II errors of inferences and conclude that some empirical findings in the literature could be misleading due to incorrect model measurement relationships.

Petter, S., Straub, D., & Rai, A., (2007) Specifying formative constructs in information systems research. MIS Quarterly 31, 4, 623-656.

This article provides an excellent overview of issues surrounding the use of reflective versus formative constructs, highlighting the option of creating multidimensional constructs as well as second order models to overcome some of the problem associated with the use of formative constructs. The authors examine 39 articles in the MIS literature and find that in 30% of the cases the constructs were miss-specified as reflective when they should have been formative. They provide excellent examples of reflective, formative and mixed constructs in order to illustrate how they are different. An important contribution is their discussion of the limitations imposed by the analysis approach. Traditional covariance-based SEM (i.e., using

LISREL) imposes several restrictions on the use of formative constructs while the use of components-based SEM (i.e., Partial Least Squares Path Analysis) has fewer restrictions on the use of the formative constructs and leads to easier interpretation and assessment of the resulting model. The paper includes a table outlining the step by step process for developing and testing formative constructs.

Rodgers, W., & Guiral-Contreras, A. (2007). Partial least squares and the use of formative and reflective indicators in complex constructs: An opportunity for accounting researchers. http://www.licom.pt/eaa2007/papers/EAA2007_0169_final.pdf

This lengthy article looks at complex constructs that use formative indicator measurement models in the accounting field. The authors, from an accounting field perspective, look at the use and implications of reflective versus formative constructs, and how the modelling approach of Partial Least Squares (PLS) is the most flexible data analysis technique that can help researchers specify both reflective and formative relationships. Using examples from the accounting field, the paper describes the concepts of both reflective and formative indicators, and reports results from an empirical example comparing PLS modeling (both formative and reflective) with Maximum Likelihood technique (only reflective). They conclude that the PLS technique has the benefit of integrating formative and reflective factors, but should be used primarily for predictive-causal analysis in situations of high complexity, but low theoretical information. When the research is focused mainly on measure development and theory testing, then Maximum Likelihood or generalized Least Squares techniques are preferable.

Strong, D. R., Breen, R. B. & Lejuez, C. W. (2003). Using item response theory to examine gambling attitudes and beliefs. *Personality and Individual Differences, 36*, 1515-1529.

Contrary to current popular reflective gambling assessment measures like the SOGS (Lesieur & Blume, 1987) which focus on experienced consequences to gambling involvement and the classification of individuals as non-pathological or pathological, the Gambling Attitudes and Beliefs Survey (GABS) may tap an underlying vulnerability to gambling problems (i.e., the attitudes and beliefs that may accompany gambling activity). The GABS is a formative measure, designed to assess a latent affinity for gambling. Item Response Theory (IRT) methods allow researchers to examine how the probability of choosing each option for each GAB items varies in relation to individual levels of affinity for gambling. This study

explores whether or not the items on the GABS measure can discriminate among people across a range of gambling affinity. To evaluate the properties of the 35 item GABS, Strong et al used a sample of pathological gamblers seeking treatment as well as a sample of college students with a range of social gambling behaviours. Analysis of the GABS items showed an ability to effectively discriminate individual levels of gambling affinity across both the PG sample and the student (Non-PG) sample. The assessment of gambling affinity can have beneficial intervention and treatment possibilities when looking at people with an underlying vulnerability to become pathological gamblers, but who currently do not meet criteria as a pathological gambler.

Wilcox, James B., Howell Roy D., Breivik Einar. 'Questions about formative measurement', J Bus Res (2008), in press.

The authors of this article have been the primary voices against the use of formative constructs over the last several years so it is fitting that they author the second article in this special issue on formative constructs. They start their discussion stating that the overarching issue addressed by this research is "Does formative measurement allow researchers to use the same "off-the-shelf" measure in different contexts to test different theories?" The context of their discussion therefore is theory development and assumes the goal is to create constructs that are independent of the context in which they are used. This then imposes several restrictions on the nature of the constructs so that they would meet these criteria. They point out that models based on formative constructs may not meet these criteria. If one is not "developing measures that will be used by others to utilize in different contexts" then many of their criticisms do not apply.

The paper poses a list of questions and answers regarding the use of formative measurement and conclude that their use remains problematic in theory testing research. They first address the issue of whether a researcher can tell if a construct is formative or reflective by addressing three questions, "Are constructs inherently formative or reflective?", "Do the observables inform the decision of which to use?", and "Do the relationships among the observables inform the decision?". They next address the issue of the impact of formative measures in structural equation models. They address five questions: "Does the meaning of a formatively measured construct depend on the dependent variable(s) or construct(s) included in the model?", "What is the error term associated with formatively measured constructs?", "Should a structural equation model with one or more formatively measured constructs be expected to exhibit adequate model fit?", "Are (formative) causes of constructs necessary for their definition and measurement?", and "Why develop formative

measures?". In each case they raise points that suggest that the use of formative measures could be problematic and that caution is advised until the theory surrounding the use of these measures is improved. They conclude however by stating that "Given the intuitive appeal and potential practical benefits of formative measurement, researchers may benefit from such efforts." to develop conceptualizations and procedures that overcome the problems raised in this article.