Paper: 353-2012 Comparing AMOS and SAS® Proc CALIS: Testing CIP as a second order construct

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Acknowledgement

It is a stimulating and motivating experience, completing this paper took lot of effort, time and energy. There are therefore several people we would like to thank for helping us going through this process. We would specially like to thank our guide, Prof. Amit Saraswat, Faculty and Area Chair – Decision Sciences at Shanti Business School, Ahmedabad, Gujarat, India. The supervision and support that he gave us truly helped in delivering quality content in the paper. The co-operation is indeed appreciated.

Our grateful thanks goes to both Prof. Toby Mammen, Faculty - Marketing at ICFAI, Ahmedabad, Gujarat, India and Prof. Jayesh Aagja, Assistant Professor at Nirma University, Ahmedabad, Gujarat, India for providing us with much needed guidance whenever approached.

We appreciate and acknowledge contribution of Mr. Gaurav Somani, Mr. Jankivallabh Garg, Mr. Mukesh Dave, Mr. Ravi Jain, Mr. Robin Panicker, Miss Shivani Shah and Miss Zeel Khadepaun in helping us in data collection from Ahmedabad city.

Last but not the least we would like to thank all the respondents who have given their valuable input and time by filling up the questionnaire.

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Introduction

Involvement has been the subject interest of both practitioners and researchers mainly in the area of marketing since many decades. This helps in understanding involvement of consumers towards various products, services, product categories, brands etc. Understanding Consumers' involvement aids a company to communicate to consumers in an efficient manner by creating the right stimulus. Involvement involves rational thought process and evaluation of cost – benefit ratio (Chombort 1979). Thus consumer involvement with products is a major concern with the marketers as involvement is a very subjective matter differing from person to person.

Involvement is the level of interest of a person in the object (Day, 1970). Involvement arouses or evokes interest at particular stimulus or situations. Involvement has been related to a particular situation (Mitchell1979). Involvement is also said as arousal at a particular moment of time (Cohen1983). Hence, involvement can be understood as the degree of interest in a person created by a stimulus.

Involvement is also effected by the situation in which the consumer is, at the time of purchasing (Zaichkowsky, 1985). Purchasing Involvement is self relevance of purchasing activities to the individual (Slama and Tashchian, 1985). It affects the decision making process of the consumers consisting of information search – process – evaluation and attitudes and behavior towards purchasing.

This means that there are levels of involvement (high or low) but there is no single indicator which could describe involvement level (Kiesler, et. Al.1969 and Rothschild, 1979). Earlier literature suggests measuring levels of consumer involvement based on product's pleasure value, sign value, risk importance, probability of purchase error, attitude, perception, commitment, familiarity, brand importance, optimum stimulus level, etc. (Traylor, 1981; Lastovicka and Gardner, 1985; Hupfer and Gardner, 1971; Raju, 1980). However, Laurent and Kapferer, 1985 suggest that instead of measuring involvement by using antecedents namely – product's pleasure value, sign or symbolic value, risk importance and probability of purchase error individually; these antecedents should be integrated, to measure the consumer involvement. This group/set of antecedents is termed as Consumer Involvement Profile (CIP). Therefore while considering involvement profile" should be considered to specify relationship between consumer and product. The subtle difference in level of involvement is because of antecedents of involvement (Laurent and Kapferer, 1985). Thus involvement is a first order multi dimensional construct.

Involvement of an individual is a result of its antecedents which consists of five facets i.e. Product's Pleasure Value, Sign or Symbolic Value, Risk Importance and Probability of Purchase Error. Dynamics of involvement can be described completely only when these facets are integrated together to form a profile (Laurent & Kapferer, 1985). Each facet talks about one's involvement (high – low) individually, and hence the integrated results of all these facets also talk about the same i.e. high – low involvement of a consumer.

It can be inferred that facets effect involvement. Be it purchasing involvement, involvement with products or general involvement (which can be defined by set of components of involvement), these different scales gives rise to a complete consumer involvement profile (which also includes high – low involvement of consumer). This shows that CIP is not the immediate successor of five facets but is an immediate successor of PI, IP and CP. So it can be inferred that CIP is a second order construct rather than first order construct.

