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Abstract

This article is a response to the March, 2013, special issue of the AMS Review, which was purportedly about "scientific progress in marketing" but in fact was about measurement in marketing. Even narrower than that, the special issue was about "formative measurement" in marketing. The present article contends that the problems raised by the special issue's authors were solved earlier by Rossiter's C-OAR-SE measurement theory. Four key references on C-OAR-SE theory (Rossiter in Int J Res Mark 19(4):305-335, 2002; Bergkvist and Rossiter in J Mark Res 44(2):175-184, 2007; Rossiter's 2011a book; Rossiter in Eur J Market 45(11/12):1589-1600, 2011b) are revisited to explain how continued ignorance of C-OAR-SE principles has stifled progress in measurement in all the social sciences.

Keywords

measurement, theory, scientific, progress

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Scientific progress in measurement theory?

Abstract This article is a response to the March, 2013, special issue of the *AMS Review*, which was purportedly about "scientific progress in marketing" but in fact was about *measurement* in marketing. Even narrower than that, the special issue was about "formative measurement" in marketing. The present article contends that the problems raised by the special issue's authors were solved earlier by Rossiter's C-OAR-SE measurement theory. The main references on C-OAR-SE theory (Rossiter 2002; Bergkvist & Rossiter 2007; Rossiter 2011a; Rossiter 2011b) are revisited to explain how continued ignorance of C-OAR-SE principles has stifled progress in measurement in all the social sciences.

Keywords Measurement theory · C-OAR-SE approach · Psychometrics approach · Formative vs. reflective debate

Introduction

The March 2013 issue of *AMS Review* was supposed to be about "scientific progress in marketing," the title of the issue's Editorial written by Crittenden and Peterson (pp. 1-2). The articles, however, which amount to a special issue, were actually about *social science measurement theory*. This is a topic on which the present author literally "wrote the book" (see Rossiter 2011a). The articles focused on the hackneyed topic of "formative" versus "reflective" measures. The lead article on formative vs. reflective measurement was written by Lee, Cadogan, and Chamberlain (2013) and the three following articles consisted of commentaries by established psychometricians (Howell 2013; Rigdon 2013; and Diamantopoulos 2013). As many readers might be aware, the present author has proposed an "anti-psychometrics" approach to measurement that argues for *expert-assessed content validity* as the only requirement for the design and use of a measure. This theory and its associated measure-design procedure – acronymed C-OAR-SE for the six steps involved, which are Construct definition, Object classification, Attribute classification, Rater identification, Scale formation, and Enumeration and reporting – has often been dismissed as being only about "content analysis" or about doing thorough "content checks," which almost every measure designer claims to have done for his or her measure.

But content validity is far more than this, as explained in my very first publication on C-OAR-SE (Rossiter 2002). In future publications, content validity in the C-OAR-SE sense will hereafter be described as *construct-to-measure validity*, or CtM validity, to emphasize the fact that the content of the measure (item or items and answer options) must demonstrate very high semantic correspondence with the content of the researcher's *construct definition* (a definition that must specify the object, attribute, and rater entity in the construct). The semantics of the measure, in its item or items and its answer options, must make sense to the *rater entity* defined in the construct. The relevant rater entity to whom items and answer

options must make sense is the least-educated raters in the case of *perceptual* constructs and the individual expert in the case of *psychological* constructs (a distinction newly introduced in the updated version of C-OAR-SE theory; see Rossiter 2011a). Perceptual constructs are the type most used in the social sciences and their measures must be content-checked, before use, by the method of cognitive interviewing (see Rossiter 2002, pp. 320-321). In no way is C-OAR-SE an arbitrary "researcher's opinion" procedure as some critics have alleged.

There are four "key" references in C-OAR-SE theory: first, Rossiter (*IJRM*, 2002), an article cited 960 times according to Google Scholar as of March 2013, the date of the special issue, and which in 2012 was acknowledged by receiving *IJRM*'s Steenkamp Long-Term Impact Award; second, Bergkvist and Rossiter (*JMR*, 2007), cited 506 times, and runner-up in 2012 for that journal's O'Dell Award for 5-Year Impact; third, Rossiter (2011a), the C-OAR-SE book available from the publisher of *AMS Review*, Springer, as an e-book and a hard-cover book; and fourth, Rossiter (*EJM*, 2011b), an article invited by Nick Lee (the lead author of the main article in the *AMS Review* special issue) to which he gave the credit of being the Outstanding Paper in *EJM* of that year, and to which several of the special issue's authors – Lee, Cadogan, Howell, and Rigdon – co-signed a rejoinder to in the same issue of that journal. I cannot understand why the special issue's authors referred to C-OAR-SE theory only superficially, if at all. Lee et al. cited the Rossiter 2002 and 2011b articles but not the 2011a book; Howell cited none of them; Rigdon cited the 2002 article and was the only author to cite the 2011a book; and another author, Diamantopoulos, cited just one of them, the original 2002 article on C-OAR-SE. Worse, none of the authors acknowledged any of the C-OAR-SE principles despite using some of them, unattributed, in their articles.

The original C-OAR-SE article (Rossiter 2002) had actually *solved* all the issues raised by the special-issue authors about "formative measurement." In that article, I talked about abstract formed *objects* (pp. 312-313), abstract formed *attributes* (pp. 314-315), *index*

formation from the main components of the object and attribute rather than from a "domain sample" of components (p. 315), and the use of *weights* on the components only if the construct definition pre-specifies them (p. 325). I concluded the section on formed attributes – the source of the central dispute in the special issue – with the following quote (p. 315) that bears repeating:

> The theoretical and practical implications of the attribute classification decision are major… Bagozzi (1994, p. 334) says that formative indicators (formed attributes) are only "occasionally useful" in marketing measures. To the contrary, formed attributes are probably the prevalent type in marketing constructs.

Compare the above 2002 statement from C-OAR-SE theory with what Lee et al. believe to be their major insight (2013, p. 11): "Clarifying which type of variable one is dealing with [formative vs. reflective] for all variables in a given model is vitally important…" Well, this is nothing if not (part of) the C-OAR-SE message! C-OAR-SE however, requires a *classification* rather than a "clarification" and it is a *three-fold* classification (on each of O, A, and R) rather than the single classification (of A) that Lee et al. are proposing.

The present article is organized under five main headings:

1. Construct definition
2. Neglect of the object in the construct
3. Classification of the attribute in the construct
4. Identification of the rater entity in the construct
5. Putting O, A, and R together to form the measure
6. Borsboom's concept of "entity realism"
7. Michell was wrong, too

Throughout the article, I will provide the C-OAR-SE correctives to all the criticisms I make of the special issue authors' work. I will adhere to the practice adopted in C-OAR-SE

(Rossiter 2002) of denoting construct definitions in ALL CAPS and construct components in Upper and Lower Case.

1. Construct definition

Measurement theory in the social sciences is supposed to be about the measurement of *constructs*. However, the commentating authors in this special issue followed the lead authors' mistaken practice of referring to the measurement of *variables*. By "variable" they mean only the *attribute* in the construct, the values of which can vary. An example of a construct discussed by Lee et al., and commentated on by the others, is THE COMPANY'S TOTAL ANNUAL ADVERTISING EXPENDITURE AS VERIFIED BY AN INDEPENDENT AUDITOR. In the construct of THE COMPANY'S TOTAL ANNUAL ADVERTISING EXPENDITURE AS VERIFIED BY AN INDEPENDENT AUDITOR the *attribute* that can vary, obviously, is the amount of EXPENDITURE expressed in units of *money* – dollars, or euros, or pounds, or whatever the currency may be.

This last example leads into the major point that I want to make here, which is that all measurement in the social sciences must begin with a *full construct definition*. Construct definition is what the "C" stands for in the C-OAR-SE acronym. According to C-OAR-SE theory, a construct must be defined in terms of three elements: (1) the *object* to be judged, (2) the *attribute* in terms of which it is to be judged, and (3) the *rater entity* who is providing the judgments. In the construct of THE COMPANY'S TOTAL ANNUAL ADVERTISING EXPENDITURE AS VERIFIED BY AN INDEPENDENT AUDITOR, the *object* is THE COMPANY'S TOTAL ANNUAL ADVERTISING; the *attribute* is EXPENDITURE (in units of Money or alternatively UNITS OF Gross Rating Points, as the marketing authors Lee et al. should know); and the *rater entity* is, or should be, in this case, an EXPERT AUDITOR, such as one of the various industry media-auditing bodies.

As I have pointed out many times before (e.g., Rossiter 2002, 2011a, 2011b), social science theorists inevitably refer only to the *attribute* in the construct. For example, Lee et al. (2013) label the other constructs they discuss in their article simply (and simplistically) as SOCIOECONOMIC STATUS; ROLE AMBIGUITY; and PERCEIVED COERCIVE POWER. They, like the commentating authors, fail to specify what the *object* is in these constructs (whose socioeconomic status? what role? and who exactly wields the coercive power?). They also fail to specify the *rater entity* in each construct (the EXPERT AUDITOR for advertising expenditure; the SOCIOLOGIST EXPERT for assessing the *resource value* of various occupations in forming SES assignments of households (see below); the EMPLOYEE in *job-role* ambiguity; and the BUYERS FROM A SPECIFIC SUPPLIER for rating the supplier's perceived coercive power). A good example of rater-entity neglect was Lee et al.'s (2013) struggle with the construct of THE BUYER'S PERCEPTION OF THE SUPPLIER'S COERCIVE POWER; they had to *define* this construct differently, as ACCESS TO COERCIVE TOOLS, when the rater entity – or "unit of analysis" as they termed the rater entity – shifted from the BUYER to the SUPPLIER (see their Table 1 on p. 10). Here, Lee et al. were merely rediscovering the C-OAR-SE formula for construct definition.