Objectives

Objectives of the paper are:

- 1. The study tries to establish Consumer Involvement Profiles (CIP) as a second order construct and Involvement with Products (IP), Purchasing involvement (PI) and Components of Involvement (CP) are the first order constructs.
- 2. To understand and compare the process of scale modification using SAS PROC CALIS, (North Carolina State University, 1976) and AMOS (Arbuckle, 2006). Literature on scale development establishes that AMOS has been the instrument of choice. Through this paper we compare and contrast the scale development process using AMOS and SAS.

Literature Review

In order to achieve the objectives it is important to study the first order constructs namely – Involvement with Products, Components of Involvement, Purchase decision involvement and Consumer Involvement Profiles, is as follows:

Involvement with Products

Product involvement is a person's perceived relevance of the object based on inherent needs, values and interest (Zaichkowsky, 1985). According to prior literature product involvement is been seen into two different ways first as product importance and second as enduring involvement. Involvement with a product which lasts for long time can be said as enduring involvement. Products which give pleasure arouse enduring involvement. On the other hand, a functional product may or may not have enduring involvement but these products could be of high importance. A printer is important to consumer but he may not have enduring involvement for it. Moreover, situations also affect the involvement level of a consumer which is activated by a stimulus and involvement reflects an individual's self identity. Traylor and Joseph, 1986 gave a uni-dimensional scale consisting of 6 items measured on a 7 - point Likert scale that is tested on a wide range of products.

Components of Involvement

Involvement is made up of two major components namely – normative importance and commitment (Lastovicka and Gardner, 1979). They described normative importance as the level or degree of engagement a product has to the value sets of and individual. On the other hand, commitment is viewed as the self – promise or binding of and individual to his / her choice of brand or product or product category. They gave a list of 22 items to be measured on Likert statements on 7 – point scales. Lastovicka and Gardner, 1979 gave a scale to measure the involvement level which is general to several products.

Purchasing Involvement

Purchasing involvement means the self-relevance of purchasing activities to the individual. Slama and Taschian, 1985 developed a scale to measure overall purchasing involvement. Purchasing Involvement is a promising variable in marketing due to three reasons:

- 1. It may be combined with product and situation involvement to better explain buying behavior. This could help the marketers to identify segment as per the degrees of involvement thus giving them an ability to adjust the marketing strategy according to the combined effect of product, situation and purchasing involvement.
- 2. There might be a significant relation of purchasing involvement with the personality, traits and / or values variables.
- 3. Also it can be realized that the purchasing involvement of a consumer is never restricted solely to product category or the product itself.

Consumer Involvement Profiles

Involvement cannot be measured directly however to measure Consumer Involvement Profiles, Laurent and Kapferer integrated antecedents of involvement and developed a scale to measure CIP to give a better understanding of the dynamics of consumer involvement. The antecedents of involvement mentioned are –

- Perceived importance of product
- Perceived risk associated with the product purchase
- Symbolic / Sign value attributed by the consumers to the product, its purchase and its consumption.
- Hedonic value of the product

This verified CIP a first order construct. Risk associated with product purchase will include two facets: One is the perception regarding negative results of poor choice and second is the perception about the chances of committing such a mistake.

Hypothesis

The three variables under study namely – Involvement with Products, Purchasing Involvement and Components of Involvement are the first order constructs which combine together to give overall profile of a consumer explaining the dynamics of involvement. Hence CIP is hypothesized to be a second order construct.

H₀: Consumer Involvement Profiles (CIP) is a second order construct formed from IP, CP and PI.

 $\mathbf{H}_{1:}$ Consumer Involvement Profiles (CIP) is not a second order construct formed from IP, CP and PI.

Choosing the Product Category

The product category chosen was jeans / denims for the simple reason that Jeans are a very popular form of casual dress around the world and have been so for decades. It has become an integral part of living in this fast and rugged world. This is a product category that all youth (the target segment for research – elaborated in the next section) can relate to easily and identify with it. Moreover, the target segment has experience with the product category.