Neglect of the *object* and neglect of the *rater entity* are the two most common mistakes in measure design and they make up my next two criticisms.

2. Neglect of the object in the construct

The authors in the special issue fail to realize that a construct can be formed over its *sub-objects*, if any, as well as over its sub-attributes, if any. I say "if any" in both cases because the object in the construct may be singular and unambiguous and thus "concrete" and so, too, the attribute may be "concrete." This led to my concept of "doubly concrete"

constructs – of which BELIEFS are the prime example – which require only a highly content-valid *single-item measure* (see especially Bergkvist and Rossiter 2007).

In the original C-OAR-SE article (Rossiter 2002), I proposed that the object of the construct could be classified either as "concrete," as "abstract collective," or as "abstract formed." In the construct of TOTAL ADVERTISING EXPENDITURE – and I will use Lee et al.'s inadequate short label here purely for convenience – the object, THE COMPANY'S TOTAL ANNUAL ADVERTISING, is *abstract collective*, consisting of the sub-objects TV Advertising, Newspaper Advertising, and so forth, across all media in which THE COMPANY places its advertising. The expenditure on each of these sub-objects is "collected together" and added up in the measure. This is because the term "TOTAL ADVERTISING" is ambiguous and therefore *abstract* unless its sub-objects are specified. The sub-objects themselves – TV Advertising, Newspaper Advertising, etc. – are *concrete*, as there should be no ambiguity about these.

There are also sub-objects in the short-named, economist-originated, construct of SOCIOECONOMIC STATUS. The *attribute* in the SES construct is actually RESOURCES – an *abstract formed* attribute that is supposed to represent both monetary and intellectual resources (see Rossiter 2012). In contrast, in the *sociologically originated* construct of A HOUSEHOLD'S SOCIAL CLASS AS ESTIMATED BY AN EXPERT INTERVIEWER (see W. Lloyd Warner's pioneering work in *Social Class in America* and see the excellent account of SOCIAL CLASS conceptualization and measurement by Coleman 1983), the *attribute* is SOCIAL PRESTIGE. The *object* of the SES construct, too, is clearly *abstract formed*. The researcher forms the SES object by defining it in terms of *selected sub-objects*. For example, Hollingshead's early SES index combined Occupation Rank (of, in those days, the male head of household's occupation) and Education Level (again only of the male household head). It was only later that Income Level (usually the pre-tax income of all

household members combined) was added to SES indexes. Modern SES indexes also take into account the partner's occupation ranking and education level, when a partner is present (see Coleman 1983; Rossiter 2012). The SES *object* is therefore arbitrarily formed by the researcher's arbitrary (and, generously, *theoretical*) selection of demographic indicators as *sub-objects*. Ironically enough, just as C-OAR-SE has been placed by many in the "too-hard basket," so too have multiple-demographic measures of SES. As revealed in Rossiter (2012, p. 90), the U.S. Census Bureau, the U.K. government, and the Australian Bureau of Statistics now use only *one* component, or "indicator" – Occupational Status Ranking – to measure SES.

The construct of THE BUYER'S PERCEPTION OF THE SUPPLIER'S COERCIVE POWER provides another example of a construct with an *abstract formed* object. In the examples in Lee et al.'s Table 1 on p. 10, the researchers arbitrarily chose the sub-objects that arguably represent the supplier's acts of coercion – Delaying Delivery, Delaying Warranty Claims, Charging High Prices, and so on. These multiple items also incorporate their own *sub-attributes* – Delay, Overcharging, and the like – which all get at the overall attribute of COERCION. The PERCEIVED COERCIVE POWER construct (again to use its short label) is therefore *doubly formed*: it is formed over the selected sub-objects (the chosen acts) and over the chosen sub-attributes (representing coercion). Marketing theorists should also realize that the famous SERVQUAL measure also represents a *doubly formed* construct: the *sub-objects* are the service provider's Physical Retail Facilities, and the Service Personnel, primarily, whereas the *sub-attributes* variously paired with these sub-objects are such things as Appearance, Politeness, Empathy, and Response Time. For these reasons, the present author referred to the *construct* that SERVQUAL is supposed to measure as COMPONENTIAL SERVICE QUALITY AS PERCEIVED BY CUSTOMERS VS. POTENTIAL CUSTOMERS. He designed a C-OAR-SE-based measure of componential

service quality in *e-retailing* called ER-SERVCOMPQUAL (see Rossiter 2009). Management theorists such as Diamantopoulos (an author in this special issue) should also realize that one of his invented constructs, EXPORT COORDINATION AS PERCEIVED BY DEPARTMENTAL MANAGERS IN AN EXPORT FIRM, is also *doubly formed* (see Rossiter 2008).

Such important subtleties in construct definition have been missed by social psychologists, as well. The sole exception to this indictment seems to be for the intercultural construct of INDIVIDUALISM-COLLECTIVISM. Brewer and Chen (2007) asked the pertinent question in the title of their paper: "Where (who) are collectives in collectivism?" From a content analysis of I-C measures, they found that the nature of the COLLECTIVE REFERENCE GROUP was in fact various – sometimes Family, sometimes Close Friends, sometimes Work Colleagues, sometimes the individual's Nation at Large, and at other times not even specified (e.g., "It is important to maintain harmony within my group"). These are, of course, *sub-objects* and their haphazard identification in questionnaire measures of I-C raises the question of just what people are supposed to be "collective" *toward*. The COLLECTIVE as an overall object, in C-OAR-SE terminology, is *abstract formed* because the researcher has to decide what the main sub-objects are; it is not, as might first appear, abstract collective, simply because the population of COLLECTIVES is ill-defined and almost unbounded. The attribute in the INDIVIDUALISM-COLLECTIVISM construct is also conceptually interesting. My reference to collectives as *reference groups* suggests that the *attribute* is simple and concrete, namely, IDENTIFICATION WITH. However, Brewer and Chen's (2007) content analysis of the *measures* of I-C suggests that researchers have conceptualized the attribute as *abstract* (and formed) and consisting of sub-attributes such as Agency, Felt Obligation, and Norm Following (called "Responsiveness to others' needs" by those authors; see p. 141). According to Brewer and Chen's *construct definition*, therefore,

THE INDIVIDUAL'S STANDING ON THE INDIVIDUALISM-COLLECTIVISM TRAIT would be classified as what I have called (in the Rossiter 2011a book) a FORMOB-ABACHD-INDRAT construct in which the object is formed, the attribute is also formed or what I now describe as *achieved* (with this renaming undertaken precisely to get out of the silly "formative" versus "reflective" debate), and the rater entity is the individual (who performs a self-rating on the component items of the measure). This nicely illustrates the *three-fold* classification of construct elements that has to be made in the C-OAR-SE approach.

This advanced type of "content analysis" is difficult and is doubtless the main reason why researchers have not adopted the C-OAR-SE method of measure design. You actually have to think, up front, to define the construct and to classify its object, attribute, and rater entity. Why classify? Because the *measure types* differ. Measure types will be discussed in section 5.

3. Classification of the attribute in the construct

In the original C-OAR-SE article was a footnote that everyone, including the authors in the special issue of *AMS Review*, has ignored (Rossiter 2002, p. 314, note 6). This note explains why the term "formative indicators" should not be used and why the term *formed attribute* should be used instead. Because of its obvious importance to the present article, I reproduce this note in full:

> The description "formative attribute" is not correct because it suggests that it is the attribute that is doing the forming rather than, correctly, that it is the *items* that are doing so. For the opposite reason, the earlier terms "cause indicators" (Blalock, 1964), or "formative indicators" (Fornell & Bookstein, 1982), are not suitable because they refer to the *items* rather than to the resulting *attribute*. Also, describing both types of items as "indicators" is confusing because in the case of formed attributes, and abstract formed objects, the items are *defining*, not merely indicants. In C-OAR-SE, the indicator description of items is applicable only for attributes that are classified as *eliciting*.

The last word, "eliciting," is my term for what others would call a "reflective" attribute. This term clarifies the mistake made by Blalock (1964) and later Bollen and Lennox (1991) in referring to "cause indicators" versus "effect indicators," when a much better case could be made for reversing these descriptions. Specifically, the sub-attributes of a formed attribute do not *cause* the overall attribute other than in the trivial sense of causing an arithmetic sum score to be produced. On the other hand, an eliciting attribute *is* a cause in that it literally causes the *sub-attributes*, so that these sub-attributes are actually "indicators of the cause" not "indicators of the effect(s)" as Blalock's original description implies. To avoid this conceptual (and semantic) confusion, the term "formed attribute" in the 2002 version of C-OAR-SE was replaced in the 2011 version by the term *achieved attribute*, and the term "eliciting attribute" was replaced by the term *dispositional attribute*. I still like the term "eliciting" because this is exactly what a dispositional attribute does; for example, Spearman's generalized intelligence attribute, *g*, *elicits* scores on a test of general intelligence. Moreover, and here I'm going to fire a shot at those such as Lee et al. who tried to understand MacCorquodale and Meehl's famous 1948 article without understanding learning theory, *g* is hypothesized to do this in Hull's innate, or *unlearned*, stimulus-response connection, or $_{S}U_{R}$, sense.