Data Collection

A sample of 800 respondents was randomly chosen for the study within the age group of 20 to 38 years from the geographical location of Ahmedabad – a mega city in the state of Gujarat, India. The sample consisted of students pursuing graduation and / or post graduation. For this we surveyed various colleges and universities of Ahmedabad and recorded the responses of the respondents. The colleges and universities had a homogenous mix of the target segment but possessed heterogeneity in terms of courses they had opted. This sample was chosen as they have shown more inclination towards the product category under consideration i.e. jeans and are more prone to use it on a daily basis thereby possessing higher involvement levels with the product category.

Modifying the measurement scales

The scales used to measure the first order construct have been tested in the U.S. context. Some modifications were made in those scales in terms of language simplification to ease the understanding of the statements in the questionnaire. It becomes imperative to note that none of the items have been removed at the time of collecting the responses.

Methodology

The data was collected based upon the questionnaire developed using the scales for measuring IP, CP, PI and CIP (Bearden, et. Al, 1993).Confirmatory factor analysis procedure was followed and then items were deleted from the model. Then the measurement model was tested on SAS and SPSS AMOS. After refining the initial model, the final Structural Model was tested on SPSS AMOS and SAS and the results were compared thereafter.

Analysis and Discussions

The measurement model given in Figure 1 was tested for errors, correlations and model fitness. AMOS and SAS both were used for the process of scale modification. The codes / programs used to test the model in SAS using SAS Proc CALIS are provided in Annexure 1.



Figure 1

Standard scales were used to measure the model (Bearden, et. Al, 1993). The details of the scales are reported in the Table 1.

Scale	No. of items	Denoted by
CP (Lastovicka, John L. and David M. Gardner(1979), "Components Of Involvement," In Attitude Research Plays for High Stakes, J.C.Maloney and B.Silverm.an (eds), Chicago: American Marketing Association, 53-73)	22	A1,A2,A3A22
IP (Traylor, Mark B. and W. Benoy Joseph (1984), "Measuring Consumer Involvement with Products: Developing a General Scale," Psychology and Marketing, 1 (Summer), 65-77).	04	B1,B2, B3, B4
CIP (Laurent, Gills and Jean-Noel Kapferer (1985), "Measuring Consumer Involvement Profiles," Journal of Marketing Research, 22 (February), 41-53).	17	C1,C2,C3C17
PI (Slama, Mark, E. and Armin Taschian (1985), "Selected Socio-economic and Demographic Characteristics Associated with Purchasing Involvement," Journal of Marketing, 49 (Winter), 72-82.)	24	D1,D2,D3D24

Table 1

Results of AMOS

Initial Measurement Model

The initial measurement model consisted of all the variables and items under consideration which gave the values of fitness indices as shown in Table 2.

Parameters	Values
CMIN	3304.12
CMIN / DF	2.81
RMSEA	0.05
GFI	0.81
CFI	0.55
	(0.05)
Hoelter	277
	(0.01)
	285



Initial Structural Model

After getting the values for fitness indices on measurement model, the structural model was tested for values of fitness indices reported below in Table 3.

Parameters	Values
CMIN	3339.74
CMIN / DF	2.84
RMSEA	0.05
GFI	0.81
CFI	0.55
	(0.05)
Haaltar	275
поещег	(0.01)
	282

Table 3

Final Measurement Model

The final measurement model consists of items remaining after the process of scale purification. We started with the hypothesized model i.e. CIP is a second order construct. The process of purifying the scale was followed using the factor loadings. Items with factor loadings less that 0.5 were removed from the analysis (Hair, et. Al., 2011). After removing items with factor loadings less than 0.5 we arrived at the final measurement model as shown in Figure 2. Correlation connections have been suggested by modification indices.



Parameters	Values
CMIN	106.40
CMIN / DF	2.85
RMSEA	0.05
GFI	0.97
CFI	0.95
Hoelter	(0.05)
	360
	(0.01)
	413

The model fit parameters for the final measurement model are as reported in Table 4.



Final Structural Model - after deletion of items using Modification Indices

After testing the measurement model, we introduced CIP – the second order construct (latent). We found that the measurement model accepted and explained the latent second order construct i.e. CIP with all the parameter values fulfilling the acceptance criteria. The final structural model is shown below in Figure 3.

The model fit parameters for the final structural model are as reported in Table 5.

Parameters	Values
CMIN	112.10
CMIN / DF	6.50
RMSEA	0.08
GFI	0.94
CFI	0.86
Healtar	(0.05)
	158
поеще	(0.01)
	180

Table 5

The values of model fit parameters mentioned in Table 5 are acceptable (Hair et. Al., 2011). The modification process through AMOS leads to a structural model containing greatly reduced items as shown in Figure 3.



Results of PROC CALIS using SAS

Initial Measurement Model

The process of scale modification was done using SAS PROC Calis. Then using the standardized beta weights and Squared Multiple Correlations (SMC), the items having a standardized loading less than 0.4 or squared multiple correlations less than 0.4 were removed.

The final model fit parameters for the measurement model are reported in Table 6.

Parameters	Values
CMIN	1348.29
CMIN / DF	1.12
GFI	0.48
RMSEA	0.04
CFI	0.84



Further deletion of items from the measurement model resulted into loss of its optimal state and QUANEW and LEVMAR Optimization not being achieved, hence no further items were deleted.

Initial Structural Model

After the measurement model was finalized, the second order construct (latent) i.e. CIP was introduced and parameters were estimated. The goodness of fit parameters showed an increase in their values and Chi – square decreased when the structural model was tested as compared to the final measurement model.

The final model fit parameters for the structural model are reported in Table 7.

Parameters	Values
CMIN	1366.71
CMIN / DF	1.16
GFI	0.50
RMSEA	0.04
CFI	0.83

Table 7

The values of model fit parameters mentioned in Table 7 are acceptable (Hair et. Al., 2011).

Any modification process leads to a suggestion of cross – loading of few items. But the changes do NOT lead to significant rise in fitness indices.

Comparing models using AMOS and CALIS.

There are differences in the final models arrived through SPSS AMOS and SAS PROC CALIS. As can be seen from the models the two software report different kind of structures. The reason for the difference should be studies in detail. SPSS AMOS is highly used for scale development in market research. We intent to question the validity of scales developed using only AMOS when SAS PROC CALIS does not approve the validity of the same. Table 8 reports the difference in the model fit parameter values of structural models of AMOS and SAS.

Parameter	AMOS Final Structural	SAS Final Structural
CMIN/DF	6.50	1.19
GFI	0.94	0.58
RMSEA	0.08	0.05
CFI	0.86	0.84

Table 8

Conclusions and Directions for future work

 The AMOS scale modification suggests that CIP is not a second order construct. The measurement model suggests validity of the items like B1, B3, B4, D14, D12, D7, A12, A13, A17, A19, A21. Table 9 reports the first order factors, number of items left after modification for each factor and the original number of items for each factor.

First order factors	No. of items after scale modification	Original no. of items
IP (Involvement with Products)	3	4
CP (Components of Involvement)	5	22
PI (Purchasing Involvement)	3	24

Table 9

The structural model in AMOS negates the hypothesis that CIP is a second order construct. CIP is not a second order construct based on IP, CP and PI as first order factors.

2. The Proc CALIS procedure allows large number of statements to be retained, but also suggests that CIP is not a second order construct. Literature indicates that CIP is a second

order construct; further research has to be conducted to select the right scales in order to conclude the validity of CIP as a second order construct.

3. The difference in values of fitness indices in AMOS and SAS is large though Structural Equation Modeling technique is based on covariance structure decomposition. Both software give very different results. Table 10 reports the differences in the Initial Structural Model tested by AMOS and SAS Proc CALIS.