I wish to remind readers (and the special issue's authors) that there was always a third classification of attribute in C-OAR-SE theory – the *concrete* attribute. Only *abstract* (multi-meaning) attributes can be "achieved" or "dispositional," or "formed" versus "reflective" if you prefer the older terminology. In the 2011a book version of C-OAR-SE theory, I subdivided concrete attributes into two further classifications called "perceptual" and "psychological," respectively. I shall take up this distinction in section 5 (on putting the measure together) after discussing the final element of every construct.

4. Identification of the rater entity in the construct

In C-OAR-SE theory I have always maintained that the construct must be defined in terms of its object, its attribute, and its rater entity. In the 2002 original C-OAR-SE theory there were three possible types of rater entity – the Individual rater, the Expert rater, and the Group rater; and in the 2011a version Expert raters were subdivided into Substantive Experts and "trained experts" called Coders, and group raters were also subdivided into Manager Groups and Consumer Groups.

In the construct of SOCIOECONOMIC STATUS (to again use the short label), the rater entity is the CODER, who must code the Occupation Descriptions, Educational Qualifications, and Reported Income into status-reflecting (actually *resource-reflecting*) levels. In the quite different construct of SOCIAL CLASS (again to employ the short label), the rater entity should be the EXPERT SOCIOLOGIST INTERVIEWER – see especially discussion of this by Coleman (1983). The expert sociologist interviewer makes an extended visit to the individual's home to interview the head or heads of household to establish the full nature of their occupation (and seniority of job position held), the quality of their education (giving higher scores for private schooling and top-line universities, for example), and the *source* of their income (giving higher scores to inheritance and investments as the primary source of income); and also judging the prestige value of all of the following – the home itself, its residential area, motor vehicles, furniture and furnishings, collected art objects and art-going interests, and even the adult occupants' choice of formal and casual clothing for themselves and for their children, if any. It is little wonder that economists, marketers, and sociologists alike turn to the easy but much less accurate route of demographic indicators!

In Lee et al.'s short-named construct of ROLE AMBIGUITY, the rater entity is most evidently the INDIVIDUAL (or SELF); this individual could be an EMPLOYEE if the role of

theoretical interest is a JOB ROLE or, say, a PARENT if the role of interest is the PARENTAL ROLE (a topic of fierce debate now with same-sex marriages).

I have already discussed the rater entity for the short-named construct of TOTAL ADVERTISING EXPENDITURE but I now wish to reinforce and expand upon Diamantopoulos's (2013, p. 34) observation about PERCEIVED ADVERTISING EXPENDITURE, which is an entirely different construct because of the *rater entity*. Companies have long followed the practice of publicly *overstating* their total advertising budgets, or these days "marketing communications" budgets, to deter their competitors in the industry (in my outside work as an advertising consultant, many of my clients have privately admitted to engaging in this practice because "everyone does it"). This means that PERCEIVED ADVERTISING EXPENDITURE AS PERCEIVED BY COMPETITORS' MANAGERS is a very real *perceptual* construct that differs from the objectively rated construct of TOTAL ADVERTISING EXPENDITURE. A second different construct was proposed by Ambler and Hollier (2005) in a thoughtful article in the *Journal of Advertising Research*. Their theory is that when the rater entity – although they didn't use that term – is the PROSPECTIVE CUSTOMER or the POTENTIAL CONSUMER-BUYER, then THE BRAND'S PERCEIVED ADVERTISING VISIBILITY serves as a signal, or "surrogate indicator," of THE BRAND'S QUALITY. These observations go to show, as Diamantopoulos suspected, that so-called TOTAL ADVERTISING EXPENDITURE is a meaningless construct unless its object (whose advertising expenditure?), its attribute (objectively money or subjectively a perception), and its *rater entity* (see above) are identified and named in the construct definition.

I will give just one example of the importance of specifying the rater entity in the construct definition in the field of social psychology. This is the example of the construct of PERSONALITY TRAITS. H.J. Eysenck's well-known biologically-based personality traits

of EXTRAVERSION-INTROVERSION, NEUROTICISM, and PSYCHOTICISM require an EXPERT PSYCHOLOGIST as the rater entity. In contrast, the so-called Big Five personality traits of OPENNESS, CONSCIENTIOUSNESS, EXTRAVERSION, AGREEABLENESS, and NEUROTICISM (forming the OCEAN acronym) require only the INDIVIDUAL as the rater entity; this is because the OCEANs are not personality traits at all but rather are *person-perception characteristics* (see Rossiter 2011a). The INDIVIDUAL rater entity can either be the SELF, as in self-rated "personality," or an OTHER, as when someone else, such as a friend, a teacher, or an employer makes these judgments about *your* "personality."