Parameters	AMOS Initial Structural	SAS Proc CALIS Initial
	Model	Structural Model
CMIN	3339.74	1366.71
CMIN/DF	2.84	1.16
CFI	0.55	0.83
GFI	0.81	0.50
RMSEA	0.05	0.04

Table 10

4. Proc CALIS suggests that the model with all items loaded has the best fitness indices, deleting any items further leads to deterioration of the model. This is certainly surprising.

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Annexure 1

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I	SAS CODE FOR STRUCTURAL MODEL	SAS CODE FOR MEASUREMENT MODEL
	TITLE "CONSUMER INVOLVEMENT PROFILE";	TITLE "CONSUMER INVOLVEMENT PROFILE";
	PROC CALIS DATA = OUTPUTFINAL COVARIANCE	PROC CALIS DATA = OUTPUTFINAL COVARIANCE
	RESIDUAL MODIFICATION MAXITER = 1000;	RESIDUAL MODIFICATION MAXITER = 1000;
	VAR A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15	VAR
	A16 A17 A18 A19 A20 A21 A22 B1 B2 B3 B4 D1 D2 D3 D4 D5	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16
	D6 D7 D8 D9 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20	A17 A18 A19 A20 A21 A22 B1 B2 B3 B4 D1 D2 D3 D4 D5 D6 D7
	D21 D22 D23 D24;	D8 D9 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20 D21 D22
	LINEQS	D23 D24;
	A1=B1 F_CP+E1,	LINEQS
	A2=B2 F_CP+E2 ,	A1=B1 F_CP+E1,
	A3=B3 F_CP+E3,	A2=B2 F_CP+E2,
	A4=B4 F_CP+E4,	A3=B3 F_CP+E3,
	A5=B5 F_CP+E5,	A4=B4 F_CP+E4,
	A6=B6 F_CP+E6,	A5=B5 F_CP+E5,
	A7=B7 F_CP+E7,	A6=B6 F_CP+E6,
	A8=B8 F_CP+E8,	A7=B7 F_CP+E7,
	A9=B9 F_CP+E9,	A8=B8 F_CP+E8,
	A10=B10 F_CP+E10,	A9=B9 F_CP+E9,
	A11=B11 F_CP+E11,	A10=B10 F_CP+E10,
	A12=B12 F_CP+E12,	A11=B11 F_CP+E11,
	A13=B13 F_CP+E13,	A12=B12 F_CP+E12,
	A14=B14 F_CP+E14,	A13=B13 F_CP+E13,
	A15=B15 F_CP+E15,	A14=B14 F_CP+E14,
	A16=B16 F_CP+E16,	A15=B15 F_CP+E15,
	A17=B17 F_CP+E17,	A16=B16 F_CP+E16,
	A18=B18 F_CP+E18,	A17=B17 F_CP+E17,
	A19=1.0 F_CP+E19,	A18=B18 F_CP+E18,
	A20=B20 F_CP+E20,	A19=1.0 F_CP+E19,
	A21=B21 F_CP+E21,	A20=B20 F_CP+E20,
	A22=B22 F_CP+E22,	A21=B21 F_CP+E21,
	B1=B23 F_IP+E23,	A22=B22 F_CP+E22,
	B2=B24 F_IP+E24,	B1=B23 F_IP+E23,
	B3=1.0 F_IP+E25,	B2=B24 F_IP+E24,
I	B4=B26 F IP+E26	B3=10F IP+E25