5. Putting O, A, and R together to form the measure

In fact, *all* measures of social science constructs are formed. Single-item measures are *formed* by combining an object part with an attribute part (see Rossiter 2002, pp. 319-320). Multiple-item measures are formed aggregations of single-item measures (see Rossiter and Bergkvist 2009) and are therefore, in effect, *formed twice over* (at the item level and then at the "scale" level). The *rater entity* specified in the construct does not appear directly in the measure. However, it too forms every item *indirectly*. The rater entity's presence is represented by wording the item, or items – and the answer options – to be perfectly understood by the rater entity.

C-OAR-SE theory is *unique* in proposing that measure design depends *directly* on the prior classification, by the researcher, of the *object* and the *attribute* in the construct. In Rossiter 2011a, rules for item design and total measure design were spelled out for the very first time in the social science literature (whereas they were only implicit in the 2002 article). These are repeated (in slightly improved form) in Table 1 for the benefit of those who haven't yet read the 2011a book and of those who have read it and now wish to *apply* C-OAR-SE.

Table 1 about here

Application of C-OAR-SE measure-design principles requires the researcher to fully define the to-be-measured construct in terms of its object and attribute, and then to *classify* the object and the attribute. Failure to do both was the problem throughout Lee et al.'s article. For example, as pointed out earlier, TOTAL ADVERTISING EXPENDITURE should have been fully defined as THE COMPANY'S TOTAL ANNUAL ADVERTISING (the object) EXPRESSED IN DOLLARS OF EXPENDITURE (the attribute) AS ESTIMATED BY AN INDEPENDENT AUDITOR (the rater entity). It would then be seen that the object is *abstract collective* – requiring in this case a *census*, not a sample, of all the media that the company spends advertising money in, as *sub-objects*. The attribute is *concrete* (concrete perceptual) and thus requires only a single attribute item-part for the various media types, namely, dollars. What was loosely described as TOTAL ADVERTISING EXPENDITURE now becomes a COLLOB-CONCPERC-EXPRAT construct in C-OAR-SE (2011a) terms. The *overall measure* of it is formed over the *sub-objects*, and the *items* are formed by the respective concrete sub-object paired with the common concrete attribute of money.

It might be worth examining once again another of Lee et al.'s constructs, SOCIOECONOMIC STATUS, or SES, because this was the example of "formative measurement" used by Bollen and Lennox (1991) and later by Borsboom (2005), measurement theorists whom Lee et al. (2013) cite and admire. As explained earlier, SES is considered by modern economists to be a measure of RESOURCES (the attribute) available to a HOUSEHOLD (the object) as estimated indirectly (by an expert rater entity) from the HEAD(S) OF HOUSEHOLD'S DEMOGRAPHICS. The Australian government, for example, allocates funding to schools in inverse proportion to the *average* SES of the

households located in the school's drawing area (usually a postcode). The expert coder, knowingly or not, is assigning "SES points" according to occupation status, education level achieved, and total income bracket on the basis of the *economic resources – a.k.a.* in newspeak "social capital" – that each demographic attainment level usually brings. However, the attribute of RESOURCES is entirely fuzzy or, in other words, *abstract*, because it gets into the politically sensitive issue of the *intellectual* resource advantages that might be involved. It is undoubtedly the difficulty of making the resource inferences from demographic levels that has led economists in some countries, as noted earlier, to fall back on *one* indicator – Occupation Status Rank – for the measure (occupation *status*, note, which excludes "millionaire tradesmen," would-be "gangsters," and similar "black money" high earners, and *does* indicate intellectual resources – general intelligence and usually better education – as much as financial resources). The multiple-demographic construct of SES would be classified as COLLOB-ABACHD-EXPRAT, with the two measure-design rules (see again Table 1) of a multiple-item census of sub-objects (household adults' multiple demographic reports) and one good item *part* for each of the sub-attributes (measuring the respective inferences of the amount of "resources" attributable to the level of each demographic sub-object). Anyone having to design a measure of SES for a serious (rather than academic) purpose would realize these design rules intuitively.

Complex? You bet! Complicated? Necessarily! Scientific progress? Yes, undeniably. I will conclude with comments on a couple of other measurement theorists' work which also does *not* represent progress.

6. Borsboom's concept of "entity realism"

C-OAR-SE was originally described as a "rationalist" approach to measurement as contrasted with the "empiricist" approach of the psychometricians (Rossiter 2002, p. 308).

This distinction is demonstrated by my insistence on *a priori* construct-to-measure (CtM) validity as the only requirement of a measure, whereas psychometricians attempt to "validate" the measure by seeing, afterwards, how well it performs empirically in terms of its score's statistics – factor loadings of item scores, coefficient alpha, and so forth. My rationalist position was also clearly explained in my 2011b *EJM* article (on pp. 1562 and 1565). In my 2011a book (in the preface and in the introductory chapter), I described what Borsboom and Lee et al. would call my "ontological stance" as *rational realism*. I even told the non-apocryphal story (on p. vii) about my listening to country music when I want to "get real," and I could have added that this is most often when I've read some study or other that employs psychometrics!

More seriously, I made a detailed argument against "latent constructs" on the grounds that they are *not real*. I argued that the latent constructs proposed by most social scientists are artificial – and artifactual – entities mostly derived from blind reliance on factor analysis and blind adherence to the psychometric tradition. In other words, these latent constructs do not exist – either in theory or in the mind of the rater entity. Real but *non self-reportable* constructs I called (Rossiter 2011a) *psychological constructs* and gave as prime examples Sigmund Freud's psychoanalytic constructs of REPRESSION, PROJECTION, SUBLIMATION, and the OEDIPUS COMPLEX and ELECTRA COMPLEX (and see Westen's 1988 contention that most of Freud's constructs have been inadvertently reified and relabeled in modern cognitive psychology, and that they still exist in the *researcher's* mind though with new labels). Real *self-reportable* constructs I called *perceptual constructs* and these include ubiquitous social science constructs such as BELIEFS, OVERALL ATTITUDE, and VALUES, which must exist in the *rater entity's mind* in order for the individual to function. I would argue that "latent constructs" such as INDIVIDUALISM-COLLECTIVISM, SOCIOECONOMIC STATUS (as opposed to SOCIAL PRESTIGE),

ROLE AMBIGUITY, and PERCEIVED COERCIVE POWER do *not* exist in any *functional* sense. In the real world, people do not go around thinking to themselves, for example, that "I am a collectivist" or "My socioeconomic status is high" or "My job is ambiguous" or "Gee, that supplier has a lot of coercive power!" Rather, people function according to concrete beliefs, actual felt emotions, vocally if privately expressed specific values, real (but sometimes unrecognized or unadmitted) motives, and the like. These mental constructs *unarguably* exist because, otherwise, individual differences in responses to the same stimulus could not be accounted for. This fact is well represented in the S-O-R theories that long ago overtook Watsonian S-R theories in the social sciences. In the Hull-Spence Behavior Theory that I personally favor (see Foxall and Rossiter 2008; Rossiter and Percy 1997) these undoubtedly existing constructs are represented in the individual by *learned* connections, such as ${}_{S}V_{R}$ for stimulus-object awareness, ${}_{S}H_{R}$ for overall attitude, and ${}_{S}K_{R}$ for incentive motivation. And you might want to closely read MacCorquodale and Meehl (1948) for a complex discussion of this point.

As Lee et al. (2013, p. 5) note, Borsboom rules out "formative measurement" and thus dismisses *formed constructs*. Borsboom (2005; also Borsboom, Mellenbergh, and van Heerden 2004) argues that for a construct to be valid (a) it must exist as an independent entity – a condition with which I obviously agree, as argued above; and (b) the construct must cause the scores on the measure of it. This second condition appears to allow only "reflective" or *dispositional attributes* but in fact must apply to *concrete attributes* as well (e.g., when a specific and doubly concrete learned attitude in the rater's mind causes the rating level that he or she endorses on an attitude scale). Borsboom's second condition appears to dismiss *formed constructs* (remembering that such constructs can be formed by virtue of having sub-objects *or* sub-attributes *or* both). His argument, echoed by others in the special issue including Lee et al., is that the formed construct does not *exist* independently of its components (the sub-

objects or the sub-attributes). This is true, but only because the components form an *abstract* construct rather than a *functional* construct, which must be *concrete*. However, we certainly can *measure* an abstract construct and we do so all the time (measuring a company's TOTAL ADVERTISING EXPENDITURE being just one example). As I stated in a C-OAR-SE article earlier (Rossiter 2005), the exclusion of formed constructs would eliminate most of the major constructs in the social sciences. Excluded constructs would include SOCIOECONOMIC STATUS in economics (formed over demographic attributes), CONSERVATISM in social psychology (formed over attitude objects), the SELF-CONCEPT in individual psychology (formed over attributes such as self-esteem and self-efficacy), ENTREPRENEURIAL ORIENTATION in management, and SERVICE QUALITY in marketing (both of which are *doubly* formed over sub-objects and their sub-attributes). Regardless of whether or not these abstract constructs are "researchers' fictions," they *can* be measured. One cannot rule out formed constructs, as Borsboom does, as not being "measurement."