D1=B44 F_PI+E44,	B4=B26 F_IP+E26,
D2=B45 F_PI+E45,	D1=B44 F_PI+E44,
D3=B46 F_PI+E46,	D2=B45 F_PI+E45,
D4=B47 F_PI+E47,	D3=B46 F_PI+E46,
D5=B48 F_PI+E48,	D4=B47 F_PI+E47,
$D6=B49 F_PI+E49$,	D5=B48 F_PI+E48,
D7=B50 F_PI+E50,	D6=B49 F_PI+E49,
D8=B51 F_PI+E51,	D7=B50 F_PI+E50,
$D9=B52 F_PI+E52,$	D8=B51 F_PI+E51,
D10=B53 F_PI+E53,	D9=B52 F_PI+E52,
D11=B54 F_PI+E54,	D10=B53 F_PI+E53,
D12=B55 F_PI+E55,	D11=B54 F_PI+E54,
D13=B56 F_IP+E56,	D12=B55 F_PI+E55,
D14=B57 F PI+E57,	D13=B56 F IP+E56,
D15=1.0 F_PI+E58,	D14=B57 F_PI+E57,
D16=B59 F PI+E59,	D15=1.0 F PI+E58,
D17=B60 F_PI+E60,	D16=B59 F_PI+E59,
D18=B61 F_PI+E61,	D17=B60 F_PI+E60,
D19=B62 F_PI+E62,	D18=B61 F_PI+E61,
D20=B63 F_PI+E63,	D19=B62 F_PI+E62,
D21=B64 F_PI+E64,	D20=B63 F_PI+E63,
D22=B65 F_PI+E65,	D21=B64 F_PI+E64,
D23=B66 F_PI+E66,	D22=B65 F_PI+E65,
D24=B67 F_PI+E67,	D23=B66 F_PI+E66,
F_PI=B68 F_CIP+E68,	D24=B67 F_PI+E67;
F_IP=1.0 F_CIP+E69,	STD
F_CP=B69 F_CIP+E70;	$F_PI F_IP F_CP = 1.0 \ 1.0 \ 1.0$
STD	E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11 E12 E13 E14 E15 E16 E17
$F_{CIP} = 1.0,$	E18 E19 E20 E21 E22 E23 E24 E25 E26 E44 E45 E46 E47 E48 E49
E70 = 1.0,	E50 E51 E52 E53 E54 E55 E56 E57 E58 E59 E60 E61 E62 E63 E64
E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11 E12 E13 E14 E15 E16 E17	E65 E66 E67= E_VAR1 E_VAR2 E_VAR3 E_VAR4 E_VAR5
E18 E19 E20 E21 E22 E23 E24 E25 E26 E44 E45 E46 E47 E48 E49	E_VAR6 E_VAR7 E_VAR8 E_VAR9 E_VAR10 E_VAR11
E50 E51 E52 E53 E54 E55 E56 E57 E58 E59 E60 E61 E62 E63 E64	E_VAR12 E_VAR13 E_VAR14 E_VAR15 E_VAR16 E_VAR17
E65 E66 E67 E68 E69 = E_VAR1 E_VAR2 E_VAR3 E_VAR4	E_VAR18 E_VAR19 E_VAR20 E_VAR21 E_VAR22 E_VAR23
E_VAR5 E_VAR6 E_VAR7 E_VAR8 E_VAR9 E_VAR10	E_VAR24 E_VAR25 E_VAR26 E_VAR44 E_VAR45 E_VAR46
E_VAR11 E_VAR12 E_VAR13 E_VAR14 E_VAR15 E_VAR16	E_VAR47 E_VAR48 E_VAR49 E_VAR50 E_VAR51 E_VAR52
E_VAR17 E_VAR18 E_VAR19 E_VAR20 E_VAR21 E_VAR22	E_VAR53 E_VAR54 E_VAR55 E_VAR56 E_VAR57 E_VAR58
E_VAR23 E_VAR24 E_VAR25 E_VAR26 E_VAR44 E_VAR45	E_VAR59 E_VAR60 E_VAR61 E_VAR62 E_VAR63 E_VAR64
E_VAR46 E_VAR47 E_VAR48 E_VAR49 E_VAR50 E_VAR51	E_VAR65 E_VAR66 E_VAR67;
E_VAR52 E_VAR53 E_VAR54 E_VAR55 E_VAR56 E_VAR57	COV
E_VAR58 E_VAR59 E_VAR60 E_VAR61 E_VAR62 E_VAR63	$F_PI F_IP F_CP = PHI1 PHI2 PHI3;$
E_VAR64 E_VAR65 E_VAR66 E_VAR67 E_VAR68 E_VAR69;	RUN;
RUN;	