What has not been realized is the change in C-OAR-SE theory that I stated plainly in the Abstract in my 2011b *EJM* article (which Borsboom and some of the present authors commented on) and also on pp. 54-56 of my 2011a book (which Rigdon, at least, claimed to have read). The updated version of C-OAR-SE theory now *rejects* the "reflective" measurement approach. Specifically, I argued in the C-OAR-SE update that all *abstract* attributes are *formed* from a measure-design standpoint. This is because the sum scores on even a *reflective* attribute are completely dependent on the scores obtained from the particular items chosen to make up the measure. For instance, total scores on the NEUROTICISM personality trait are formed by, and depend entirely on, the set of items included in the multiple-item measure and these sets are many and various (see Rossiter 2011a, pp. 54-56). Various – and *variable* – item selection is widely practiced when researchers design reflective

measures using *factor analysis* or when they *shorten* others' measures for convenience. The designed or shortened measure depends totally on the component items selected; in other words, the measure is *formed* by them. (Reflective or what I call eliciting attributes – dispositions – *must functionally exist* and they can be shown to exist in the *brain* as a set of innate or learned S-R connections. Far too many researchers *invent* dispositions as mere descriptions of the Rs; see especially B.F. Skinner, 1959, for this well-known criticism.)

But back to Borsboom. The realization that so-called reflective constructs *also* do not exist independently of the items chosen to measure them, coupled with the fact that he does not even grant the existence of doubly concrete constructs, means that Borsboom would rule out *all* measures!

7. Michell was wrong, too

Ruling out all measures in the social sciences is essentially what the University of Sydney psychologist, Joel Michell, has done. One of the special issue authors (Rigdon 2013, pp. 27-28) drags in Michell's old (1986) argument, which is basically that measures that deliver *anything less than ratio-scaled numerical answers* – as 99% do in the social sciences – are not measures at all. In Michell's view, nominal (categorical) and ordinal (rank order) measures are not acceptable, although he makes a clever case for *equal-interval* measures as being able to produce ratio results. Rigdon then uses this questionable argument, citing Michell (2009), to reject C-OAR-SE theory because its classifications of objects, attributes, and rater entities are only *categorical*. That is true, but this line of argument would rule out *clinical diagnoses* in psychiatry as not measuring anything valid because the diagnoses are categorical; it would rule out all *typologies* in psychology and management because each type is a category; and it would rule out *customer segments* in marketing since these, too, are categorical. This line of argument also would rule out *factor analysis* in all fields because it

groups items in R-factor analysis, or individuals in Q-factor analysis, into categories. Categorical measurement is still *measurement* and to argue otherwise is to pursue a very strange and constricted view of measurement. And if Rigdon wants to further endorse Michell's position by rejecting *ordinal* measurement, he might want to consider the much-ignored argument made by Norman Cliff (made most recently in Cliff and Keats' 2003 book) that all quantitative measures in the social sciences need to be *no more than ordinal* and, what is more, that our favored statistical routines, including factor analysis, do *not* require anything more than ordinal measures. Michell takes an excessively quantitative (and unrealistic) position with regard to social science measurement.

Rigdon does not actually empathize with Michell's nihilistic prognosis. Rigdon's final paragraph begins with the following: "Could it really be that bad? Could there really be decades of research with nothing to show for it?" (p. 28). My answer is: "Yes, it *is* that bad." In my major theoretical publications on C-OAR-SE, from the first (Rossiter 2002) to the last (Rossiter 2011a, 2011b), I contended that inattention beforehand to what I now call *construct-to-measure validity* and unthinking adherence to the *psychometric* practice of attempting to validate measures after the fact by looking at the scores they produce renders all findings suspect in the social sciences since about 1950, when the psychometric "true-score plus error" notion took over.

Conclusion

To return to the "scientific progress" theme of the *AMS Review* special issue, it is the neglect of the C-OAR-SE theory of measure design that has *hindered* progress in the social sciences. We will not make any progress until our measures are properly designed. To put it coarsely, progress will require the abortion of psychometrics and the adoption of C-OAR-SE. That there is still a debate in the *AMS Review* about "formative" versus "reflective"

measurement when *all* constructs necessarily have *formed* measures typifies the backward-looking stance taken by those who ignore C-OAR-SE.

In the interest of encouraging researchers to read more about C-OAR-SE theory and how to apply it, I have listed all 23 C-OAR-SE-based references separately from the main references. The “key” references relied on in the present article carry an asterisk.

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* Key reference

Table 1 C-OAR-SE (2011) classification of objects and attributes and their associated measure-design rules

Classification	Measure-design rule
Object type	
Concrete	*Iconic* representation of object
Abstract collective	Census or, if many, a *representative sample* of constituent sub-objects
Abstract formed	Set of *main meanings* of the object as sub-objects
Attribute type	
Concrete perceptual	One good *rater-derived* description of the attribute
Concrete psychological	One good *researcher-chosen* description of the attribute
Abstract achieved	One concrete item for each *first-order* sub-attribute
Abstract dispositional	Several concrete items for each *second-order component* sub-attribute

Note: Each first-order item (the items on the questionnaire) must be *doubly concrete*; that is, it must have a concrete object part paired with a concrete attribute part.